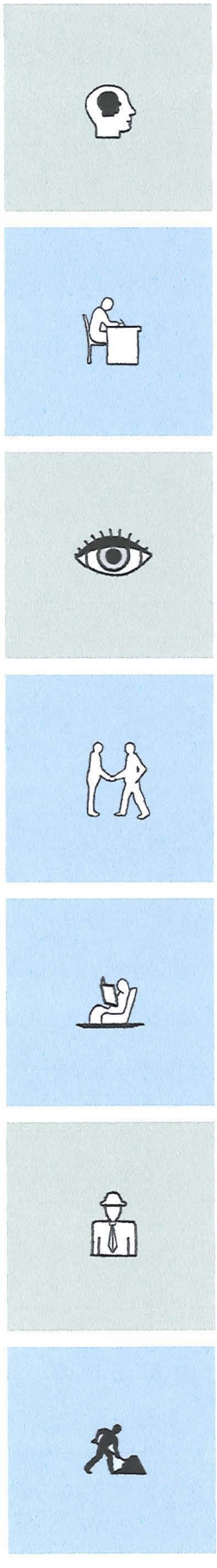
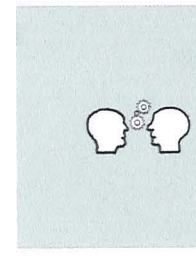


(In)tangibles

Sociocultural references in the design process milieu

Megan Strickfaden



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(In)tangibles
Sociocultural references in the design process milieu

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Napier University

This thesis is submitted in partial fulfillment for the award of Doctor of Philosophy

Abstract

This thesis broadly engages with the design process and design education, but focuses particularly on sociocultural and (in)tangible references that are communicated verbally, visually and textually within the design environment. With the aim of defining references and subsequently understanding the contextualized sociocultural environments ethnographically oriented methods and an interdisciplinary theoretical model are developed and applied to two field studies. This research combines design with cultural anthropology, social psychology and social cognition towards gaining a more holistic viewpoint on design processes. Each empirical field study uses the same research approach, methodology, theoretical framework, and subsequent data analyses and display. The methods include observational techniques, questionnaires to query personal information, and informal interviews to track the design process. Videotape recordings are used to track the in-studio activity and still photography is used to capture the visual communications along with the sociocultural context of the participants. The studies are longitudinal, being six and seven weeks in duration, and follow university level industrial design students and their instructors from the onset of their design brief to the completion of their project. The first study takes place in Scotland in the United Kingdom (UK) where the students are working towards the design of an airline meal tray. The second study takes place in Western Canada and involves the design of sports eyewear.

This research defines and describes sociocultural factors as these are identified through references. Sociocultural references include the individual-personal and social-cultural information that is embedded in an individuals' personal make-up, called here sociocultural capital. How, when and why sociocultural capital is used during the creation of an artefact is of primary interest in this work. Design decisions are made regarding artefact form, overall aesthetics, materials, manufacture, user experience and more. These decisions are made through considering the stakeholders in the project (*e.g.,* instructors, clients, users) and references to these are called tangible because they are easily relatable to the design brief and the well-known documented stages of designing. The references that are abstract and have distance from the task at hand are called the intangibles. Sociocultural references are both tangible and intangible but relate specifically to the sociocultural capital of the individuals making them. Patterns, themes and categories about the design process, designing, the individual design students and two educational scenarios including the studio culture and design culture are revealed through the references.

This research herein discusses and raises three central ideas as follows:

- A theoretical model called the design process milieu for understanding the holistic designing scenario including inside-local, inside-universal, outside-local and inside-universal environments. This includes a detailed breakdown of how to use the model including a systematic approach, methods and analyses system.
- A definition and description of the nature of (in)tangible references including when and why they are used during the design process.
- Detailed descriptions of two design environments including the studio culture and design culture.

It is argued in this research that references provide important details about the sociocultural context of the design scenario. Furthermore it is also argued that all things discussed in the design process are meaningful and have the potential to steer the development of an artefact. Therefore, there are substantial implications for this research relating to how design students, educators and designers are affected by the sociocultural contexts enveloping them; what types of sociocultural capital designers use; and to a lesser degree, how, when and why they use their sociocultural capital. The insights from this work result in recommendations for design education, practice and design research in general.

for Charles

You are my friend, my partner, my husband and my soul mate. Without your support this work would not have been possible.

The Circles of Design

> *Here was my gymnasium, over there in the building looking across was my university, and a little further to the left my office. In this small circle – and he drew a few circles with his finger – my whole life is enclosed.*

In the 1920s living in Prague, Franz Kafka describes circles enclosing his life, which can be described as a representation of the concepts of continual change, fullness, relatedness, and interdependence. These concentric circles are likened to the anthropological theories used in this research. It is my belief that it is through an holistic, ecological outlook on the world that an increased understanding will be brought to the complex flow of human existence and ultimately to the complexity of cultural production in artefact development. The context of design is a complex architecture that surrounds many spaces within. Design is what becomes of the space within the circles. People's lives are surrounded by circles and designers work *with* the circles, creating something of the space within. They act to bring to existence something of purpose that was originally perceived as non-existent.

It therefore follows that design research involves exploring and understanding the relationships among the circles and the spaces within. My understanding of research involves reflection on the processes of researching. Reflection in research and design is not a particularly new concept. However, I firmly believe that being reflective about research allow for the deconstruction of the researcher's authority and also allows for the growth of the multiplicity of perspectives of the participants to emerge. My reflection on design began as an implicit value in this work, and ultimately emerges as a central recommendation for the future of design education. It is my belief that the 'little narratives' of all designers brings clarity to how we act as designers and these provide us with pointers towards the future cultural production. Having proclaimed my fundamental views on how I approached this research, it naturally follows that I will now begin to describe the interconnectedness of my life and how this has affected my work.

After graduating from the University of Alberta in Canada with a Bachelor of Arts in art and design with a specialization in industrial design practice and anthropology I worked as a design consultant for twelve years. During this time I encountered a diverse range of projects including design for retail spaces, exhibition design, theatre design, and furniture and product development. Throughout this period I taught design history and three-dimensional design workshop in a visual communications school at Grant MacEwan College in Edmonton. I began working on a master's of design in 1999 following an economic drought where I saw much of my work over the previous decade being auctioned off due to bankruptcies. It was this opportunity to work on sustainable design practice, also at the University of Alberta, that ultimately brought me around the globe to Edinburgh. While working on the sustainable design of a flat plate solar collector I discovered the world's top solar engineer was at Napier University in Edinburgh. This peaked my interests since I had visited Edinburgh, lived in London, and felt a connection to the United Kingdom. Therefore, when I saw a notice for the position of research assistant, I could not resist applying. My love for teaching design connected well with the central topic of this project—research into design process and education. In essence, this research project provided me with the opportunity to reflect on my role as a design practitioner, the design process and my role as a teacher in the practice orientated learning environment. Therefore, this research as a whole is *reflexive* since I am

approaching this work from the perspective of an *insider* to design, an *insider* to the design process and an *insider* to design education. What I did not expect was that I would feel like such an *outsider* to design research and to my situation in Edinburgh. This, however, has provided me with more opportunity than grief, more growth than setbacks, and more understanding than I had ever expected. As a reflexive designer I have approached this work as an insider and an outsider, and as a *reflective* researcher I feel strongly that I am making the best contribution to the design community that I am capable of.

For the twelve years prior to furthering my career as a design researcher I was typically involved in collaboration and teamwork. This project is no exception. This research would not have been possible without a strong circle of support. In this situation the circle has been broad and sweeps several continents. Strangely, the miles between the places I have called home over the past 48 months are great, but within myself the distance is as close as just down the street. These places—especially Edinburgh, Edmonton, Calgary—are surrounded by individuals and groups of individuals who make up my world. These friends and colleagues have supported me in a variety of ways including financially, intellectually, physically, emotionally, and spiritually. I am truly grateful for the support of all those who have, for me, made this research possible.

The first individual I would like to thank is Paul Rodgers. Paul put forth the advertisement for a research assistant at Napier University in 2001 and chose me for the position. Without his initial foresight and interest in the area of *inspirational sources* this research would have never begun. Unknowingly, Paul provided me with the opportunity to fulfil a dream of more than twenty years—this was to study industrial design in the country of its origin. Secondly, immense gratitude goes to Huw Davies and the *School of Design and Media Arts* for providing the financial assistance throughout this research. I especially appreciate support to attend the *Engineering Design Research Summer School* and the many conferences funded by small research grants. Your financial generosity has provided me with an opportunity I would otherwise never have had. I would also like to thank all the faculty and staff in *Design and Media Arts* who supported and assisted me throughout my twenty-month residency in Edinburgh. Thank you also to Matthew Turner and Louise Milne for your continued intellectual stimulation. I appreciate your willingness to share with me your understanding of design, cultural and critical studies. You each hold such a wealth of knowledge and information, of which I could only hope to have and express as well as you, in the future. I especially thank Will Titley for his friendship from the beginning, and Mary-Ann Kennedy for being a kindred spirit and for sharing her family with ours.

Many friends in Edinburgh also deserve thanks. I would first like to thank my friends from 22 Mardale Crescent—Ruth Martin, Matthew White, George Bird and Andrés Esquivel. You all consistently provided me with pointers about British culture and taught me to 'go towards the sun like lemmings' for barbeques in the garden when the skies were clear. Other dear friends from Edinburgh, all of whom have provided me with temporary homes and a feeling of stability on my commutes from Canada include: Maike, Leonard and Emily Beveridge; Mary-Ann, Richard, Claire and Calum Dietrich-Kennedy; David and Christopher Rowse; Matt and John Wilson. It is often said that under adverse conditions a person makes the dearest friends, and I hope you all know how much you mean to me and that you are always welcome wherever we live.

I also want to sincerely thank my friends in Edmonton who have continued to support me despite me frequently being away or unavailable. Peter Jarvis' support for me has been unwavering. Your belief in me has transcended all things and motivated me through the worst of times. I especially thank you for giving me 'a room of my own' to attend to the arduous task of finishing this document. My gratitude towards you, Peter, is inexpressible.

Thanks (as always) also go to Leanne Kisilevich. You have waited, supported, listened, laughed and cried with me, you are dear to me like no other. Your friendship and generosity spanning more than 15 years is a testament to the depth of our connection. Thanks also to Karen Pentland and Caroline Davis, each of you has such strength and wisdom that I feel humbled to know you both. Thank you to Marc Jarvis for our late-night / early-morning talks. You made my last efforts towards finishing this work more pleasurable. Thanks to Lisa Lunn, who popped back in my life at the right moment. Thank you also to Liz Hoffpauir, Angela Bogdanski and Kai Barrett (twice or thrice) for assisting with the final printing and binding details of this thesis. Thanks also goes to those who participated in my mock viva—Charles Kartz, Peter Jarvis, Ottilie Sanderson and Steven Hoose—your enthusiasm about this work got me through Robbie Burns day with the need for only a few drams of whisky.

And how is it possible to begin to thank my family? You are my life, Charles Kartz, Kai and Aerlan Barrett. You are the best partner and children a woman could have. You are each unbelievable—the sacrifices you have made to move overseas and back, to take chances, and to value something that is so immeasurable (intangible?). I feel blessed and honoured to be surrounded in my daily existence by such remarkable, resilient individuals. Last but not least sincere thanks goes to my extended family but especially our parents. Thank you to my father, Dr. William Strickfaden, who has discussed the pains of writing a thesis and making it through the PhD process. I have high value for our renewed relationship. Thank you also to my father-in-law Gordon Kartz for your quiet understanding of this process but especially for the loan of your car for extended periods of time. My second field study would not have been possible without its use. I also wish to thank you on behalf of our whole family for saving us from falling too far into debt.

Of course, with a project such as this that transcends several continents, there are many other groups and individuals to acknowledge. Many thanks go to my teachers, both formal and informal. These include the ever present Bruce Bentz and Tang Lee. You are my mentors, my guides, my friends—I thank you both. Thank you Tang for sharing your peaceful home in Calgary, I look forward to watching many more movies with you in the future. Sincere thanks go to Arlene Oak for showing me the way towards academia. You have accomplished so much, an act I will never be able follow! Thank you also, Arlene and David, for having me at your place on-and-off over the many years. I also wish to thank all the teachers and participants of the *Summer School on Engineering Design Research.* A special thanks goes to Mogen Myrup Andreasen and Lucienne Blessing, each of whom took time to understand my work and direct me towards a higher understanding of the multiple-disciplines of design. Other significant intellectual contributors are dotted across the globe from Japan to Europe. I thank Dan Brown in Prague for your friendship spanning two decades. You were there for me when I needed a friend—you are always in my heart. Thank you to Nami Wakabayashi in Japan for your presence despite the distance and for your undying belief in me. I sincerely thank Fung Yu, and Charlie and Xin Xin Cui from China, who were displaced companions in Edinburgh. As another family embarking on the 'research journey' you are all a strong reminder that although our paths are not ordinary or simple, they are worthwhile. This fills me with faith for our future generations. Thank you also to Troy Jones for bringing me faith in humanity for publishing our work in my absence and collaborating from afar. A special thanks also goes to Claudia Eckert, Martin Stacey, Calandra and Daria in Leicester and Cambridge—your friendship, understanding and intellectual stimulation helped me to persevere when I felt like all was lost. Last but not least, I want to thank Ann Heylighen from Belgium and Berkeley, you have been a beacon of light providing substantial contributions to this work. You have proven to me that our electronic era is

not all toys and technology; it is human, compassionate and caring. Your emails have kept my chin up even when tears have been streaming down my cheeks.

The design studios at the two universities in Scotland and Western Canada have contributed so much to the success of this research. The richness of these two groups, making up my field studies, has made this work stimulating, challenging and fruitful. I particularly wish to thank Duncan Hepburn and his fourth year industrial design students, and Barry Wylant and his senior industrial design students. Without all of your support, patience and honesty the work presented in this thesis would not have been possible.

I would also like to give sincere thanks to my supervisors, and my working and examining committees. You have provided me with a true British post-graduate education and have done your jobs exceedingly well. Thank you to Steve Stradling for your insightful questions and ease of manner during my MPhil transfer. Thank you Paul for putting up with my naïve questions and for pushing me in a way that only a dour Scot could. I am grateful to Pat Langdon for his many trips to Edinburgh, and for showing me the path towards rigour. I especially enjoyed our surreal postmodern meetings in Las Vegas this past summer. This thesis would not have transpired without the previously mentioned community of people with whom I have had the pleasure of working with over the past four years.

In Edinburgh, our flat was across from the Merchiston campus the home of the School of Design and Media Arts at Napier University. Like Kafka, I could easily wave a small circle in the air with my hand and say:

> *There is the university, my office window visible from my sitting room window. Here is my flat within walking distant of the shops and the library.*

In Edmonton my residence is in Old Strathcona and I could say:

> *There is my computer, my video camera and digital camera, and my television for transcribing. Within walking distance is the University of Alberta's Rutherford and Cameron libraries. And there are Steeps the teahouse and three Starbuck's on the way to the university.*

Or I could drive to the 'room of my own', in Virginia Woolf's words in Millwoods and I could say:

> *Here are my research transcripts, one set of charts ... and another. And here are my books, stacked according to subject and colour coded with sticky notes. And my notebooks filled with notations, thoughts, and ideas. There is the teapot with a cracked handle, my Netherlandish cup, and licorice pipes. My pocket watch is ticking on bed and I can hear banjo music being plucked in the background and three-o'clock in the morning.*
>
> *There across the ocean is North America: on the east New York, USA where I was born, and on the west Alberta, Canada where I have spent much of my life. To the south of Edinburgh is London England where I lived as an undergraduate student, The Netherlands where I lived as child and the many other countries I have visited including Germany, Czech Republic, Spain and Scandinavia to mention a few.*

These places embodying events, experiences and people all encircling my understanding of myself and design. More than ever before, I recognise the holistic viewpoint I have of the world and of my discipline design studies. I am honoured to contribute to a growing field of study in design research. But most of all, I feel a connected to the places and people both from *inside* and *outside* my immediate sphere. I am now part of the future of the broad circles of design.

Figures and Tables

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1 Exploring Sociocultural References

1.1 Introduction

The development of an artefact is inherently bound up with meanings, relationships, and value systems relative to the individuals creating them, and to the context of their immediate and external environments. An artefact does not pop out of thin air fully formed. It is part of a development process, an evolution that involves many factors and considerations. Design decisions are made regarding artefact form, overall aesthetics, materials, manufacture, user experience and more. These decisions are made through the knowledge of others and by considering the needs of clients (*i.e.,* manufacturers) and users (*i.e.,* consumers). These considerations in the design decision-making process are called the tangibles of design and are either taught explicitly or are implicitly present in the students' design studio environment. These tangibles are the well-known and well-documented stages of the design process and considerations that the design community presently considers as major contributors to the development of an artefact.

The development of artefacts is generally assumed to have been around since the beginning of humanity. Artefacts are defined as *goods* or *products* designed and made for people's use. The range of artefacts currently available for purchase varies considerably in cost, quality, function and aesthetics. In this thesis, artefact development refers to the contemporary products that industrial designers[1] design. These products are mass-produced artefacts varying from small household appliances to personal music devices to automobiles. Artefact development typically occurs within collaborative team situations (Scrivener *et al.* 2000). This is due to the numerous stakeholders in the final artefact (*e.g.,* manufacturers, clients, users) and growing numbers of *things* embodied in each artefact (*e.g.,* electronics, materials, ergonomics). Designers commonly work with a

[1] The term industrial design is used throughout this thesis to describe the profession or educational situation of individuals who develop artefacts. Although industrial design may be considered an obsolete term in the post-industrial era, it is used in the context of this thesis as a general term that may encompass designers and professional terms not described as *industrial*. Industrial design here is considered to be synonymous with consumer product design, design futures, and interactive design. Industrial design is not about the specific artefact being designed but is about the systematic way in

team of individuals from a variety of different disciplines in order to meet the common goal, the development of the best possible artefact for industrial manufacture. Therefore, designers are commonly exposed to a variety of perspectives, needs and factors while designing an artefact. Although it is a valued pursuit to investigate teamwork, this research looks at the social and cultural information that each *individual* designer brings to the design process. That is, this research defines and describes individual-personal and social-cultural (sociocultural) information that is brought to the design process through referencing experiences, events, memories and objects. Hereafter, referencing the sociocultural context is described as the 'sociocultural references'.

In order to investigate the breadth of contemporary artefact development, two groups of senior industrial design students have been chosen for this enquiry into the design process. By tracking the design of a single artefact, developed by each individual in a group scenario, the references are separated as relating to the inside design environment, the outside environment (sociocultural context) and as either tangible or intangibles (closely related to the artefact or far from it). This is done within an educational setting more easily because the central stakeholder in the design of an artefact is the students' instructor(s)[2]. Access to previous projects, the design curriculum, and past histories make the inside distinguishable from the sociocultural context. Furthermore, an educational setting provides an environment where specific variables can be controlled. Factors including the number of participants, previous design experiences, the lengths of each study and design briefs are comparable in each study presented here.

Each study tracks a group of university level industrial design students, one for six and the other for seven weeks, each from the onset of their design brief to the completion of their project. The first group of students is working towards the design of an airline meal tray at a university in the United Kingdom (UK). The second group is working towards the design of sports eyewear at a university in Canada. Each student within the group works more or less independently towards a proposed design. However, they consult each other in a variety of ways: one-to-one, in mini-groups, as a complete group; formally or informally; and with or without their instructor(s). An ethnographically oriented approach is taken in order to capture information about the designers' sociocultural context sought after in this research. Design theory along with cultural anthropology and social psychology form the core of the theoretical framework. A mixed method approach is used in order to capture a

---

which artefacts are designed. Hereafter, the term *designer* refers to *industrial designer* or more generically artefact designer.

[2] The term instructor is used throughout this thesis to avoid the hierarchical construct associated between the terms *tutor* and *professor*. It is understood that the university terminology varies from continent to continent and that these terms are not necessarily associated with the individual's experience-base. All the instructors who participated in these studies are highly qualified individuals who have worked both as practicing designers and teachers for more than 10 years.

breadth of the design process and separate the tangible from the intangible. The methods used include observations, informal interviews, and questionnaires.

This thesis broadly engages the design process within a design educational environment, and focuses on the intangible references used during the designing of an artefact. This chapter begins by introducing the idea of the references to the sociocultural and (in)tangible references as part of the design process and provides a broad overview of the intellectual traditions that inform the research problem. From this, the problem statement is identified within the context of design, in the section titled 'what are the intangible references?'. The abbreviated review of design in this introduction does not completely answer the problem statement of this research; therefore, the hypothesis, goals, objectives, and the research question are elaborated. Finally, the overall structure of this thesis is mapped out at the end of this chapter.

1.1.1 References to the sociocultural context within the design process

Artefact creation within the design process is contextual. The context of artefact creation is described here as relative to stakeholders and to the groups that the designer is currently working with. Moreover, the context of artefact creation is also relative to the individual designing the artefact and the immediate (inside) and external (outside) environments that he or she is exposed to. The designer[3] carries a substantial amount of information about the world. He or she does not come to design as a *tabula rasa.* The information that the designer has about the world around him or her has been described as 'cultural capital' by Pierre Bourdieu (1984), and is held within the individual as personal experiences and memories. Therefore, it can be stated that, while designers are *doing* cultural production (*i.e.,* designing an artefact), they are inherently drawing upon their own understanding of culture (*i.e.,* in the form of personal cultural capital) and are also transmitting this culture through their designs. Edward Woodhouse and Jason W. Patton (2004: 2) define the concept of transmitting or reproducing culture as:

> *... design by society is intended to signify that social norms, values, and assumptions are reproduced — often unintentionally — in the products of design.*

Woodhouse and Patton's paper is the introduction to a special edition in the *Design Issues* journal focusing on design by society. Even though this introduction suggests that the papers in the journal may be about the designers' relationship to the sociocultural context, it is not so. The papers were originally written for a design seminar called Science and Technology Studies (STS) that aimed at exploring how design can help shape a

[3] The term designer is used loosely here and also refers to the design student. It is understood that a design practitioner's experiential-base is significantly different from the design student's, where the practitioner may use previous projects as a repertoire for creating a new artefact and the design student may not have a significant enough repertoire to choose from.

commendable civilization *for* people. Therefore, the papers from STS are focused on design users and not designers.

The accumulated cultural capital of an individual is expressed during the design of artefacts in the form of designer narratives. Peter Dormer (1990) refers to the 'little narratives' of design as the small details that make up individual products. It is speculated that if the little narratives are present in finalised artefacts these are also present in the artefact creation process. John Heskett (2002) further elaborates the concept of little narratives by stating that designers work within processes that are highly subjective and based on *individual insight and experience*. The individual designer's capital is information that he or she carries and reports while engaging in designing an artefact. This dialectic place is shown in figure 1.1.

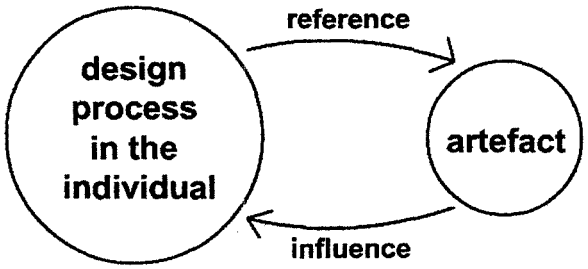

Figure 1.1: role of references during the design of an artefact

When in dialogue with other people the designer references his or her subjective experiences, which are made relevant to designing. It is important, here, to distinguish that it is the *references* that are being investigated in this research. Although it is interesting to consider whether these references influence the final artefact design, the sociocultural context is the focus. The references made by the students fall naturally in the realms of being tangible and intangible. The intangible references may be individual-personal such as events from childhood, or sociocultural experiences including religious practice. These references have been named the *intangibles* in this work because the references used by designers are not physically or materially present and are highly subjective and ambiguous. The terms 'intangibles' and 'references' are further defined in chapter 2.

Along with understanding and defining references to the sociocultural context the purpose of these references is also of interest. It is central to this work that references be understood within the framework of something that is known to designers and that is the design process. The design process is understood in a variety of ways, which is reviewed in chapter 2 and 3. The focus of this work is then, to define references within the design process. It is the central aim of this research to view the design process in as whole a form as possible in order to reveal the nature of these references. By consequence, this

research acts in two ways: one is to investigate references, and the second is to present the design process as a holistic activity (*i.e.,* from start to finish, *in situ*, and in the designers' own way). Figure 1.2 represents the two central investigations in this research that are linked by design education, including how the design process is currently understood and taught.

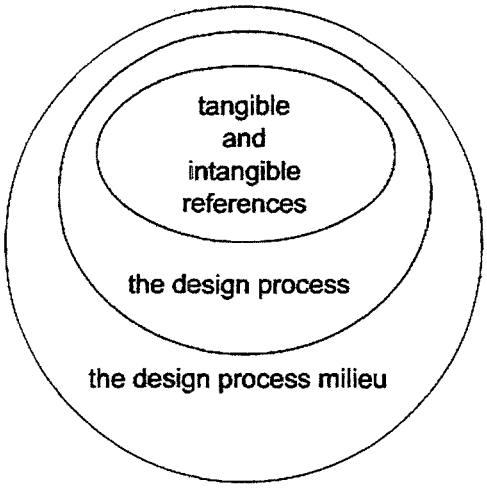

Figure 1.2: from the microscopic to the macroscopic

At the core is the microscopic (micro), the (in)tangible references. These are surrounded with the macroscopic (macro), the design process milieu. The design process milieu, introduced in chapter 3, is the model that is developed in order to understand the design process more holistically. All references, tangible and intangible, make up the design process milieu.

1.2 Intellectual traditions

One of the key challenges in doing research in the area of design is that some of the areas of concern are being studied through other disciplines. This thesis is not exempt from that challenge. Many other disciplines, pure or interdisciplinary may assist in exploring the problem of the references in the design process. For example: sociologists explore society's role in shaping the individual (Bruce 1999); psychologists examine the inner world of people including mental abilities and how these are used to operate in the world (Butler & McManus 2000); and anthropologists explore people, places, social, and cultural identities (Monaghan & Just 2000). Design researchers have crossed disciplinary boundaries and used approaches and methods from a variety of disciplines. Interestingly, this cross-fertilization is increasingly more common among disciplines such as sociology, psychology and anthropology. The blurring of disciplinary boundaries is due to the fact that many of the same broad intellectual questions drive the research in varying disciplines. For example, social psychologists, anthropologists and sociologists may raise questions about the nature of collective life or how an individual relates within a group and

theoretical explanations may cross over between disciplines. The problem here is how a design researcher approaches and subsequently analyses any given research question. Pointers to how to begin a journey into design research are found inside and outside the design research community. For example, some of the recommended sources for studying design are highlighted in the journal *Visible Language* (Poggenpohl 2002). This annotated bibliography has many sources, primarily from disciplines other than design that help mark the path towards sound design research. One example of an interdisciplinary research project from inside design is Zoe Strickler and Patricia Neafsey's work on preventing drug interactions in older adults (2002). This work combines graphic design communication with marketing, cognitive psychology, pharmacology, and gerontological nursing. The role of design in Strickler and Neafsey's work is to assess the effectiveness of interactive software as a learning tool for older adults (*ibid* 105). Other sources for pointers on how to approach design research are found among other disciplines and subdisciplines that approach research as an interdisciplinary endeavour outside of design. For example, the study of artificial intelligence is notorious for taking interdisciplinary approaches. That is, Marvin Minsky is a mathematician who made major contributions to the areas of artificial intelligence, cognitive psychology, computational linguistics, optics and more. The diverse acceptance of Minsky's work illustrates that the study of artificial intelligence is connected with and embraces many disciplines. Other disciplines, such as human ecology (Steiner 1995), are distinguished as being eclectic in the use of different approaches and methods. The majority of disciplines that embrace interdisciplinarity are ones that are less tied to specific theoretical and methodological traditions.

A key feature of research into design is that many sources emanate directly from authors who have practical experiences in design. For example, Patrick Jordan, former leader of human factors at *Philips Electronics,* has written books on user-centred design that have gained notoriety in the realm of design practice (Jordan 1998, 2000). In addition, the design consultancy *IDEO* produced a video and has published several books that attempt to demystify the creative process of design (Kelley & Littman 2001). Historically the opinions of successful designers have been sought after to demonstrate how designers work and think. Books are written from the first person (Rashid 2002) or by academics that wish to elaborate on the design process from the *experts'* point of view (Lawson 2004a, Rodgers 2004). It is well known that many academics studying design have been or are currently practicing design. This trend continues to be a primary inroad to understanding design. There is no escaping a discipline that is rooted in practice.

The diverse approaches and methods used in design research have provided little integration of knowledge across the boundaries of the discipline (*e.g.,* architecture, product engineering, industrial design, graphic design). There is even some discontent and criticism within the design research community on how research should be accomplished. Nonetheless, academic research into design has built momentum over the past three decades.

Having stated that design is approached from interdisciplinary perspectives, some of these are worthy of mention. A variety of approaches to gain valued information on the design processes include, for example: protocol analysis (Eastman 1970, Cross *et al.* 1996, Leclercq & Heylighen 2002); symbolic interactionism, ethnomethodology, and conversation analysis (Oak 2001); social constructivism and social network analysis (Ashton 2001); and integrated ethnographic and empirical methodology (Langdon *et al.* 2003). In these ways design researchers glean understandings about the practice of design, the education of designers; and further develop artefacts, tools, and theories on design by combining a traditionally practice-based discipline (design) with those that are sometimes considered more academic (humanities and the social sciences).

Reviewing and reflecting on design research can be a complicated endeavour that demands a breadth of knowledge in the arts and sciences, and a clear understanding of what other academic disciplines might offer the discipline of design. The research detailed in this thesis follows an interdisciplinary approach, similar to other design researchers who have queried design and cognition (*e.g.,* problem solving processes), personal identity in conversations (*e.g.,* talk during critiques in design education), and the social capital of designers (*e.g.,* the social nature of design education).

At the centre of this interdisciplinary model are the research questions: what kinds of references to individual personal and sociocultural experiences occur during the design of an artefact, and when and why are these used? The substantive domain of this model indicates design because it is the predominant focus in this work because there is currently a substantial body of knowledge in design called here design theory[4]. The interdisciplinary model shown in figure 1.3 is not meant as a definitive model for other design researchers to follow, but is an illustration of how several disciplines integrate to assist in better understanding a research question.

[4] There is a debate in the academic community that real *design theory* does not exist. This is because design as a philosophical question has existed for a relatively short period of time and because design is inter- and transdisciplinary. For the purpose of this thesis, I use the term *design theory* to represent all the current information on design, whether that information was originally developed for practical / applied purposes or for developing theories.

Figure 1.3 illustrates the interdisciplinary research model used in the research.

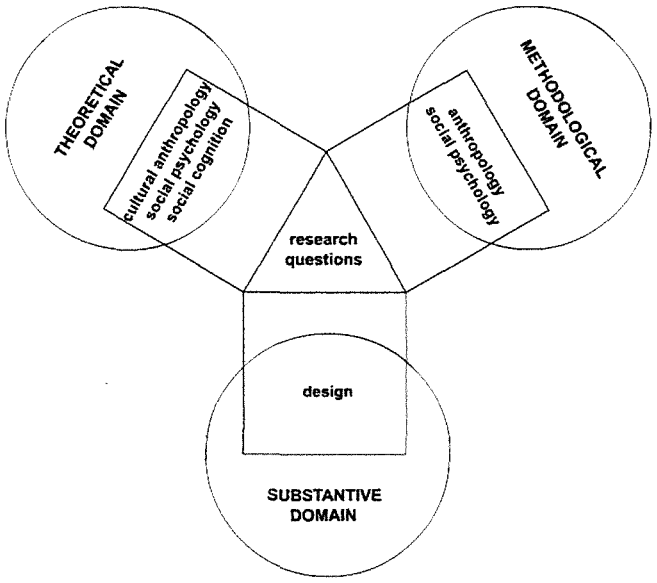

Figure 1.3: interdisciplinary research model used in this research (adapted from Strickler & Neafsey 2002)

Theoretical and methodological domains used in this research include disciplines from the social sciences that create the framework for the approach, data collection, and analysis. Secondary to design is the discipline of cultural anthropology followed by social psychology and social cognition. Anthropology and psychology act to varying degrees within this research and are key to addressing the research questions. The following sections illustrate the relevant connection points outside and inside the discipline of design.

1.2.1 Design theory

Research on design practice is identified as research into the act of designing but is better known as researching the design process. Existing research in this area typically focuses on systematic and procedural methods to improve on designing activities, or focuses on the artefacts being designed (Goldschmidt 1994; Purcell & Gero 1998; Rodgers *et al.* 2000). Research on design practice can be divided into two streams, one is *about* design and the other is *for* design. That is, research *about or into* practice has typically focused on improving the way we design, whereas research *for* practice has focused on improving the artefacts we design. Therefore, it can be stated that design is an applied discipline that has a relatively new stream that involves *understanding* design for the sake of knowledge development and the development of design theory.

Design theory is described as having three central traditions including: the prescriptive, computational, and descriptive (Minneman 1991: 40-55). The prescriptive tradition refers to the earliest work on design methods beginning in the 1960s with Alexander, Archer and Jones. These works were developed by practicing designers and seem to be heavily

influenced by the fields of cybernetics, operations research and general systems science (*ibid*). The second tradition is computational, which is described as being developed in order to support designers with computer-based tools. Finally, the third tradition is descriptive research into design practices. Descriptive research is more common in architectural studies (Blau 1984; Cuff 1982, 1991). The 1980s saw a rise in descriptive discourse; however, many studies were in the form of protocol analysis rather than observational naturalistic studies as were done in architectural studies.

Academics other than Minneman describe design theory as having distinct traditions. This includes Oak (2001) whose thesis divides research on design practice into four traditions including: design methods, design as problem solving, design as collaboration, and design as social process. Oak's four traditions can easily be paralleled with Minneman's three traditions. Minneman's descriptive tradition includes Oak's traditions of collaboration, and design as social process. Either way, design theory can be identified as being on a continuum moving from systematic and scientific to more interpretive and reflective. Early design theorists sought to approbate and master the subject matter of design by categorization and generalization. The emerging descriptive tradition begins to take into account the nuances of design and is more accepting to research with the simple purpose of understanding rather than serving as tools to learn and tools to design. Although the work in this thesis is not entirely free from the possibility being applied, it is accepted that understanding design processes constitutes a valid contribution to the growing area of design theory.

Having design research break from a model that is valid beyond serving design practice is not altogether unusual. Other disciplines (both practice- and non-practice-based) have followed a similar pattern in an evolutionary trend towards fewer generalizations and more nuances. For example, research in anthropology began with academics having an authoritarian voice telling the world what other cultures were like, but in contemporary anthropology the interpretation of data is more of a negotiation between the academic and the research participants (see chapter 3 for more detail). Therefore, design, like anthropology, is looking towards a more reflective approach to research with fewer definite *answers* to apply to education or practice and more descriptions that lead to a broader understanding of design.

Ultimately, the traditions of design research and theory have taken an interesting path towards defining design as a deeper philosophical endeavour. These traditions have illustrated limitations and benefits to specific approaches, allowing for deeper reflection on design research. For example, the prescriptive / design methods tradition presents

current researchers with a clear understanding of the limitation of producing a generic model, that is, this tradition does not account for the idiosyncratic and ambiguous characteristics of the individual. The computational / problem solving tradition provided the study of design with an interdisciplinary model for approaching design (*i.e.,* through the introduction of interviews, surveys and protocol analysis) but is relatively limited to the understanding of design cognition. The emerging descriptive / collaborative / design as social process traditions are defined by further interdisciplinarity and embrace a broader range of approaches and methods. The growing body of research on the social nature of design, although still in the minority, is the area of research this thesis builds upon.

An interdisciplinary and mixed-methods approach is used here for gaining access to information about interactions that take place while the designer is engaged in the design process and about the effects of sociocultural context on design. These enable insight into the design process as a whole including fleeting idiosyncratic details. One consideration for embarking on this approach and methodology to investigate design was that some of the early approaches to design research had been criticized for being constructed under unnatural and artificially constrained circumstances. This particularly refers to protocol analysis where in addition to posing unnatural conditions, a number of studies have raised questions about the validity of the method (Nisbett & Wilson 1977; Russo *et al.* 1989). This thesis approaches the research question by investigating the design process in the naturalistic setting of the design students' studio environment. There has also been criticism in the design research community that there is no consistent approach taken to coding and interpreting data (Cross *et al.* 1996; Scrivener *et al.* 2000). Data interpretation is to some extent a matter of preference and style. However, it is important that the researchers who disseminate information from their research itemize exactly how the analyses were completed. The data collected in the two empirical studies detailed here is coded and interpreted through well-established theoretical frameworks associated with anthropology and social psychology, and is described in detail in order to allow for criticism from the design research community in general. Furthermore, the validity of any research approach and methodology can and should be questioned, especially from within the research community involved. However, it is the responsibility of the researcher to crosscheck his or her work. One technique for crosschecking used in this work is consistent consultation with researchers from anthropology and social psychology. Another technique used for crosschecking is investigating the intangible references at more than one site (*i.e.,* two field studies). This allows for a comparison, but also allows for a truer investigation into sociocultural context in the broadest sense by having two field studies to investigate.

It is clear that although the prescriptive / design methods and computational / problem solving traditions of design research have limitations they should not be discarded completely. By discarding them a hierarchical system in design research would be proposed. On the contrary to this, this research project proposes an integration of design methods with reflective research practice by exploiting the earlier traditions of design theory as tools / methods to provide pointers about when sociocultural references are made in the design process.

1.2.2 Anthropology

Anthropology is anthrocentric, which means that humanity is central to its investigation and that the central goal of anthropology is to build a wider understanding of human nature. The discipline of anthropology accepts the idea of monogenesis (Barnard 2000:23). This means that it is understood that all humankind comes from 'one origin' and that all people are fundamentally the same (*i.e.,* biologically and physically). One central difference between anthropology and other disciplines is that it does *not* take the view that the individual is central. Individual actions are de-emphasized in order to seek broader patterns. According to Emile Durkheim individuals are considered to be the pieces that make-up social structure and how these individuals relate to one another is the focus of anthropology (Peacock 1986:13). Anthropologists begin with the whole, not the parts. Therefore, two central aspects of anthropology are to:

1. observe society or a group as a whole, and
2. examine societies or groups in relation to other societies in order to establish similarities and differences.

Observing society as a whole involves investigating the integration of individuals within social and cultural contexts. Ghandi's metaphor describing that individual's are drops in the ocean and that the individuals cannot survive without the ocean (Robbins 2001:170), is a description that is well suited to the notion of holism in anthropology. Ruth Benedict defines one of the earlier ideas of holism and expressed these in her book *Patterns of Culture* (1934) where she describes studying the Plains Indian culture by using a series of themes. She presents the whole of the culture relative to a number of categories. The use of categories is considered to be a way of seeing the whole in an understandable way and not as a true representation of reality *per se* (Peacock 1986:22). The categories are not considered to be 'things'; they are abstractions from the whole. Categories, therefore, provide details that are grasped in the context of the whole. The categories used in this research are detailed in chapter 4. A holistic perspective allows for an exploration that moves between the macro (culture) and the micro (details). In this way, culture can be described as unity and details can provide diversity. This holistic model also involves the

exploration of the interconnectedness (Barnard 2000:73) within and outside a given study. Relationships and connections are sought to understand the whole (inside) or to compare one society / culture to another (outside).

Anthropology can loosely be defined in two subdisciplines, social and cultural. There is no absolute divide between the two with many overlaps. For example, Durkheim contributed to social and cultural anthropology as well as to the discipline of sociology (McIntosh 1997:6). The difference between social and cultural anthropology (and all disciplines and subdisciplines that investigate sociality or culture) are in the emphasis of the research questions. Social anthropology is the exploration of the social field in which people engage. Therefore, focus on what is being investigated and emphasized is required along with a general understanding of the themes and tools for exploration. Society is governed by rules and functions and is naturally framed by culture. Social anthropologists are interested in the rules and regulations that govern social behavior, how people associate with each other and how social activities are organized. Bronislaw Malinowski and A. R. Radcliffe-Brown were two founding members of social anthropology. The work in this thesis is does not focus on societal rules and regulations, therefore, approaches and methods relative to cultural anthropology are predominantly used here.

Cultural anthropology is the largest subdiscipline of anthropology and is in the widest sense, as described by Barnard (2000:3):

> *... the study of cultural diversity, the search for cultural universals, the unlocking of social structures, the interpretation of symbolisms.*

Historically cultural anthropology is bound to colonialism but the boundaries of cultural anthropology have been expanded in the past several decades. What began as work primarily conducted by western researchers on non-western peoples (*e.g.,* colonialism) is now research that is taken from many perspectives, including investigations into western civilizations and explorations by non-western researchers. Social and cultural anthropology are further divided into themes of study such as identity, marriage, ethnic groups, nations, economy, religions, and linguistics. Social and cultural anthropology are enmeshed through theoretical approaches and in the methods employed to access information. Dialogue is considered to be the backbone of anthropology, which is captured best through observation and interviewing. Therefore, anthropologists typically use ethnographic methods where they observe groups of people by interacting with them over extended periods of time. The resulting data about the group they are researching is rich in description and is typically more interpretive than some other forms of research. The relevant theoretical foundations, corresponding methods and means of data analyses used in this research are discussed more in depth in chapters 3 and 4.

Because culture is at the heart of anthropology and an interest in this thesis, it follows that the notion of culture be defined. Culture is an ambivalent concept and not easily defined. The concept of culture has been debated among anthropologists for over a century and will undoubtedly continue for some time to follow. Edward Tylor's (Peacock 1986:3) classical definition dating back to 1871 is:

> *Culture ... that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society.*

One of the most important concepts in this definition is that culture is defined as being *acquired* and is an accumulation rather than being something an individual is born with. Here, culture begins to be understood as a human activity and the definition implies infinite variations of culture. These variations are understood to take place within boundaries that are produced within the physical and mental capabilities of humanity (Monaghan & Just 2000:43). Franz Boas, considered the father of cultural anthropology, describes culture as a pair of glasses that we each look through. Culture, according to Boas is about the way people understand the world around them, how they frame their actions and interpret the actions of others (*ibid* 36-37). In orthodox anthropology, culture stands for regularity and pattern — culture is a coherent system of values, norms and habits that are repeated predictably at an individual level (Bauman 1999:xvii). Contemporary anthropologists define culture as a dynamic, complex force that is linked to praxis. Renowned anthropologist, Clifford Geertz (2000) discusses the notion of culture over numerous pages in his book *Available Light Anthropological Reflections on Philosophical Topics* (*ibid* 11-16). Geertz never clearly pins down the notion of culture but states that culture is:

> *... learned behavior, that is superorganic, that it shapes our lives as a cake-mold shapes a cake or gravity our movements.* (*ibid* 13)

In essence, Geertz believes culture to be defined by the societies and sub-groups that create their culture. Interestingly, these cultural groups are also *shaped by* culture (inside or outside their own). In all cases culture is a localized understanding and knowledge whereby the culture created is as unique as the one that shaped the individuals involved in that group.

For the purpose of this thesis, culture is understood as complex and differentiated; therefore, it is not possible to present culture as a completed picture. Culture will always be incomplete, from a philosophical standpoint as well as from a practical standpoint. Philosophically, it is not possible to read culture like a book and relay systematic information about that culture in a complete manner. This is because the reader of the culture will always influence the understanding of the culture whether he or she is one of

the writers of that culture or not. From a practical position, a single culture can never be absolute and complete because information is fleeting and easily missed or lost. There is a multitude of minute details in any given cultural study. The description of any given culture, is therefore, a negotiation between the researchers / participants and the resources / time available towards its investigation. Finally, whether anthropologists study the social or the cultural realms it is understood that human reality is complex and that this reality is constructed (Alasuutari 2004:11) from the inside and outside. The resulting discourses that have emerged out of anthropological studies to date represent the interests of a segment of society and are considered works in progress. Geertz describes anthropology as a creative endeavour that is about description and narration (Barnard 2000:164). Geertz (2000:93) exerts that:

> *... the specialness of what anthropologists do is their holistic, humanistic, qualitative, strongly artisanal approach to social research.*

By using anthropology as an approach to design research, the notion of continuity and interconnectedness is proposed. The concepts of holism, and the notion of culture form the basis for using an anthropological approach in the investigation of the design process. This is not only a way to look at the world of design, but interconnectedness is also a concept that relates to design research. The very nature of an anthropological approach is one of inclusion and holism, therefore it deemed reasonable even within anthropology to use design methods in combination with anthropological approaches.

1.2.3 Psychology

The connections between design and psychology in this research are particularly important due to the extensive interdisciplinary work accomplished to date between these two disciplines. By providing a concrete understanding of the theoretical and methodological connections with this work, a sense of continuity is provided with current and previous research in design. However, the task of making connections between psychology and design is not simple because psychology is a vast and diverse field that bridges the natural and social sciences. Psychology, in its broadest sense (Butler & McManus 2000:133) provides:

> *... an understanding of mental life from many perspectives — cognitive and behavioral, psychophysiological, biological, and social.*

According to Peter Gray (2002) classical psychology encompasses the study of behavior and the mind through science. Behavior refers to the *observable actions of a person;* the mind refers to an *individual's sensations, perceptions, memories, thoughts, dreams, motives, emotional feelings, and other subjective experiences*; and science refers to the collection of data, which *endeavours to answer questions through systematic collection*

and logical analysis of objectively observable data (*ibid* 3). The two key areas from classical psychology that connect with this research include the *mind* and *science*.

The *mind* refers to cognitive psychology, which is about people's abilities to acquire, organize, remember and use knowledge that guides their behavior. Cognitive psychologists have asked questions about how people learn, structure, store and use knowledge (Sternberg 2003). This work does not directly follow this line of investigation; however, it does look at the subjective experiences of the designers that typically occur in the form of the memories. This work does not address the specific use of memories. It does; however, look at the references that are made *about* personal memories and experiences. Psychologists believe that memory is intimately tied to learning and the design studios studied here are learning situations just like many design projects are also learning situations (*e.g.*, newly encountered problems). Peter Gray (2002:323) writes:

> *The effectiveness of our behavior depends on knowledge we have stored as memory. It also depends on our ability to call up and combine the portions of that knowledge that are useful for the task at hand.*

It is clear that in design, as in many activities people encounter on a daily basis, memory is used to explain, explore, evaluate and understand the surrounding world.

The *science* of psychology is significant to this research in that the information provided by the participants as data in the two field studies is approached in a relatively scientific and systematic manner. This is similar to how a psychologist might approach field research. For example, it is common for psychologists to use correlation studies in order to observe different variables. The two field studies here involve two groups of students; however, one group is all male and one group is fifty percent male and fifty percent female. In this way, the variable of gender differs from one study to the next, which enables basic observation of gendered references during the design process. It is important to state here, that in psychology lab experiments are most commonly used. The psychologist performs experiments, in labs or settings close to natural, and will often deliberately manipulate the subjects in situations created by the experimenters. In this work, the fieldwork is deliberately *not* manipulated. The studies take place in the natural settings of the design studios of the participants involved. The final locations for the field studies were chosen based on time frames and the willingness of the participants to engage in the research. Therefore, the participants not the researcher contrive the contents and situations represented in the field studies. Ultimately, the control variables chosen by the researcher are the length of the studies, the use of a single design brief, and the limited number of participants. The make-up of each social grouping was known to the researcher in advance but not chosen by the researcher. This fieldwork approach is

not unique to a psychology, as described through its use in anthropology. This approach leans towards sociology therefore the subdiscipline of social psychology is relevant to this work along with classical psychology. In the studies presented here the science of psychology has an influence on the way that the data is collected and analysed. Further details on this topic are presented in chapters 3 and 4.

Social psychology, according to J. B. Watson (1919), is the study of a person's behavior which is the product of their past experiences. Watson, along with other behavioral psychologists believes that understanding the sociality of humanity is linked to analysing observable stimuli and responses. Furthermore, social psychology is about the here-and-now and identifies processes that people are influenced by. Most importantly though is:

> *Social psychology is the study of the interrelations amongst individuals, their interactions and the societies they live in* (Watson in Fraser 2001:2).

This research draws upon the social psychologists' understanding of interpersonal relationships from a socio-centred approach (Graumann 2001:5). This includes, but is not limited, to theories about the individual as a social being, the make-up of social groups, and factors that relate to sociality. The theories relevant to this work are examined in detail in chapter 3.

In general, the understanding of interpersonal relationships is significant to this work especially because it is the interactions within interpersonal relations that contain the intangible references. Interpersonal relationships and intra-personal experience are defined as having successive levels of complexity (Hinde 2001:118), and the design studio is not exempt from these. Social complexity works on several levels but includes all that is going on outside of the individual. Of course the internal world of the individual is affected and affects the social situation; however, this is not explored in detail here. The individual is affected by the current environmental conditions (design studio, university, geographical locale) and the current sociocultural conditions. In addition, the individual has memories of past environmental and sociocultural conditions. This work primarily investigates the area between individual behavior and interaction (through dialogue / references) in order to better understand the roles of design studio / design school (inside environmental processes) and sociocultural (outside processes) situation. Socially, the individual is involved on many levels with other individuals, which are called interpersonal relationships. These include one-to-one relationships, relationships with a set group, and relationships outside of that group with other groups or greater society.

The levels of social complexity are shown in figure 1.4.

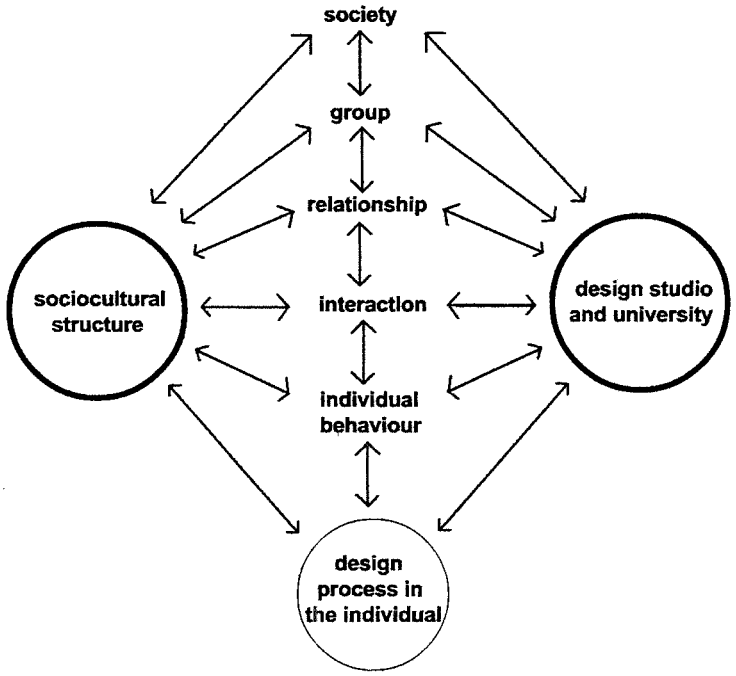

Figure 1.4: levels of social complexity in the design studio (adapted from Hinde 2001:118)

Interpersonal relationships are divided into two areas: relationships and interactions. Relationships are a series of interactions between individuals who know each other and interactions are of limited duration (Hinde 2001:117). The lines between what constitutes relationships and interactions are blurred because these are dynamic processes. Social psychologists have studied interpersonal relationships in depth. For example, Kelley *et al.* (1983) explore the actions and subjective phenomenon within interaction. Some of what they look at is patterns, strengths, and diversity of 'temporal chains' between two individuals. Kelley *et al.'s* fine-grained work analyses the interactions of the individuals and not the relationships between the individuals.

As previously mentioned, references are part of the interaction that occurs in the design studio. Although the relationships of the participants involved in the studies presented here are relatively developed (*i.e.,* they have spent a great deal of time together in the university environment) this work is about what is discussed during the design process and why it is discussed. It is recognized here that relationships define the types of interactions that occur within certain situations. For example, the teacher-pupil relationship implies particular contents in that relationship because it is governed by certain types of rules (Hinde 2001:121). The participants in this study are certainly governed by their relationship with their instructors. Therefore, leadership and the teacher-pupil relationship are taken into account when it is relevant. In general social psychologists work towards making sense of people's beliefs, their social behaviors, and how people influence one another. These are all framed within the context of individual's

past experiences. In this way, there is much to gain from looking to social psychology when investigating design processes in the design environment.

The intellectual traditions that form the foundations of this research are interdisciplinary with design at the heart. Anthropology is central to the assumptions and approaches taken here. Anthropology and social psychology work to inform the theoretical foundations and the data analyses. The same broad questions that drive anthropological and social psychological research are at the core of this work. The central question being: how can we better understand the collective dilemmas of the designer during the design process? In addition, dialogue is the backbone of anthropology and language is central to understanding human psychology. Dialogue, language, discourse — these are the ways that people interact with one another and reflect cultural activities and values (Benedict 1934; Geertz 1973). Words and sentences are representations of meaning (Chomsky 2002) and so are the visual images and representations used and created by designers. The *references* made in the design process milieu are filled with symbols that relate to the design environment and beyond. The act of designing in the design process milieu includes aspects from the studio, the university, and broader sociocultural context. Therefore, the holistic interactions including the tangible and intangible references among design students provide us with insight into the sociality and culture of designing. Finally, the problems associated with researching within an applied, practice-based discipline remains to be an influence on how this work is approached. As a designer seeking to better understand the design process and an instructor seeking to be a better teacher, the notion of doing research that can apply to *improving designing* or to *teaching* are factors, but not the driving forces, in this research. Therefore it follows that an approach that reflects a categorical system of making sense of process is used here. These categories are not meant as an end to discovering the sociocultural context, but a beginning, from an alternate interdisciplinary perspective. In this way, the research model described and used here is interdisciplinary in that design, anthropology *and* social psychology make up the approach, theoretical foundation, and analytical system for this work.

1.3 Problem definition in the context of design education

A base understanding of the nature of design is needed when investigating references in the design context. It is clear that designed artefacts are conceived, discussed, and planned before they are developed and this is, of course, where references to sociocultural context emerge. An argument has been made in favour of addressing design as part of broader social and cultural processes therefore an holistic perspective is

adopted for these studies. Although the history of design education is out of the scope of this work, it is relevant on a basic level. That is, it is necessary to understand design education in order to provide a context to frame the references and to engage in a more holistic study. A brief history of design education is detailed in appendix I.

There is essentially no prescriptive approach to understanding and subsequently teaching the pluralism of design. A number of generic and systematic approaches have been developed, primarily for the purpose of educating designers. Some of these approaches date back to the early idea that design was relative to fine arts and some are more current deconstructions of what is considered good design. No doubt, design educators embrace some of these approaches today while other approaches may be considered out of fashion or too restrictive. These approaches to understanding design are loosely divided into four categories including design methods, design elements, problem solving and design principles. A selection of these approaches is reviewed in chapter 2.

Even though design educators have access to a plethora of approaches to design, it seems that the current norm is to approach design education from a relatively idiosyncratic point of view. Interestingly, design education in the United Kingdom is highly valued for placing individuality as central and is famous for its idiosyncratic artistic approach (Smith 1998). There seems to be no right or wrong way to teach design, and in fact creativity in teaching practice is generally encouraged. The approach to educating the future designers not only relates to the individual instructors, but it also relates to the programme, the design school[5], and no doubt the country design is taught in. Even though design education cannot be generalized as having a single cohesive approach, there are themes that emerge that are worthwhile exploring. These themes are discussed in the following sections — design culture, studio culture, and industrial design.

1.3.1 Design culture

The phrase 'design culture' is problematic since the very nature of design is fluid and so is the nature of culture. The idea of a single design culture is unrealistic; however, design can be characterized as having some common aspects across the subdisciplines (*e.g.*, graphics, architecture, fashion, industrial). In Guy Julier's book *Design Culture* (2000), he identifies three domains of design culture. These are designer, production and consumption (*ibid* 4). The designer domain is clearly bound up with process, which is at the core of this thesis. The designer is shaped by his or her experiences inside and

[5] Typically a university grants BA, BSc, or BDes undergraduate degrees and approaches education more liberally (*i.e.*, a broader range of course materials to select from). Universities also offer degrees at the Masters and PhD level and are focused on teaching critical thinking in addition to the practical skills needed in design. Design school is a more generic term that can refer to an institution that may or may not grant degrees but likely provides a more streamlined education

outside design *and* shapes the content of what he or she is creating. Therefore the designer is responsible for creating culture through the production of material culture as well as being involved in one or more cultures while engaged with this process. The production domain of design includes manufacture, materials and technologies which all have an effect on marketing and distribution. The consumption domain relates to all aspects of artefact use and includes gathering information about user-groups. Design culture is intrinsically linked to industry with the goals of design ultimately being relative to the economics of a country (Thistlewood 1992). The Council of Industrial Design (CoID) in Britain is an example of the marriage of design to economy. CoID was established in December 1944 *in order to take steps to encourage good design in British industry* (MacCarthy 1979: 73). It was established to support trade and industry but also with the vision to improving the lives of the men and women of Britain and the world (*ibid*). CoID was renamed the Design Council in the early 1970s and changed the focus from design and industry to a focus on business and education in 1988[6]. Both CoID and the Design Council provided Britain with an international reputation for forward thinking in design. The influences of British design and the notion that design can aid in developing and improving the world is demonstrated by the influence of academics such as Bruce Archer. In 1973 Archer, then head of the Department of Design Research at the Royal College of Art made a trip to Canada where he promoted design awareness and its benefits to industry and the economy. Archer's series of design lectures and discussion seminars was followed up with a book published by the Department of Industry, Trade and Commerce in Ottawa Canada called *Design Awareness and Planned Creativity in Industry* (Archer 1974) where good design is described as a stimulant to generate a strong economy. More recently, the Canadian government released a report on design explicitly illustrating the potential for design to improve the economy of the country (Jones 1996). The objectives of this document were to inspire industry to collaborate with institutions on design projects, and young people to study design. Interestingly, it is well known that in Canada there has been a decrease in manufacturing occurring in the country (Giard 1990:24), which is also the case in the UK. Furthermore, many books on product development do not begin by describing the profession of design; they focus on the importance of sales and product cost. For example, the first sentence in Karl Ulrich and Steven Eppinger's (2000) book uses the phrase 'economic success' and follows this by stating that product developers create products that meet the needs of customers that should be produced at a low cost. Similarly, on page 1 of Mike Baxter's (1995) book he states that product innovation is vital to business success and follows this by describing

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(*i.e.*, a pre-set programme of study) that focuses on skill development. Even so, *design school* and *university* are used synonymously in this thesis.

how a company must compete with other companies by continually introducing new products. Neither of these well-respected books define what a product is relative to any system other than economics at the onset of the book. Whereas Eskild Tjalve (1979) begins his book with the idea of form and continues by describing the properties of a product. It is clear that no matter what the finished product, production and consumption will always play a central role in the design process. Designing is rooted in the idea of function and usability therefore design culture is less about personal expression and more about utility.

Along with the three domains of design culture, there are other design criteria that guide the final artefact. These include issues relative to the use environment, safety issues, and issues relating to impacts made on the environment. Along with these are less materially driven aspects such as cultural context, impact on people, symbolic value, philosophical beliefs, and suitability. These immaterial aspects relate to how an artefact connects with the user group, which includes a specific cultural group, gender group, and age group. Currently, immaterial aspects of design are those designed-in features of a product that can elevate one artefact above another. Currently, there is a push to be a more conscious designer by having a deeper sense of the user's needs. This emerges from the ideas of *Participatory Design* in architecture (Cross 1971) and has developed into areas such as user-centred design (Jordan 2000) and design ethnographies (Squires & Byrne 2002). For designers to have a deepening sense of peoples' needs and to design-in immaterial features is an important move towards artefacts of increased value. The participatory design movement also included the notion of designing for more diverse groups. On the other hand, in addition to consciously designing-in immaterial features the designer may also be unknowingly designing-in features that relate to his or her cultural capital. Because the designers' cultural capital is made up of individual personal and sociocultural experiences (*i.e.,* immateriality), this is where the references to the sociocultural stem from. It is this realm of immateriality, from outside of design that provides the clues to understanding sociocultural influences on the design process.

While artefacts development is the result of human decisions, the subject of design itself is not fixed; design is constantly undergoing exploration and continually evolving. Designers are often defined as problem-solvers yet they rarely *solve* problems the way mathematicians do. What designers really do is propose a given set of actions for a problem, out of a myriad of possible actions — responding to a design problem but not solving it *per se*. Therefore, current day designers are more aptly defined as problem-

[6] 'The Design Council' <http://www.design-council.org.uk> Accessed on February 17, 2005.

identifiers (Gedenryd 1998). In this role, the designer begins a complex examination of the social nature and purpose of what they are designing. Most designers seem to enjoy the thrill of a new design problem and work well under conditions that relate to the unknown. Richard Buchanan (1995) describes design as partly *rational and cognitive*, and partly *irrational, emotive, intuitive and noncognitive*. Bryan Lawson (1998) also described the design process as having an aspect that involves *intuitive and imaginative thinking.* One key part of designing is that designers and design educators value the idiosyncratic and elusive nature of designing. *Aha moments* (Cross 2000) and *gaps* (Strickfaden & Rodgers 2004) in designing are considered a big part of design creativity and moving forward. In one of the pilot studies for this research project, it was revealed that students consistently liked to hide the sources of their ideas in order to present themselves as being magicians or inventors (*ibid*). In this way, knowingly or unknowingly, the students create a myth about how creative they are. This example is one of three themes that are revealed in that early pilot study (see pilot study 2 chapter 4). The other two themes are that students reference their everyday world (*e.g.,* television, comic books, personal possessions) more consistently than the design world (*e.g.,* high design items, designers); and that a futuristic genre is explored as a source of information because designers are ultimately designing for the future. These three themes include the designers' myth of creation, references to everyday events and experiences, and designing for the future are features of design culture. However, these themes may also be unique to the design studio where this study took place. Even so, this begged the central questions of this investigation, and inspired researching into the idea of the design and studio culture.

In design literature descriptions of the culture of design education are fairly limited. For the most part, when a design culture is described, it is done so retrospectively, much after the fact. For example, Heiner Jacob describes the culture of HfG Ulm (1988) by reflecting on his time spent at the school. He describes the space as a *design monastery* that was *stripped bare of everything essential (ibid*:224). Jacob also describes the work pattern of the instructors and students and details such as the clothes people wore, the music they listened to and quirky trends such as the students changing their first names and adopting lower-case-style writing (*ibid*:226). Although Jacob's reflection is an excellent description of HfG Ulm's culture, it is incomplete and relatively narrow because it is presented from the insider viewpoint and there is a great distance of time from when the author was at HfG Ulm. There are very few examples of design culture being examined in detail and no examples where understanding design culture is primary to the study. One source that provided some insights into design culture is Arlene Oak's PhD thesis (2001). Although the word culture is never used in her work, it is implied in some of her

descriptions of design education. For example, Oak provides a thorough account of the current state and history of design education in England. She describes the foundations of design being rooted in fine art education in 1837 (*ibid* 46) and its transformation to a shift of focus from art to industry in the 1980s (*ibid* 56). Oak also identifies the levels of power involved in design education and how these may play out in current educational situations. Oak, however, fails to present a holistic feel for themes that underscore the learning situation. For example, most design programmes will focus in varying proportions on skill development, the application of principles in design (*e.g.,* user-centred, anthropometrics, branding) and design discourse (*i.e.,* history and theory). It can be assumed that to some extent, somewhere in the course of their studies, the design student will have developed the skills to communicate through visual means (*e.g.,* drawing, model making) and to communicate verbally (*e.g.,* one-to-one, presentations) and will have been exposed to many of the topical issues in design history and theory. In addition, it is likely that in any design programme the majority of the work done by students will be practice orientated rather than lecture-based. Therefore a big part of the design process in an educational setting will be completed in smaller, more intimate groups and more focused on the individual as a result. The work herein acts to examine the specific cultures of two design educational scenarios, which facilitates the distinction between the inside environment and the broader outside (sociocultural) environment.

1.3.2 Studio culture

The idea of a design student sketching or modeling late into the night in a design studio is as common as the idea of an archaeology student digging rain or shine at an historical site. The studio is at the heart of design learning. It is the place that students gather to discuss ideas with their teachers, and have informal discussions with their colleagues. It is a place where critiques are held. It is also a place of fun and games. The design studio is said to be an environment that emulates the studio of a practicing architect or product designer. This idea implies a strong link between the educational setting and industry. In fact, during the 1980s and 1990s universities and colleges teaching design shifted their focus to industry relevance including corporate sponsorship (Valentine 1998:7). Today, links to industry are common in design schools, either through sponsorship or through collaborations that provide what are considered *real design* experiences for the students.

Design studios vary in size, configuration, and provide different levels of privacy for individuals. Generally, senior year students are afforded higher privileges and tend to have more space and privacy than the gymnasium-style studios of junior year groups. Along with this, junior year students are often ganged together in larger groups of thirty or more,

whereas senior groups tend to be smaller and more intimate in size. The physical space of a design studio may contain banks of drawing boards or computers, depending on the design school. Either way, design studios are created to support learning through action (Schön 1983) or learning through doing. The design studio requires space for skill development, for discussion, and ideally walls to pin up work or related materials. Some studios have small model-making facilities whereas others are more like a typical classroom environment. The physical environment is not the focus of the design studio; however, it is common for students to personalize their desk area and often the general space. Of course, it is activities that occur within the space that are most important in this work.

The activities that students engage with in the studio spaces are typically drawing, modeling, sometimes researching, and a great deal of sharing. Interaction in the design studio generally involves sharing through looking at the various stages of ideation, teaching each other skills (*e.g.,* model making, drawing), joking around, and mostly talking. The focus of the design students' discussion is often on their current design project / design brief. Design briefs can be highly detailed with lists of specifications or relatively short left up to personal interpretation. A specification-orientated brief is often connected to numerous objectives relating to materials, users, and technical requirements. Shorter briefs are given to the senior groups as they can be interpreted in several different ways. Short design briefs test the student's abilities to critically prioritize the design needs. Design briefs can be set from inside the design school (*e.g.,* by the instructors) or be set from outside the school (*e.g.,* collaborations with industry, design competitions). The design brief varies immensely between studios, schools and countries. One of the field studies illustrated here used an outside design brief from a national design competition and the other study used a brief set by two instructors at the school.

The two fundamental forms of communicating in design are through visual representation and through dialogue. Designing is not like most other forms of thought and communication in that it is not *word-and-sentence-based*, but *image-and-sequence-based*. Design necessitates multiple levels of communication including verbal speech, textual details and illustrations and visual imagery. The visualization of ideas has been affected by changing technologies in the past few decades. The design of computer software, equipment, and interfaces have supported the *image-and-sequence-based* thought process of designing; however, the majority of these tools are for communicating design ideas, and for creating rapid prototypes to test design ideas. The support of the *image-and-sequence-based* thought process in designing involves more than just tools.

The designer and student will always rely on napkin-backs during the concept development phase, just as he or she relies on the computer for finalised presentations. Visualizing the stages of artefact development is presented in the form of images, sketches, illustrations, renderings, technical drawings, models, and / or prototypes. These are generally used for the focus of discussion and are often treated as if they are *real* objects (Oak 2001:38).

Verbal speech and textual details are just as important as the visualization techniques in design. There is a need to balance the different forms of communication in order to move forward in the design work. Verbal speech in the form of discussion, talking and chatting is common in the design studio. Discussions may be one-to-one, in small groups or done as an entire group. Typically they are done in front of the whole class but not necessarily as a collective even when one-to-one. Discussions always involve face-to-face interaction. For example, in one of the studies discussed here, it was common to hold desk critiques that were between the instructor(s) and one student (that any other student could sit in on), and formal critiques were held that involved the whole group but featured each individual's work one at a time (with anyone from the *programme* invited to attend and participate). Whereas the second field study featured relatively private one-to-one discussions with the instructor and a final closed-door critique with the group, instructor, and other instructors from the programme. The second study was also intermixed with formal round table discussions involving the whole group, which were not common to the first field study. These different approaches to discussions and critiques illustrate individualistic approaches to engaging in a design studio environment. The make-up of the studio cultures of each study is discussed in detail in chapter 5.

Critiques are a common feature within the studio culture. There have been several studies done on critiques within design to date (Flemming 1996,1998; Anthony 1991; Oak 2001; Uluoglu 2000). The idea of the critique is relatively unique to art and design. It is the core activity for assessing the design work achieved in the design student's studio work. Critiques involve the students formally presenting their work in the requested visual format (*e.g.,* presentation boards, power point, models) supported by a verbal discussion of this work. The instructor(s) typically explore the work by critically examining the design intention and the physical manifestation of this intention. Although design critiques are not the focus of this work, they do play a part in the design process and therefore in the exploration of the references. The use of critiques is highly variable and dependent on many factors. For example with the two studies illustrated in this work critiques were used in two different ways even though each study took place over a similar time frame. One

study had just one critique over the course of the project, whereas the other study had three formal critiques over the course of their project. Critiques are typically viewed as the arena for the assessment of the *finished* work, which is illustrated in one field study; however, the critique is used to mark design-in-progress with the other field study. This variation is attributed to style of the instructor(s) involved and the expectations of the programme.

The most significant work to date on interaction in the design studio environment is Donald Schön's work, which focused on the interactions between architecture students and instructors (1983,1985,1987). Schön is particularly concerned with the relationships and practices that occur between students and instructors. He engages with the notion of ill-defined questions in design and is especially concerned with the *messiness of problematic situations* in design (*ibid* 1985:89). Schön discusses five primary elements including knowing-in-action, reflection-in-action, conversation-with-the-situation, reflecting-on-the-situation, and reflective-conversation-with-the-situation (*ibid* 1983). These five elements are what Schön defines as the elements of interacting in a design situation. He proposes that what is necessary is more reflection-in-action done by students, because this is most suited to their current experience level. Minneman (1991:32) simplifies Schön's five elements into doing, adapting, framing, storytelling, and design. Even though one of Schön's books is called *The Design Studio* (1985), which implies a detailed description of the sociocultural context, he focuses only on the relationships and interactions in the design studio. Schön's work is, therefore, relevant to the exploration of references in so far as each is about interactions within the design studio. The work presented here is concerned with the relationship between the interactions and the sociocultural context of the design studio and beyond.

The studio culture is a place that is dynamic and ever changing. Studio spaces are known to change from year to year depending on the group and instructors involved. Even the same people may alter the space from time to time for a change or to create more spontaneity. The space itself may drive the activity to some extent especially if the studio contains drawing boards, computers, or model making tools. Due to the addition of new projects, reworking old projects, projects that are done in a group or individually, it is not uncommon to see furniture be shifted within the studio space. Projects come and go, posters and visual references get pinned up and taken down. Books and objects adorn desk spaces, along with measuring tools and visualizing tools. Fads are often created among the group, for example, collections of *Kinder Surprise* toys and assembly instructions were lined up *en masse* on several participants' desks in one study. In the

other study, it was popular to turn crisp packets into origami animals. With a focus on artefact creation and coming up with fresh, new ideas, it is not surprising that there is such a focus on material objects and clever play as part of the design studio environment.

1.3.3 Industrial design

John Heskett (1980:10) states that:

> *... industrial design is a process of creation, invention and definition separated from the means of production, involving an eventual synthesis of contributory and often conflicting factors, into a concept of three-dimensional form, and its material reality, capable of multiple production by mechanical means.*

Although, Heskett's definition was written a quarter of a century ago, this definition of industrial design still rings true. In his quote Heskett identifies several key features of industrial design. He begins with the notion that industrial designers need the ability to create something new from nothing, which involves being creative. Creativity implies that industrial design has a connection with art in so far as the process for developing an artefact is individualistic and may be linked to personal expression, experiences and interpretations. Design, as previously discussed involves high levels of visualization and imagination. A balance between being creative and considering the utilitarian is essential in industrial design. Second, Heskett has identified the designer as being separated from the production process. This is true; an individual who is involved in producing his or her own designs is generally called a craftsperson[7]. In general, designers work with some of the project stakeholders (*e.g.,* manufacturers, clients) to create an artefact based on the design brief provided. Third, Heskett acknowledges that industrial design is complex in content in that the factors that contribute towards developing an artefact may not be straightforward or logical. Fourth, a three-dimensional form is emphasized along with the notion of materiality. The artefact that an industrial designer is creating is likely physical and involves volume and space rather than a two-dimensional representation. Fifth, Heskett identifies with the notion of industrial production though mechanical means. Industrial design is all these things and some. For example, industrial designers work to create artefacts that are functional. Unlike with the fine artist, aesthetics in design *are* functional, this is because aesthetics are the initial interface between the artefact and the intended user and ultimately function to bring the two together.

[7] Although industrial design and design education is deeply rooted with the Art and Crafts movement and the Werkbund of Germany that was based on a guild system and apprenticeship, industrial design has to some extent been divorced from any connection to craft. The craft production process, on many levels, does not differ as dramatically as it is made to seem. In fact, designing a website or interactive game may be described as a craft because of the one-of-a-kind nature of such creations. However, for the purpose of this thesis, craft development is not examined even though it is understood that the lines between design and craft are not as clear as they once seemed to be.

Industrial design is a highly complex activity. Part of this complexity arises from the fact that design requires considerable amounts of knowledge beyond what is stated in a given design brief. As Nigel Cross (1982) aptly states:

> *... the solution is not simply lying there among the data, like the dog among the dots in the well-known perceptual puzzle; it has to be actively constructed by the designer's own efforts.*

Industrial design education is the combination of formal education and social agents (*i.e.* economic factors, gender, geographical conditions, and political interests) that informs all design decision-making. Because these social agents inform the design process, a hierarchical problem solving process (Dormer 1990) is needed. Educators for many years have looked to systematic approaches to guide students through the design process and are called design methods (Tjalve 1979; Baxter 1995; Pugh 1991; Cross 2000; Ulrich & Eppinger 2000; Goldenberg & Mazursky 2002). Some of these approaches are discussed in greater detail in chapters 2 and 3.

Although industrial design is described as a process of problem identification, there is a great deal of material written on design as a complex problem solving process. It follows then, that there are different types of problems in design. Vincenti (1990: 8) describes *normal* design and *radical* design, and states that the bulk of engineering design can be categorized as *normal*. It is clear that the knowledge base required for all disciplines of design are enormously diverse and complex. Yet, the nature of industrial design varies from other design disciplines in that the majority of design problems, especially within an educational context, can be considered *radical* problems. Rittel and Webber (1984: 136) describe unique design problems as being *wicked*. In industrial design the majority of problems encountered weigh heavily towards being *radical* or *wicked* because there are often no constants in industrial design like in other design disciplines. For example, architecture design has a site / location for each structure designed and built. It can be said that function, a specific technology, or common manufacturing process could be the *constants* in industrial design. This would be true if we were teaching students to have sub-subdisciplines in industrial design, such as electronic designers or blow-molding designers. This approach would limit the student's education, for it is diversity and creativity of the industrial designer that defines him or her as an industrial designer. Therefore, the teachable aspects of industrial design are extreme in the breadth of information covered including a wide variety of tasks, technologies, scenarios, processes, and functions. Students must be prepared to design an electronic toy, an artificial limb, a running shoe, and an all-terrain vehicle. This broadened approach to design problem solving is supported by Kees Dorst (2003) who describes design problems in two paradigms of design methodology. These are the *rational problem solving paradigm* and

the *reflective practice paradigm*. According to Dorst design problems are situated problems that require both paradigms, but that *reflective practice* is better for describing and relating and ill-defined problems require this type of framing because the problems are not straightforward (Dorst 2003). Problem solving is an investigation into design cognition. Although design cognition is out of the scope of this research, it is acknowledged here that the notion of designers as problem solvers is a strong factor in defining industrial designers.

Manufactured artefacts are the result of industrial design activity. These artefacts are part of product lifecycle. Figure 1.5 illustrates the lifecycle of an artefact whereby it begins with a set of criteria typically presented in the form of a design brief. The designer then takes concepts through to realization where the artefact is manufactured.

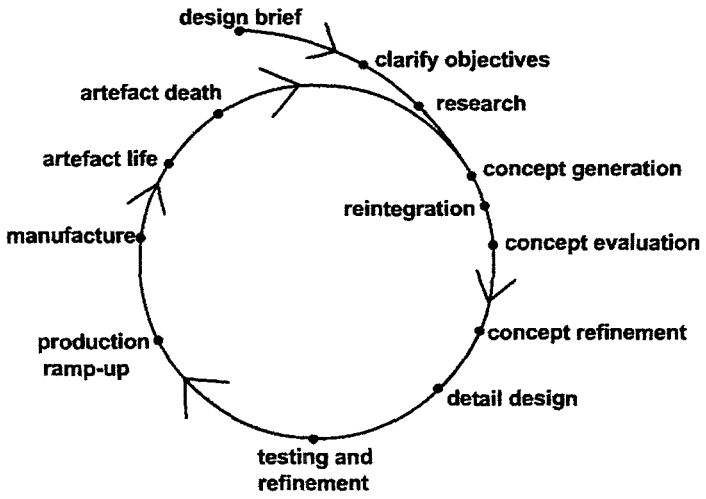


Figure 1.5: model of the lifecycle of an artefact

Historically an artefact is created, is used, and then is discarded. This still occurs with many artefacts, especially items designed for single or limited usages (*e.g.,* disposable razors, toothbrushes). With an increased concern for the environment, a product may be reintegrated through recycle or reuse of some or all of the components. Artefacts vary considerably in their looks and feel, as is obvious to all people. However, artefacts are described generically as being comprised of five basic properties. These are structure, form, materials, dimension, and surface (Tjalve 1979); these are the material / tangible things relative to an artefact. Teaching these properties may be done explicitly or implicitly in learning situation, but either way these are things that are talked about frequently in the design process. Oak (2001:40) indicates that the bulk of discussion during design critiques in about the artefacts appearance or technical characteristics. This rings true because during critiques in both field studies in this research the subjects for discussion are centred on visualized representations of the proposed design(s). The research

reported here investigates to what extent the immaterial are discussed across the whole of the design process.

The formal aspects of industrial design are taught in a number of different ways from a variety of approaches that have been offered to the design discipline over the past thirty years. The social agents that drive the design process may be taught explicitly at some level but are always implicitly present in the design process. This thesis will demonstrate how many of these social agents are related to the artefacts being designed but are positioned at varying distances from the target (*i.e.,* the artefact being designed). To a great extent industrial design educators use a pick-and-mix approach towards educating the designer. This is undoubtedly due to the complexity of issues that relate to the design of a single artefact. Despite what some educators think, there will never be a definitive prescriptive approach to creating solutions to the complicated problems presented in industrial design. This thesis examines, at its core, the things that are discussed and valued in the course of designing an artefact in the two field studies. The goal of this work is not to generalize what a design culture or studio culture should be, or what themes or approaches should be used in the design process. The goal is to provide insights into the diversity of different design and studio cultures, by example, through two empirical studies. Even so, some general recommendations towards the recognition of a more holistic design process will be discussed in chapter 7.

1.4 What are (in)tangible references?

The (in)tangible references are bound up with shared communication in design (*i.e.,* speech and visual representation), local culture (*i.e.,* design and studio culture) and universal culture, and the notion that design learning involves drawing upon resources from *inside* and *outside* the design environment. What constitutes the local culture, which may also include visitors, technical support, administrative support and more are illustrated in figure 1.6.The local design culture is further surrounded by the universal design culture, which includes the current body of knowledge about design.

Any references to this *inside* culture are always considered to be tangible. Furthermore, tangible references are also the subjects, topics, and experiences that the design student takes from *outside* the design environment that are relevant to the task at hand. Tangible references include discussions about the shape of the design, the materials and modes of production proposed, and the user groups who might use the finished artefact. For example, in the field study that takes place in the United Kingdom they are designing an airline meal tray for *Virgin Atlantic* and references to travel experiences and music (because *Virgin Atlantic* owns *Virgin Records*) are tangibles.

The local culture is defined in figure 1.6.

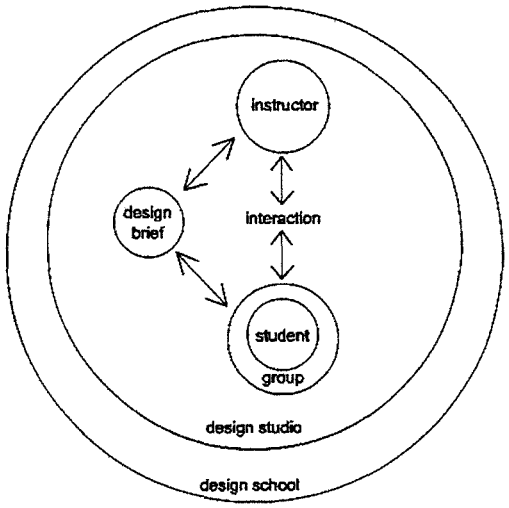


Figure 1.6: local culture inside the design studio environment

Intangible references are discussed to a lesser degree during the design of an artefact, but are nonetheless present. Intangible references are most often made to previous experiences with objects and events that are further away from the task at hand. These are references that are abstract, unusual, ambiguous and idiosyncratic. Intangible references always come from *outside* the design environment and may be individual personal or sociocultural references. For example, in the field study that takes place in Canada they are designing sports eyewear and references to travel experiences and music are considered intangible references. This is because travel and music are not directly relatable to the design of sports eyewear. Furthermore, once an intangible reference is made *inside* the group, this reference if made at later date is considered to be tangible. This is because when the reference is made it is no longer fresh or new and exists as an explicit reference made inside the group. For example, in one field study a participant talks about games from his childhood. This spurs on a whole string of explorations into the idea of games as part of the airline meal tray. For all but the first person who mentioned games, all subsequent references are part of a chain of references that do not necessarily link personally to the individuals who are using them.

By illustrating how tangible and intangible references are defined with examples, it is clear that the only way to distinguish between the two is through a holistic investigation, whereby, the researcher can move between a relatively whole picture and the details of the references. Understanding the nature of the references is highly dependent on context therefore the design process milieu model is developed with this exploration in mind. This model is detailed in chapter 3.

1.5 Research questions

This research project acknowledges that design students create meaning in their studio environment and that they link that meaning when involved in artefact development. Furthermore, all individuals involved in the design process reveal things when they interact with each other. These things include aspects about themselves and about their understanding of design and design practice. These aspects relate to the experiences, objects and events that have informed them as individuals. These experiences, objects and events are fragments of memories that refer to their individual personal and sociocultural make-ups. Ultimately, it is speculated that the references to these memories serve to act as drivers and are part of the design process.

From this evolved the following six specific questions:

- What personal and cultural experiences are referred to in the context of designing an artefact?

To answer this question, an interdisciplinary research model has been developed based on theories of social and cultural practices. In addition, a model representing the design process milieu has been created from an extensive review of design theory and is directly applicable to the design environment. The model allows a more holistic investigation into the design process where the different references are separable. Detailed examples of two participants from each study are provided to illustrate the entire process including all references, tangible and intangible.

- When do the intangible references occur within the design process?
- Are these intangible references driving the design process and if they are, in what way are they driving the process?

To answer these questions, known models of existing design methods have been reviewed and two well-respected sources (Cross 2000; Ulrich and Eppinger 2000) are combined. This is called the generic design process model and is detailed in chapter 3. The intangible references are arranged in tandem with the generic stages of the design process in order to provide an approximation of when they occur.

Following this, the intangible references are investigated in the context of the dialogue and related to the design process in order to determine why the participants are using them.

- Are there any patterns, similarities and differences within each field study or between the two?

To answer the fourth question the references are charted-out systematically in each study in order to see any possible connections within or between the studies.

- What is the proportion of tangible references to intangible references?

To answer the fifth question the tangible and intangible references of two participants from each study are quantified.

- Are there any links between the sociocultural references and final designed artefact?

This final question is not explored in detail; however, some incident of a link between the sociocultural references and the final design occurred. To get a flavour for this concept, the participants were asked to reflect on their process and reveal if there was anything in particular that they found to be influential. Several incidents of these references influencing final artefact designs are provided in the discussion in chapter 7.

1.6 Conclusion

This chapter identifies the central themes for exploring references to the sociocultural context in the design process. These themes include designing an artefact, the social and cultural context of the design process, the educational setting, and the importance of recognizing the idiosyncratic aspects in the design process. Currently there is a growing body of knowledge about design cognition; however, a great deal less is known about designing as connected to the broader sociocultural context. This research acts to expand the latter area of the current body of information about designing through two empirical studies. The integration of these themes necessitates an interdisciplinary model that includes design as the focus. Cultural anthropology and social psychology form a triad with design and make up the theoretical framework and methodological toolkit. The importance of an interdisciplinary model is that the disciplines remain separate but provide a unique way of approaching a given research problem (Moran 2002: 56). The interdisciplinary model used here allows for greater inclusion of research approaches and methods, with fewer restrictions based on the traditions of a single discipline. This research integrates several disciplines in order to understand design while maintaining design studies as the focus. It is important to note that this work is not definable within the framework of the subsidiary disciplinary approaches and methods. That is, this is not a work of anthropology or social psychology; however, all efforts have been made to honour the core beliefs of these disciplines.

The greatest challenge of exploring references in the design process is that in order to discover the nature of these both the tangibles and intangibles must also be understood. Therefore an anthropology approach enables a more holistic view into the design process milieu. In order to adequately understand the design process, culture is explored on two levels, local culture (studio) and universal culture (design). Looking at the macro (sociocultural) and micro (specific references) in the design process is an approach that

considers the common understanding of design as well as the fleeting ambiguous details of designing.

According to Pamela Shurmer-Smith (2002: 3):

> *Culture is the communicating, sense-making, evaluating, wondering, reinforcing, experimenting, qualifier of what people do.*

This understanding of culture can be paralleled with the design process. Designing is about discussing ideas, making sense of those ideas, evaluating the directions, reflecting on where to go, reinforcing or discarding ideas, and experimenting with the material and immaterial. It is about the designing-and-doing process. In so doing, the details are explored in the form of the tangible and intangible reference categories. These are naturally abstractions from the whole of the design process; however, these enable an alternate representation of the design process from a point of view that includes sociocultural references as being part of design.

1.6.1 Overview of the thesis structure

This chapter has explored the idea of the (in)tangible references as part of the design process. The interdisciplinary research model along with the key theoretical and methodological influences has been reviewed. The problem statement, as it relates to the current understanding of the design and studio cultures, and industrial design have also been reviewed. In doing so, the approach to this work is a desire for a more holistic look at the design process. It has been identified that it is not possible to diffuse social and cultural information into an all-encompassing explanation without the danger of stereotyping the design and studio cultures. This research proposes a discussion about some of the elusive experiences, as Joe Moran (2002:69) puts it:

> *... the momentary fleeting aspects of experience that are difficult to represent or analyse.*

There are many fleeting aspects of experience in general, which permeate design experience as well. The notion of the design process teeming with ambiguous and dynamic elements is at the core of this work. In order to explore the questions and central issues described in this chapter, two field studies have been performed. These two empirical studies are chosen as a means of examining, in detail, the idea of the sociocultural context in design and the minuscule details of the design experience through references.

The two primary aims of this chapter were to introduce the notion of references as part of the designers' sociocultural environment and to define the research questions and hypothesis as this relates to the two field studies discussed in this thesis.

Figure 1.7 illustrates the central topics that have been covered in this chapter.

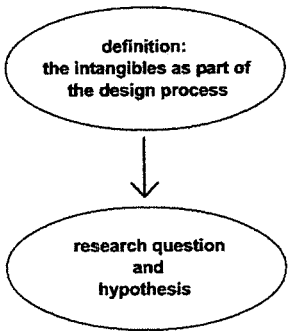


Figure 1.7: two primary aims of this chapter

This chapter is followed by the literature review, which is broken into two chapters involving the design related materials (chapter 2) and the theoretical foundations (chapter 3). Figure 1.8 is a map of the body of this thesis, which includes chapters 2 through 7.

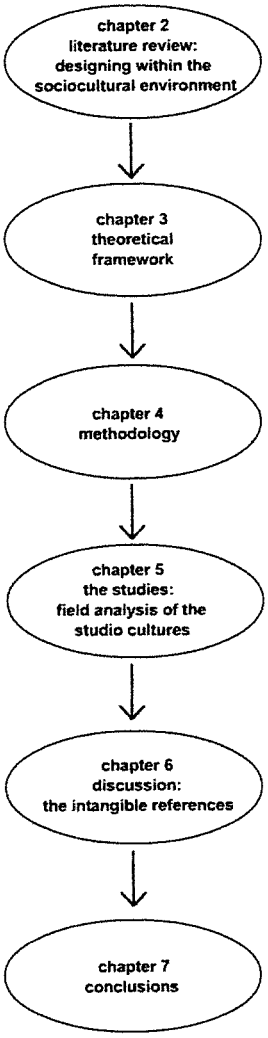


Figure 1.8: map of the body of this thesis

Chapter 2 covers research in design on the social environment, and chapter 3 covers materials that primarily inform the approach and analysis of field studies presented here. Chapter 3 includes research from outside of design and research from inside design that

is connected to a lesser extent to this thesis, but nonetheless significant to this work. Following this, in chapter 4, an overview of pilot studies and the field studies are presented within the frame of the ethnographically oriented methodology employed. The findings of this research are discussed in the next two chapters, including the inside-local environments of the field studies (chapter 5) and the details of the references (chapter 6). Chapter 7 concludes this thesis by answering the research questions with what has been learned about sociocultural references while designing. In addition, chapter 7 concludes with the implications of this research on design including recommendations for design education, practice and future research.

2 Designing within the Social and Cultural Environments

2.1 Introduction

The need to investigate designing further within the sociocultural context along with the approaches to doing this have been defined in chapter 1. It has been argued that interdisciplinary approaches and methods are most appropriate for the investigation into the macro (sociocultural) and micro (specific references) issues that are central to this work. The anthropological framework that is used here reflects the definition by Clifford Geertz (2000), who states that cultural studies focus on the humanistic, the holistic, and the qualitative. This approach provides insights into the act of designing as enacted in a specific environment with a group of individuals; that is, in an educational studio-based environment with industrial design students. Outside of the design students' direct environment is the broader sociocultural context, which is of considerable interest in this research. The sociocultural context is investigated through the design environment and engages with the multiple levels of design activities including the actors (designers), the object being created (artefact), the modes of communicating (references) while naturally occurring within the context of creation (design studio).

The aim of this chapter is to provide details of the relevant work within the design community that has been completed to date. This literature review includes two basic topics relevant to the current understanding of the social and cultural environments of design: pedagogical philosophies about the act of designing and the social and cultural processes in design. Literature that is broadly related to this thesis is followed by work that is more specifically related. It begins with an overview of design education within the studio-based environment including a discussion on the curriculum and pedagogical philosophies that are at the core of design education. This is followed by a more detailed review of empirical research projects that directly relate to the social and cultural processes in design.

Figure 2.1 illustrates an overview of the topics covered in this literature review.

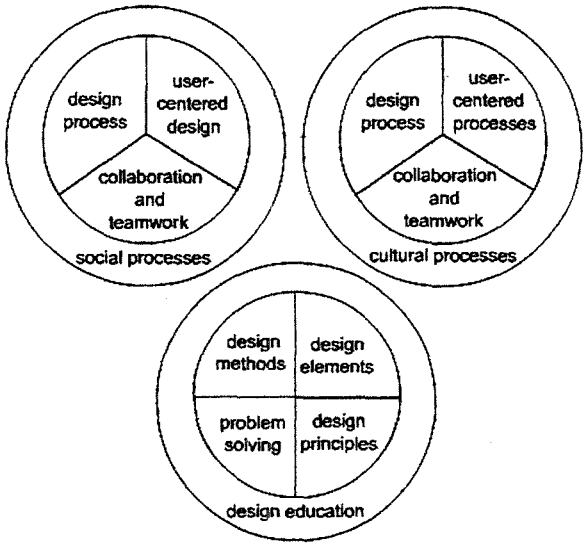


Figure 2.1: three topics broadly addressed in this literature review

Each of the topics reviewed here are subdivided into sections as shown in figure 2.1. These are introduced and followed with examples of the research projects that are most relevant to this study. At the end of this chapter the terms 'intangibles' and 'references' are defined as they relate to design research.

2.2 Designing in the studio-based environment

Design education is typically concentrated within the design studios of universities / colleges. It is distinct from other types of education because design requires a broad range of skills necessary for practice. The studio-based environment is, naturally, the closest sociocultural context that the design student is involved with and is one of the key things that separate design education from other disciplines. Although design education sometimes occurs in lecture-based classrooms, the design studio is the core place for design students to explore their work physically (skills), mentally (thought), and emotionally (intuition, feelings, reflection). Within the studio design students typically have a space of their own where they can examine, build and reflect on their work.

Also included in the sociocultural context of studio-based environment is the curriculum and pedagogical philosophies. The notion of designing has been around for centuries; however, design education is a relatively new phenomenon. Even so, studying design in the industrialized societies is surprisingly unified in approach. Appendix I summarizes the essentials of design education from the 19th-century.

The literature review in this section constitutes an important anchor for the field studies presented in this thesis because the studies herein take place within the educational

context. This section begins by identifying the physical skills and conceptual tools involved in designing. It is followed with the four central conceptual processes that are typically taught in industrial design education, which are design methods, elements of design, design as problem solving and principles of design.

2.2.1 Physical skills and conceptual tools

The sociocultural context of the design studio involves particular ways of communicating and distinct thought processes involved with designing. This section outlines the basic means of communicating and conceptualizing things focused on the visual realm. As discussed in chapter 1 designing requires image-and-sequenced-based thought processes and necessitates multiple levels of communication. In order to communicate on many levels, the designer must be able to visualize his or her ideas from the onset of a project to its completion. This is accomplished through sketches, renderings, illustrations, technical drawings, computer simulations, and representations of use-scenarios and context. Therefore, the physical skills required by current day designers are the ability to draw and to use the computer effectively. There are numerous programs available to support the designer in his or her work including layout packages (*e.g., Photoshop* and *Illustrator*) and three-dimensional rendering programs (*e.g., Rhino* and *Micro-station*). To date, there are no computer programs that effectively support the industrial designer in the concept development phases of the design process.

In many situations the industrial designer also needs to have some skills in the art of materials and manufacture. Students are generally exposed to the basics of paper and card manipulation and often undergo projects that require creating something three-dimensional from something flat. From this basic woodworking, metalworking, and plastics manipulation make up the foundation of many design programmes. Typically students also experiment in manipulating clay and plaster and at the very least can create sketch models of their design iterations. Many design schools focus on a generalist approach to materials and manufacture; however, some maintain a specialization in specific materials such as ceramics or metals much like the original German Bauhaus did. For example, designer Arnout Visser (Ramakers & Bakker 1998) was trained in the area of glass working and ceramics and continues to design much like a crafts-person, but with a goal to have his work industrially manufactured (Visser 2003). The results of physical skills (*e.g.,* drawings) make up some of the data in the field studies in this thesis.

The conceptual tools include all the aspects that relate to designing including those used for discussing artefacts in progress. Conceptual tools are those tools gained through process-oriented approaches to design. As previously mentioned these are thought-

based and gained through instruction or research. It is acknowledged that all conceptual tools cannot be actively taught in every design programme. That is, some tools will be explicitly taught and some will be implicitly present, whereas others will not be present at all. According to Vincenti (1990), explicit knowledge can be put down in words, tables, diagrams and pictures, whereas implicit information involves skill, judgment, intuition and associated knowledge. Explicit information includes the tangible aspects of design that are more easily taught in formal situations (*i.e.,* lectures, seminars). Polanyi (1962, 1966) best describes implicit or tacit information as an individual person's body of past experiences, the contents of which cannot be explicitly articulated. Implicit information in design is all that is documented by the design community (*e.g.,* journals, books) and all the information that the instructor knows but does not openly teach. Therefore, implicit information is accessible but is not taught directly. The terms explicit and implicit are typically used in the realm of cognitive psychology but apply here in so far as it is important to delineate the conceptual tools that fall directly *inside* the design educational process.

It is important to distinguish between the idea of explicit and implicit information on the one hand and the idea of tangible and intangible references on the other hand. Evidently, all references are explicit, yet intangible references emerge from something that is implicitly known to the individual who made the reference. Implicit information can be related to the individual-personal and / or sociocultural experiences, which are the focus of the (in)tangible references. People naturally make connections with experiences they have had and link these to things that are happening in social situations. In the Canadian field study, for example, the students were asked to design sports eyewear for their sport of choice. The majority of the participants chose a sport they had been involved in because they had an implicit understanding of that sport. In addition, even though some of the conceptual tools are not explicitly taught and are only implicitly known in the design community, the direct relevance to the artefacts being designed mean that these are tangible references. For example, the instructors in both field studies do not explicitly state the need to discuss the elements of design, yet they are often the focus of discussion.

It is through the understanding of the physical skills and conceptual tools in design, whether explicitly taught or implicitly present, that the sociocultural references are discovered. Again, this is because the conceptual tools make up what is understood about the *inside* of design while the other references come from *outside* design. The

following subsections explore four conceptual tools that commonly taught and are therefore part of the sociocultural context inside design.

2.2.2 Design methods

Understanding the design process is the first conceptual tool examined by design academics beginning in the 1960s and continuing today. Research into the design process began in order to improve the efficiency of design practice and continues as a quest to understand what is happening while designing. This work is termed 'design methods' and in its earliest approach looked at how to design in a prescriptive way. That is, these works lay out a course of action that the designer *should* follow in order to design efficiently. The design methods approach divides the design process into a sequence of procedures that are followed towards the design of an artefact. Early work in this area includes that of Bruce Archer (1963/64) who worked towards systematically understanding design problems, J. Christopher Jones (1963) who attempted to account for the intuitive and logical in design, and Christopher Alexander (1964) who also presented a prescriptive methodology for designers to follow. These first generations of design methods involved a scientific and prescriptive approach to design processes that can be likened to a step-by-step system generically including analysis, synthesis, and evaluation.

Not long after the discovery of the systematic design methods approach many researchers discovered that design problems are not easily subdivided into distinct stages. Even though Jones' textbook on design methods was published in 1970, many researchers were not satisfied with the rigidity of the proposed method. For example, in the preface dated 1971 of his eighth printing of *Notes on the Synthesis of Form* (1974) Alexander writes:

> *Indeed, since the book was published, a whole academic field has grown up around the idea of "design methods"— and I have been hailed as one of the leading exponents of these so-called design methods. I am very sorry that this has happened, and want to state publicly, that I reject the whole idea of design methods as a subject of study, since I think it is absurd to separate the study of designing from the practice of design. ... No one will become a better designer by blindly following this method, or indeed by following any method blindly.*

Alexander's point is twofold. The first point is that *individual designers* should study design methods and the second is that methods should not be separated from practice. Here Alexander is stating that designers ought to be reflective about their processes in order to advance themselves personally and that methods are tightly bound to the experience of designing. The second point Alexander makes is that design methods work

to guide the designer and aid in moving through the process, but ought not be followed by the number. That is, methods are markers not prescriptions. Later Archer admitted that design methods had limitations and stated that creativity can be unsystematic (Archer 1984). In doing so, Archer recognized that design methods functioned on a limited level and did not get at the root of creativity. Also Jones had reservations about the rigidity of design methods. According to Nigel Cross (1984: 2), he separated the two ways of thinking to simplify his recommended procedures and not to create a black and white system. Both Archer and Jones acknowledged creativity and intuition as key components to designing, therefore acknowledging the idiosyncratic, subjective nature of the design process. Ultimately the prescriptive design methods approach was considered unsuccessful because it was removed from the wider social context (Alexander 1979). The limitation of the generic design methods model is that it fails to include the idiosyncratic, ambiguity of the subjective designer and the other unpredictable aspects of design activity such as the social and cultural forces. These forces imply that the designer may not always be in *control* of all the aspects of the design process (Cuff 1991).

Even though the prescriptive design methods approach was deemed unsuccessful by its originators, there is still a sizable group of contemporary research into methodology that falls into this category (Hubka 1982; Pahl & Beitz 2003; Pugh 1986,1991; Ulrich & Eppinger 2000; Lindemann 1999). These contemporary examples of design methods are most commonly referred to as 'the generic design process'. The majority of contemporary design methodologists are known to be part of the more science- and technology-oriented disciplines of design such as engineering design and computer sciences where design outcomes are more fixed and less creative. The generic design process can be described as a chain of interlinking parts. Although the process appears to be linear and straightforward, it is now recognized as being iterative. That is, this iterative process can be described as a chain of design activities that is followed by moving from one link to the next. These links may be revisited at regular intervals before reaching the end of artefact development (Cross 2000). The model of the generic design process that is used for this research is discussed in chapter 3.

Minneman (1991:44) states that these design methods (*i.e.,* the generic design process) share logic and rationality. However, their popularity does not necessarily indicate widespread use among designers. Indeed, design methods are known to most design instructors but are not necessarily taught explicitly in the classroom. In addition, most designers develop their own way of operating and do not necessarily follow in detail the approaches prescribed by the design methodologists. Minneman also states that the

design method models are useful *after the fact,* when the final design is completed and the designer wishes to reflect on his or her process (*ibid*). Having stated this, it is useful in this investigation of the sociocultural references to use the generic design process as a framework of signposts to approximate the activities that the participants are engaged in throughout their project. It is recognized that the generic design process has limitations, which are accounted for by using a more holistic model for analysing what is happening during designing.

2.2.3 Elements of design

Language is integrally connected to any sociocultural context and understanding the visual world is part of design. The visual world is discussed in design as being made up of a visual language. Because representation is governed by personal experiences, visual languages are diverse and difficult to structure. Even so, for many years design practitioners and educators have attempted to create an understandable visual language to describe the artefacts that surround them. Donis Dondis (1973:15) states that:

> *Any visual event is a form with content, but the content is highly influenced by the significance of the constituent parts, such as color, tone, texture, dimension, proportion, and their compositional relationship to meaning.*

The visual world and the way we perceptually organize elements within that world have been of interest to the design community for some time and are called the elements of design. The foundation for deconstructing the analytical methods of visualization can be traced back to numerous individuals involved in design education. Wassily Kandinsky, painter and design instructor at Bauhaus, explored the elements of design, as well as, another influential instructor from the German Bauhaus, Johannes Itten who was known for his scientific understanding of designing. Itten's contributions include *Design and Form – the Basic Course at the Bauhaus* (1974) and *The Art of Colour* (1961,1965). The notion of parts making up a whole is connected to the principles of perceptual organization established by Gestalt psychologists. Gestalt theory was popularized in approximately 1912 (Arntson 1998:74) and regards the whole as being more than the sum of its parts including organized shape and whole form (Gray 2002:12). Furthermore, other theories in psychology such as similarity also emerged around this period. Similarity denotes the tendency of humans to naturally group things that are alike. We see similar shape, size, colour, *etc.* and continually compare and contrast by grouping similarities while separating differences. Grouping by similarity is called proximity or nearness (Arntson 1998:75) and separating an object from its surrounding is called figure-ground relationship (*ibid* 78). The German Bauhaus and other design schools, particularly those in North America, explored the theories of Gestalt and similarity extensively. The elements of

design emerge from these theories and have become part of the visual language of graphic and three-dimensional design.

The elements of design are most commonly known as line, shape, texture, value and colour (Lauer 1979; Lauer & Pentak 2000). Wucius Wong divides the three-dimensional elements of design into three areas in his book the *Principles of Three-dimensional Design* (1977). These three areas include the conceptual, the visual, and the relational (*ibid* 9). The conceptual does not exist physically but is perceivable and includes points, lines, planes and volumes. The visual constitutes the final appearance of an artefact and includes shape, size, colour and texture. The relational governs the overall internal and external structure and includes position, direction, space, and gravity. Wong further elaborates that form and shape are not the same because form is the total appearance that includes shape, size, colour and texture (*ibid* 14). Most commonly the elements of design are a way of seeing the material world. The elements of design are established to help guide the designer to create visual harmony, stability and order. The elements of design are a language that enables discussion around artefacts that are encountered in the world, and may also be used as a set of methods to explore in creating artefacts.

Rowena Reed Kostellow told her industrial design students that the elements of design are about understanding (Hannah 2002:44):

> *...a combination of design relationships which you may encounter and enables you to organize the abstract relationships for yourself.*

In essence, the elements of design are a way of deconstructing the visual world into teachable elements that can later be reconstructed by the students. This method of approaching design is detailed in Hannah's book *Elements of Design Rowena Reed Kostellow and the Structure of Visual Relationships* (2002). Reed Kostellow developed a system of teaching industrial design whereby the creative process involves an intimate understanding of the elements of design. This system of teaching is a set of problems that involve rectilinear volumes, curvilinear volumes, combining rectilinear and curvilinear, fragments, planes, lines in space, and combinations of all of these. Reed Kostellow's foundation programme towards understanding form making involves the basic elements of lines, planes, volumes and spaces followed by interrelationships of elements. Reed Kostellow's system is the most complete prescription of how to use the elements of design in teaching industrial design.

Emilio Ambasz (*ibid* 9) states that Reed Kostellow:

> *... reminded them [her students] constantly that designers make maps for places that don't yet exist, that the empirical procedure of gathering past experiences and the normative stage whereby goals are stated must culminate in a synthetic act of inventing forms that will satisfy all the needs-mental and emotional-of the user.*

With this focus on *inventing forms* it is natural that a foundation study in the structure of visual relationships was developed. According to Hannah, Reed Kostellow's approach to teaching the elements of design is unique to the Pratt Institute.

It is easy to state that the elements of design may not always be explicitly taught in design education, but they are always implicitly present. For example in each field study presented in this thesis, the participants consistently discussed the form of their artefact including describing it by using the basic shapes of circle, square, triangle or more complex forms such as spiders webs. Participants also discussed the colours their artefacts might be and how this would change the user-artefact interface. Yet, at no time in either field study did the instructors tell the students to discuss the elements of design. Whether the elements of design are used as a visual language to discuss artefacts or a method to teach form giving, it is clear that these are part of industrial design in general (*i.e.,* education or practice).

2.2.4 Design as problem solving

Following explorations in design methods, in the early 1970s, scholars began to investigate the notion of design as a problem solving activity (Oak 2001:19). Theorists such as Herbert Simon and Horst Rittel wrote influential works on the notion of designing as complex problem solving. Complex problem solving involves a multitude of levels or problems and does not always have one solution. Complex problems are very different from mathematical problems that have a single correct solution. Simon describes design problems as *ill-structured and ill-defined* (1973,1981), and Rittel as *wicked* (Rittel in Churchman 1967), which is later elaborated upon by Rittel and Webber (1973, 1984). Simon (1984) takes wicked problem solving a step further by stating that wicked problems can be transformed into tame problems. In all cases, design as problem solving is viewed as a more descriptive approach to understanding the design process (Valkenburg 2000). Research into the idea of design as a problem solving activity has continued to be examined by researchers through concepts such as similarity, analogy and case-based reasoning.

In this approach design is described as a multi-faceted activity requiring many factors to make the finished artefact successful. In stating this, Simon and Rittel each acknowledge

that the designer plays a significant role in the design process because there is no single solution in design problem solving. Furthermore Rittel and Webber state that a given solution comes into being gradually and requires constant subjective judgment and critical thought processes (Rittel & Webber 1973). This notion of the designer acting towards solving wicked problems became widely accepted in the design research community (Cross 1984). The notion of design as a problem solving activity is largely orientated towards exploring the thought processes of the designer — an exploration suitable to psychological studies including cognition. However, it is interesting that the idea of complex problem solving in design acknowledges individual and sociocultural factors as part of the design process.

The idea of designers being problem-solvers is commonly used as a definition of designing in design education. For example, problem solving is considered to be at the heart of industrial design with each field study group in this research. Even so it is not entirely clear whether the students are aware of what constitutes problem solving in design. It is also unclear whether problem solving is explicitly taught in design education. In addition, the notion of designers as problem-identifiers (Gendenryd 1998) and design as a question-driven enterprise (Sellgrin 2004) provide a more current description of designing. Either way, industrial design students likely have little instruction on the notions of problem solving, problem-identification and question-driven approaches in designing. As descriptive models these are more likely to be part of theoretical discussions rather than of the practice component of design education.

2.2.5 Principles of design

Principle-based approaches to teaching industrial design are more common today than the design methods, the elements of design, and / or the problem solving approaches in design. The principles of design vary among design disciplines based on the required design outcome. For example, the principles of architecture include ordering systems such as grids, hierarchy and geometry, but more importantly principles of space (Leupen *et al.* 1997:27). Ultimately, what sets architecture apart from other disciplines is the principle of the spaces that are created inside and outside a structure. The principles of graphic design typically involve the two-dimensional and relate to compositional principles including concepts such as balance, placement, proportion, context, and contrast (Faimon & Weigard 2004). Context is a principle that is as dynamic as it is different each time. For example, context as a principle in architecture involves topography, existing buildings, existing functional links and even history (*ibid* 152). Graphic design also may involve the visual principles of geometry, which include the golden section or the ratio of

the divine proportion (Elam 2001) and the principles of two-dimensional spatial organization such as typeface, text and grid (Lupton 2004). Along with aspects relating to the compositional and spatial organization in design, other principles in architecture and graphic design include design process (Lauer & Pentak 2000), material-use, and social issues (*e.g.,* environmentalism). Although the principles of design are relatively specific to the individual design disciplines, William Lidwell *et al.* recently published a book entitled *Universal Principles of Design* (2003). This book illustrates 100 principles of design across disciplines including what they call *laws, guidelines, human biases and general design considerations* (*ibid* 10). Although information about principle-based approaches to design tend to be more descriptive, it is interesting that this publication is constructed as a how-to book to enhance, increase and improve designing, usability and artefacts. Even so, the book covers a range of principles that pertain to designing and usability and is a good introduction to some of the general principles across the discipline of design.

It is outside the scope of this thesis to review and examine all the principles of industrial design. Consequently, it is important to address some of the central principles, especially those that relate to the field studies described in this work. The central principles range from the material to the immaterial and include issues relating to the artefact, the user, and the environment.

The central principles of design that relate to artefact development are generally relative to material selection and manufacture. In a given design brief material selection and production methods (Lesko 1999; Ashby & Johnson 2002) may be narrow or flexible depending on the stakeholders and design criteria. For example, in the design of the airline mealtray, the first field study highlighted in this thesis, materials and manufacture were specified because one of the project stakeholders was *Corus* metals. In the design of sports eyewear, the second field study herein, there was no specified material or manufacture method, yet these were still relatively narrow due to the nature of the product being designed. Teaching materials and manufacture is approached in a multitude of ways depending on the resources and other factors in a design school. For example, the first field study group were predominantly taught materials and manufacture through the engineering department as a cross-disciplinary approach. The second field study group were taught materials and manufacture on a project-by-project basis, fully embedded into the studio work. Either way, materials and manufacture constitute a core principle that is taught in industrial design education.

Form-giving is an important part of artefact development in industrial design. The notions of form can be addressed with the elements of design as previously discussed, but also

through the principles of aesthetics, figure-ground relationships, symmetry, modularity, and the notion of mimicry. The principles of aesthetics involve all the human senses including the looks, the feel, the taste, and the sound of something. Typically aesthetics are played against usability (Lidwell *et al.* 2003:18) or through the notion of form and function (*ibid* 90). Although the principles of figure-ground relationships and symmetry are common in graphic design, they are also used to deconstruct the form of the artefact being designed in the field studies reported here, particularly in the design of the sports eyewear. Figure-ground relationships draw upon the Gestalt principles of perception and involve the figure being the element of focus and the ground being its undifferentiated background (Arntson 1998:78). The principle of symmetry is relative to how the artefact is perceived. Symmetry conveys balance, harmony and stability (Lauer 1979). Symmetry is a well-known principle in design and is commonly discussed in each field study. The principle of modularity is used to manage the design of complex or multiple parts with a system (Lidwell *et al.* 2003:136). This principle is relevant to the design of the airline mealtray but less so to the design of sports eyewear. The design of modular systems is considered to be significantly more difficult than the design of non-modular systems (Lidwell *et al.* 2003:136). The principle of mimicry refers to the properties of familiar objects, organisms or environments being mimicked in order to improve usability, likeability or functionality (*ibid* 132). The principle of biomimicry is when nature is mimicked in design (Pearce & Pearce 1980;Benyus 1997). Biomimicry was a topic of discussion in the design of sports eyewear.

Usability, safety and fit relative to the user are other principles of design. Usability is a topical theme in industrial design with a greater focus on user-centred design (Jordan 1998,2000). The first field study group was being explicitly taught about user-centred design and the second group implicitly understood principles relating to this topic. Principles of usability relate to the function of the artefact being created and are discussed by both groups extensively (see chapter 6). Principles of safety and fit are more central in the second field study. This is likely because sports eyewear is more intimately connected to a person. The principle of safety addresses preventable failure and potential injury (Lidwell *et al.* 2003:74). The fit of the artefact with the user involves ergonomics and anthropometrics (Kroemer & Grandjean 1997; Panero & Zelnik 1979). Human interface with artefacts, spaces and / or places is another topical theme in industrial design, particularly with the rise of interdisciplinary projects such as those among designers and ergonomicists (Jones *et al.* 2002, 2005). The principles of safety and fit are considered to be well-known design criteria in industrial design and are likely formally addressed at some point in an industrial design programme.

In recent years, the principles of design that relate to the environment have become topical in the design community. Environmental issues are explored through material and immaterial considerations (Strickfaden 2001) and involve a range of approaches towards ecological or sustainable design (Charter & Tischner 2001). The environmental principles include a range of concepts such as designing for disassembly, designing for recyclability and designing for longevity. Environmental principles were taught in the design programmes that are described in detail in chapter 5.

The principles of industrial design range from the practical (*e.g.,* materials) to the conceptual (*e.g.,* design for longevity). The principles presented here are an abbreviated sample of some of the issues that have been a part of industrial design since the onset of the discipline while others are relatively new to the discipline. All of the principles outlined here are referenced in the field studies presented in this thesis. This does not mean that these principles are more important than others not covered here. Design principles are dynamic and will vary from project to project since some principles are relevant to designing certain types of artefacts and irrelevant to designing other.

This section has detailed the physical skills and some of the central conceptual processes taught in industrial design education. These are some of things that separate design from other types of educational scenarios and are part of the sociocultural context inside design education. Insight into these is essential to understanding what is occurring inside the design studio environment, which allows an exploration into what is happening in the sociocultural context(s) outside of that setting.

2.3 Social processes in design

Design research is currently said to be entering a new phase of exploration: the exploration into design as a social process (Minneman 1991; Oak 2001). Since the 1960s the design community has been interested in understanding how a designer thinks. This interest has broadened and is currently being built upon through questioning what is happening between designers and within groups of designers. Malcolm Barnard states that one of the fundamental differences between artist and designer is that the former is generally a loner; the latter is always a member of a team (Barnard 1998). Investigating the designer as a team member is the current trend, given the growing awareness that designing in multidisciplinary teams provides better artefact outcomes. The concept of the lone designer as artist is obsolete, even among those who still consider themselves to be a team of one. Karim Rashid, for example, considers himself as more of an artist than a designer (Rashid 2002). However, Rashid employs numerous apprentices who he mentors by involving them in various aspects of the design process. Rashid's name is

connected to his designs, which implies that he works independently, yet in actuality he is part of a design team. Furthermore, the social process researcher recognizes that designers always interact with others, even if they are more independently orientated. The designer interacts with the rest of society, often non-designers, while involved in designing an artefact. The notion of the lone designer simply is not valid because he or she is always involved with a network of people including clients, potential users and manufacturers. Even when the designer is the *only* designer involved in a project, he or she is still part of a team with many influences occurring from *inside* and *outside* the project framework.

In order to investigate social processes in general, the methods and theories of anthropology and sociology are used for data collection and analysis. These are discussed in further detail in chapter 4. It is important to note that typically data from research into the social processes are disseminated as descriptive. The data from social research often results in theories that are applicable and sometimes tested in other studies.

Although designing is a planning process, there are distinct gaps in the understanding of what, when, how and why things are discussed and referred while designing an artefact. It is clear that designers will discuss what is expected. They will focus discussion on the artefact in question and reference all things that relate to that artefact. As a consequence, many of the gaps during designing point towards the sociocultural processes — the context of artefact design and the environment (inside and outside) of the designer. Furthermore, the forum for design communication is social and therefore, what designers enact are social and ideological values reflected from culture (Julier 2000). Since this is the area of interest in this research, the following literature review examines the topics covering some of the social processes in design. These include research into social interaction, social environments, teamwork and collaboration, the social processes and design process, and the social processes in design education. The work described in this thesis acts to build upon the current understanding of design as a social process. As Penny Sparke (1986) writes: *cultural forces form and transform design*. The research herein acknowledges that *sociocultural* forces form and transform the *designer* before he or she forms and transforms design.

2.3.1 Early work on social interaction

There are three significant early works on social interaction reviewed here. These include Dana Cuff's (1982) and Judith Blau's (1984) studies on architectural practice, and Louis Bucciarelli's (1984, 1988, 2001) work on engineering design practice. This early work

establishes the foundation for investigating social processes in design by using ethnographically oriented methods. The work of these three authors focuses on the profession of design by investigating designers in practice. Although these examples do not address design education, these are significant to the research presented in this thesis in that they illustrate the methods for investigating social processes and create a forum for discussing social processes in design.

Cuff's (1982) study of architectural practice is among the first studies in design, in general, that present design as a social activity. She uses a participant observation methodology for six months with three different architectural firms. Over this period of time she observes over seventy architect-client meetings and interviewed twenty-five members of staff, and reviewed the notes of ten different projects, among other activities. Cuff argues the importance of context and that design is a negotiated process between stakeholders and designers. Cuff's work stands as a milestone and introduced concepts in the design process such as the notion of ambiguity and presents the design process as being open ended. Another noteworthy earlier study, also in architectural practice, is the work of Blau (1984). Through using questionnaires and performing interviews, Blau looks at architectural practice as part of the broader social network, specifically economic activities. She investigates the financial success and failures of architectural firms through the relationship of business conduct and economic conditions. Both Cuff and Blau's work mark a significant turn in design research; they each adopt methods from anthropology and sociology in order to investigate social processes in design. Cuff's work is commendable on the sheer volume and holistic manner in which she engages with her research problem. Each of these investigations maintains a focus on the *inside* of the architectural firm and how the inside relates to one aspect of the *outside* (*i.e.,* stakeholders and economic system). That is, the firm is recognized as being part of a broader social system; however, the focus is on design practice and the success of that practice. The research presented in this thesis shares with Cuff and Blau's an interest in how design decisions are made and how others may impact the design process.

Bucciarelli (1984, 1988) is the first individual within engineering design to do ethnographical empirical studies into design as a social activity. His work is based on observations of two design companies in Boston USA, one developing photovoltaic modules (1984) and the other is developing x-ray equipment for the travel industry (1988). Bucciarelli's work emphasizes difference and ambiguity in the design process, which is linked to the fact that individuals do not share a common understanding of the object world. He contrasts the object world with the world of design process particularly in his

latter article (1988). Bucciarelli believes that concept development is driven by ambiguity especially in the early stages of designing and that *concepts need room to be maneuvered, shaped and developed* (1988:168). He identifies three types of design discourse that are used by designers and these are constraining, naming and decision. Bucciarelli discusses designing in terms of two factors: the designer as highly subjective, and designing as part of a social context. Bucciarelli, therefore, advocates that design processes are difficult to deconstruct and that tools for designers and designing need to accommodate a wider range of viewpoints. He continues to promote the concepts developed in this work in the 1980s on social interaction and these earlier works can be said to have laid the foundations for more recent investigations into the social environment of design.

2.3.2 Social environments inside design

The research presented in this subsection focuses on the social processes inside design at two research centers at Stanford University in California in two different engineering departments (*i.e.,* mechanical, civil and environmental). Two key research projects lead to the establishment of the first research center called the Center for Design Research (CDR) in the Mechanical Engineering Department. Each of the projects worked on prior to the establishment of CDR were supervised by Larry Leifer and represent research into social processes in design (Tang 1989, Minneman 1991). The goal of each project was to improve the understanding of the engineering design process, as part of a research foundation established in 1986 by the National Science Foundation. While John Tang's work focuses on the workspace behavior in small team designing, Scott Minneman's work is much broader and looks at social construction. Following the review of Tang and Minneman's work, the work of Renate Fruchter's research from the second design research lab at Stanford University will be discussed. Fruchter is the director of the Project Based Learning Laboratory (PBL) in the Department of Civil and Environmental Engineering. Both CDR and PBL are considered to be significant contributor to research into the social processes of design.

In his research on workspace behavior in small design teams, Tang (1989) looks at the shared workspaces that designers use for drawing. These include whiteboards and large pieces of paper. This work is significant because of the real-time research methods and the use of videotape in capturing the concept of sharing during the design process. In addition, Tang establishes and discusses three core activities designers engage in while using the shared workspace in his study: the use of lists, the use of drawings and the use of gesture. Although one would assume the shared drawing spaces to result in a focus on

visual communication in design, it is found that textual and non-verbal communication is at the forefront of interaction among the designers. Tang's work is much more singularly focused (*i.e.,* activity and locale) whereas the work in this thesis is much more holistic and inclusive. Like others before him, Tang is interested in the processes *inside* the group of designers, not the *outside* including the broader social and cultural context.

Scott Minneman's (1991) thesis on social construction and engineering design practice investigates design as a social activity by conducting two extensive studies. One study is longitudinal with an industrial team; the second is a series of design exercises providing a mirror for the first study. Minneman argues that the design process is a recognizable ongoing social interaction that involves the personal viewpoints of designers. The two broad categories of Minneman's findings are firstly a more (than previous to this) complete account of activities during designing and secondly a set of observations about how designers do moment-to-moment work in the complex design process. Minneman describes the communication among designers in three ways, which include making sense of the past, informing the current state, and framing future action. He discusses the complex range of communication activities that occur *inside* an engineering design exercise and how these relate to the changing task at hand. Minneman feels that design is a social activity (*ibid*: 126) and that the designer engages in social activity on all levels of the design process. Minneman's work is easily relatable to the research presented in this thesis, particularly because he investigates the design process with a group of designers. Hence, his work, like all the work reviewed so far, involves understanding the social processes *inside* the design group or individuals directly related to that group, again without paying attention to the affects of the broader sociocultural context.

More recent work into social processes is the research of Renate Fruchter's who director of Project Based Learning Laboratory (PBL) at Stanford University. PBL lab was established in 1993 in order to work on integrated research and curriculum development. The social aspects of design are at the core of Fruchter's research, which examines the role of informational conversation during the design process. Her research links issues of communication to the development of computer models that aid in the use and re-use of knowledge via the internet. Various projects include, but are not limited to, combining dialogue and sketching with the notion of reflection-in-interaction (Fruchter & Swaminathan 2005); linking gesture, discourse and sketching (Biswas & Fruchter 2005); and creating a forum for informal discourse between architects and builders (Yin & Fruchter 2005). Although these projects are linked to the understanding conversation and communication that embodies design knowledge, the goal of Fruchter's work is to serve

practice. That is, each of the projects described here involve the design of technology-based prototypes to aid in communicating. The three prototypes are called TALKINGPAPER, I-Gesture, and I-Dialogue. Each is the result of empirical studies that aim to serve designers in practice. Fruchter's work is, therefore, another example of the social processes from the *inside* of design.

The Center for Design Research (CDR) posed fundamental questions such as: *what are designers doing, thinking and feeling when they do design? And how can we improve their performance?* More recently in 2001, a lab called the Design Observatory has been set up specifically to investigate design theory and methodology in engineering design. It supports video and audio observational methods towards furthering the broad areas of the social aspects of design, design communication, design education and design teams. To date, the works of Tang and Minneman relate most strongly to the research described in this thesis even though the *in situ* methodology and basic premise of the social aspects of design are central to the Design Observatory. The Project Based Learning Laboratory (PBL) is a group that focuses on teaching and learning based on problem-based, project-centred activities that produce a product for a client. The focus is on multidisciplinarity, global teamwork and collaboration. The research at both CDR and PBL at Stanford University stand as two research groups that are focused on research into the social processes of design.

2.3.3 Teamwork and collaboration in design

While this thesis does not provide an elaborate review of research that has been done on team designing, it is important to acknowledge research into the team environment because it represents some of the earliest research into the social environment of the designer. This section provides a general definition of teamwork and collaboration in design, which is followed by accounts of significant work in teamwork and collaboration in design. These include the Delft protocol workshop (Cross *et al.* 1996), and the DRS conference on collaboration called Co-Designing (Scrivener *et al.* 2000).

Since the early 1990s there has been more extensive work in the areas of collaboration and teamwork in design. However, many design authorities suggested that designing within a group was not about social processes but about the division of labour, and simply involved breaking design tasks into manageable parts (*i.e.,* working separately not collaboratively) (Ulrich & Eppinger 2000). In current day thinking, this contrasting view of the designer as the lone genius working alone has become further from the norm, as emphasized by the inclusion of the theme of teamwork in some design conferences (*e.g.,* ICED 1993). Teamwork is moving closer to the forefront of design research, which is

illustrated with conferences that focus purely on teamwork (*e.g.,* Co-Designing 2000; SID 2005). For example, the Social Intelligence Design Workshop (SID) series has been held annually since 2001 and is lead by Renate Fruchter of the PBL laboratory at Stanford University. This workshop focuses on social intelligence that is defined as the ability for people to understand and interact effectively with others. SID challenges social intelligence by integrating the notion of sociality with cutting-edge technology. The SID 2005 workshop included topics such as natural interaction, communities, collaboration and multi-disciplinary perspectives. Furthermore, since March 2004 there is a journal published called *CoDesign,* edited by Stephen Scrivener, that is centred on principles that relate to collaboration in design. The focus on teamwork at this time was typically to support and improve design practice rather than to discover the social nature of design itself. As a consequence, it is this growing interest in teamwork and collaboration that has ultimately led to more extensive research on the social processes in design.

The activity of team designing was addressed for the first time by the Delft workshop in 1994 (Cross *et al.* 1996). This workshop was unique in that videotapes and written protocols were given to numerous researchers, who were asked to analyse and interpret data involving either or both of the following: an individual working on the design of a fastening device for a mountain bike, or three individuals working on the same design. Valkenburg (2000) divides the analysis and interpretation into four groups of researchers which include: those who look at the individual, those who look at the team but do not address team design issues, those who compare individual and team designing and those who focus on the differences between individual and team designing. More recently the Design Research Society (DRS) held a conference on collaboration in design September 2000 (Scrivener *et al.* 2000). This conference brought together a diverse group of researchers to discuss designing as part of a team. Unlike in the Delft workshop, many different design teams were discussed and no common method was used to collect and analyse the data. The disparate systems of data coding and analysis have been criticized as hampering the growth of socially-orientated research (Oak 2001). This is a significant issue, particularly if the methods used for coding and analyses are not appropriate to investigating social processes or are not reported in depth.

There have been an increased number of investigations into the social processes particularly over the past decade; however, three key examples of research projects prior to this have been reviewed. Research into this topic is predominantly focused on what happens inside design, and on the central relationships within design (*e.g.,* designer-to-designer, designer-to-stakeholder); these are not on the designer's relationship with the

social environment. The next subsection closes in on this topic by reviewing literature that combines sociality and the design process.

2.3.4 Putting the social in design process

As discussed in the earlier section the first publications on the social processes are published by Bucciarelli, Tang, Minneman, Leifer, and Fruchter. In addition, through investigations into teamwork and collaboration such as these the social processes are illustrated as an important research endeavour. The aim of these works is primarily to improve communication in team and collaborative designing, not necessarily to investigate the social aspect of the design process. This section looks at the roots of investigating the social in the design process, which began at the Design Methodology Group at the Faculty of Industrial Design Engineering, TU Delft (DMG Delft) and continues by detailing some of the work that has emerged from DMG Delft. This literature review includes research accomplished by Eckhart Frankenberger, Petra Badke-Schaub, and Rianne Valkenburg.

In 1999 an interest in social context of the design process emerged as a result of the Delft protocol workshop in 1994. The workshop was hosted by the DMG Delft, established in 1985, and aimed to build upon the understanding of design processes as established by Nigel Cross. In 2002 DMG Delft hosted a conference called *Designing in Context* (2002), following which a new interest in design education developed. Current research at the DMG Delft involves research into design communication and reflective practice. This is divided into four areas including the creative context, the design context, the business context and the meta-context. Of these four areas, the design context relates to the social aspects in the design process and has common aspects with the research described in this thesis.

Frankenberger and Badke-Schaub's (1998) research on design processes within a group scenario included the analysis of four projects in design practice, constituting a significant contribution to design research. This work states that contextual factors influence the design process and emphasize these as social activities. The authors discuss some of the *external conditions* that affect the design process, which include the factors of individual motivation, group-organization, climate (context / culture), and leadership. The problems addressed in this work involve factors that are external to or outside of the design process. Frankenberger focuses on social constructs such as group organization and leadership. The factor of individual motivation can also be categorized as a social condition. Frankenberger touches upon the notion of climate, which relates directly to the idea of studio culture addressed in this thesis. The research presented in this thesis differs

from Frankenberger's work in that it takes place in two different design educational settings and takes a wide-angle look at the individual-personal and the sociocultural as external conditions to the design process.

Besides the work of Frankenberger, Badke-Schaub has further accomplished an impressive range of research. She has a background in psychology and has focused on the research of groups and complex problem solving. Her work ranges from topics relating to leadership (Badke-Schaub & Stempfle 2004); group decision-making processes (Badke-Schaub & Gehrlicher 2003; Badke-Schaub & Stempfle 2003) to innovation and reflection during designing (Badke-Schaub 2003). Badke-Schaub is a leader in investigating design processes in group settings and has primarily focused on the aspects that make up the inside of design groups. In addition to working in the area of group processes, Badke-Schaub integrates what is happening in the internal world of the designer (the cognitive) and what is happening between the designers (social interactions). Badke-Schaub's work, especially that on leadership relates to the research in this thesis, because a leader (instructor) guides the design situation (studio culture) and is one of the central contributing factors to the direction of a project (design brief). Like Frankenberger's work, Badke-Schaub's focuses on groups and complex problem solving in design practice but does not include a broad look at the sociocultural external conditions of the context.

Valkenburg's thesis (2000) focuses on the complexity of social relationships in design, particularly among product design teams. She investigates team activity by using Schön's theory of reflective practice and looks at the interactions between the design activity, the design task and the designers. Valkenburg creates a series of empirical studies to firstly evaluate the use of Schön's theory and create a coding and notation method, and then to test the coding to see whether it is reliable. Her first empirical study involves design students and will be discussed in detail in the next section on design education. The second study involves using the videotapes and written protocols from the Delft workshops of 1994 (Cross *et al.* 1996). Valkenburg's work on teamwork in design is again an investigation into the *inside* of the social processes of design. She uses Schön's theory of reflection and deconstructs the design process with this framework. Valkenburg's work is relevant to this research on several levels. First, Valkenburg incorporates several studies in an attempt to cross-reference her findings and build upon her research question. Second, she uses the educational context for one of her studies. Third, Valkenburg uses naturalistic settings for design whenever possible. Fourth, she is investigating product design (*i.e.,* industrial design). Yet, like all other sources investigated

in this section, Valkenburg's work does not address the broader social and cultural contexts outside of design.

2.3.5 Social processes in design education

Despite the understanding that social and cultural forces are factors in the design process, the exploration of these factors, let alone in design education, have not been explored extensively. Very few relevant empirical studies that investigate the social and cultural aspects of design education could be found. Six key examples of research will be discussed and evaluated in this section. These include the works of Donald Schön and Rianne Valkenburg on reflective practice, Robert Findlay's work on collaborative learning, Louis Bucciarelli's work on bringing context into engineering design education, Arlene Oak's work on identity and the design critique, and Phillipa Ashton's work on social capital.

Schön is a practicing architect who began his research career by investigating the interactions among students and instructors in architecture. Three key books, *The Reflective Practitioner* (1983), *The Design Studio* (1985) and *Educating the Reflective Practitioner* (1987) along with numerous research papers (Schön 1984, 1988, 1992) make up his body of research into design process and education. Schön's research takes a sociological approach to design by observing designers at work and exploring design education. His primary contribution to design understanding is the notion of reflection-in-action, which he considers to be a necessary part of the design process. Reflection-in-action is a process in which the designer reflects on a situation in order to determine how to go forward in the overall process. The designer is said to be in a continual loop of reflection-in-action until the design is finalised. Although Schön's primary contribution to design is his theory of reflection-in-action, his focus on design education is of significance to this research. Schön's work focuses on design education on two basic levels. First, he does his research within the design education setting. Second, he wants design instructors to be more conscious of how they teach. Although Schön does much of his research within the educational setting, it is surprising how little he addresses the context of the setting or the sociality of the situations he is investigating. His work elaborates aspects of the design process but neglects aspects of *social* interaction. For example, he focuses on the artefacts being designed (architecture) and the conversations among the parties involved (student and instructor), but does not elaborate on the effects of leadership (*i.e.,* the nature of the relationship between student and teacher) or context (*i.e.,* the socialization that may have already occurred in the students education thus far).

Even so, Schön's work stands to date as a significant contribution to the understanding of design processes in the educational setting.

The work of Valkenburg (2000) is introduced earlier as the project on reflective practice in product design teams but included in her work is one field study on design education. Her research involves two studies including one group of design students at a university in The Netherlands. Two teams of four students are observed and videotaped during a portion of a Philips design competition. Both teams are multidisciplinary and similar in overall make-up. Valkenburg describes in detail the stages each team goes through and analyses their activities according to Schön's theory of reflection-in-action. This work is clearly an investigation into the design process and reflection as it occurs among design students. It is an example, as previously discussed, of the sociality *inside* design. Although Valkenburg's work is an empirical study into design education, she fails to address the broad concerns of the social system outside of the design project.

Findlay's (1996) thesis is another example of work on social interaction in the design education environment. Findlay, like Schön, is an architect who focuses on advocating the idea of reflection in designing. He bases his work on focus groups that he performed with seven groups of design teams. In this work he proposes a model for collaborative learning that allows students to move more fluidly from their cognitive world to a wider milieu. Findlay recognizes that student learning and design are social activities and that this deserves a greater focus in design education. He also recognizes that individuals in group learning situations benefit from their broader experiences and that this enhances discourse within the group. Findlay's approach is one that prescribes a way of supporting the collaborative learning situation rather than exploring the details of what these may be. Furthermore, Findlay fails to contextualise collaboration in the context of the learning environment. Therefore his approach seriously limits the depth and range of data about the social nature of designing within design education.

Following Bucciarelli's earlier work in the 1980s he has continued to work in the area of engineering design and social context. His current work builds upon this work that advocates that design knowledge and design knowing is context dependent (2001:297). Bucciarelli argues that current engineering design education focuses on material substance and that process needs to be understood in a broader sense (*ibid* 198). He understands the notion of design as being collective because all design requires negotiation of the designers' interests therefore the information negotiated is socially construed. Based on this understanding of engineering design, Bucciarelli proposes improvements and additions to design education. He presents two project examples that

involve a more open-ended context to problem solving that he feels mirrors real world requirements (2001). In this work, Bucciarelli proposes a somewhat prescriptive solution to integrating social context into designing. In doing so, this work is not *about* education. Although Bucciarelli's insights are a valuable contribution to addressing some of the broader issues in design education such as, keeping alive the ambience of active learning with others and allowing individuals to grapple with design requirements (*ibid* 309), these are not directly relevant to the study of intangible references. In addition, although Bucciarelli mentions the educational *setting* and the *ambience* of the environment, he merely touches on the existence of these.

In the area of design education, a growing body of work focuses on the design critique. This work is considered out of the scope of this research because, on the most part, focusing on the critique goes together with ignoring the social and cultural aspects of design education. For example, as in other areas of design research, much of the work is based on anecdotes that are isolated from a wider context (Dunster 1966, Banham 1975, Flemming 1998). These works are useful reflections on the idea of the critique, yet not relevant to this research. One exception however is the work of Oak (2001), which involves observing three groups of students at three different colleges in England. Oak uses known methods from social psychology including symbolic interactionism, ethnomethodology and conversation analysis in order to investigate the 'talk' that goes on during the design critique. She addresses the notion of identity beyond the roles that are commonly associated with design. Oak demonstrates the structures and complexities of the social nature of design by contextualising the participants within forms of social order and authority. This work is especially noteworthy because Oak comes from a design background and integrates the methods and theories of social psychology. In addition, this is one of few research projects that successfully address design issues as they relate to the broader social network, including power, institutional roles and gender.

Other noteworthy work that investigates the social processes in design education is Ashton's (2001; Ashton & Durling 2000) research on social capital. This study focuses specifically on the social context for learning that takes place in the university design studio. Ashton conducted three separate studies at three different universities in England and analysed the interaction of students during their daily tasks in a design studio. She investigates the experience in becoming a designer inside the social environment of a design school studio. That is, Ashton particularly looks at social capital among the group defined as the norms of group formation including hierarchy, status and personality (Ashton & Durling 2000:4). Her work is easily relatable to the research in this thesis. First,

it involves a relatively holistic look at design education (*i.e.,* looking at design beyond the artefact) and second it addresses forces that enter from the outside the educational situation (social capital) that affect the design process. Ashton focuses primarily on different learning styles (*e.g.,* activist, reflector) and how the student fit into the studio group (*e.g.,* alienation, active involvement). The role of the teacher as a leader is not clearly defined or investigated therefore limiting the scope of the work to student-to-student interactions. Furthermore, the notion of studio culture, which has the potential to affect the social capital of the individuals, is hardly addressed. Ashton's work does however successfully examine the position of individuals within a group and the resulting barriers and conduits for interaction within that group. This work indicates that in order to promote effective learning the effects of social hierarchy need to be understood. The idea of social capital is complex and meaningful within the design education setting, yet it is only part of the intangible forces. Many of the issues that relate to the notion of social capital are not part of everyday design discussions. Meaning, investigating references is a study about *surface interactions* that are openly communicated in the design studio.

Again, investigations into the social processes in design education are limited and are typically focused on specific activities such as ways of problem solving (individually or in a team) and the discussions that take place during a critique. Among the research highlighted, the one that is most closely aligned with this research is the work of Ashton. This is due to the approach and methods employed to get at the research question of social capital. Although the literature reviewed here demonstrates a growing interest in the social processes in design there is clearly enormous potential for further work in this area.

2.4 Towards the sociocultural processes in design

In addition to a growing interest in the social processes the design community has an interest in design culture, as emphasized in works such as Penny Sparke's (1986) book *An Introduction to Design and Culture in the Twentieth-century* and Guy Julier's (2000) book *Design Culture*. Sparke examines design as a discipline that creates material culture and has an *umbilical link with culture* (*ibid* 205). She covers many topics including a general understanding of design within the broad context of western civilization, which includes economics, politics, and technology of modern society. Sparke's central argument is that design is formed and transformed by cultural forces and that designed *artefacts act as cultural ciphers* (*ibid* xix). Julier's book, much like Sparke's, approaches the idea of design as linked to broader societal issues and discusses the material and visual relationships in design. These have been touched upon in the previous chapter, describing design as having a triadic relationship that includes the designer, production

processes and consumption (Julier 2000:4). Both Sparke's and Julier's books address the artefact and context, but not what is considered here to be at the core of cultural production: the designer's relationship to sociocultural environments and how these are reflected in the artefact. It is this query that originally led to a desire to investigate the sociocultural processes in design.

As indicated in the work reviewed, the following figure shows that research has been done in the area of social processes and design education; however, there has been little work done in the area of the affects of the cultural processes *inside* design education.

Figure 2.2 is an interpretation of the current state of the three central topics in this thesis, which of course includes looking at the cultural processes in design.

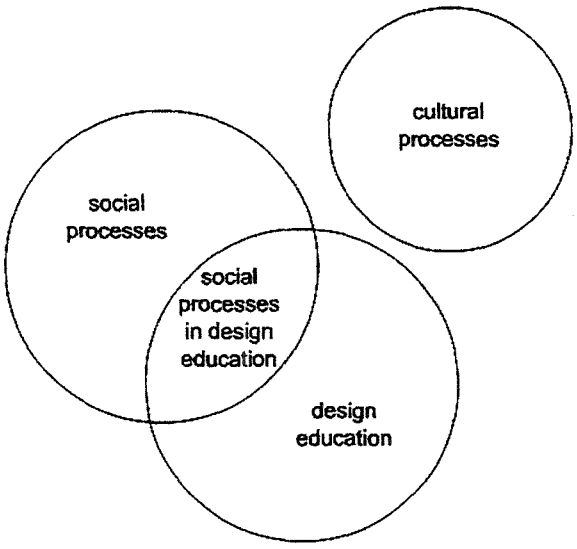


Figure 2.2: current state of research into the three topics addressed in this work

In fact, extensive literature reviews revealed that the range of work done in the area of cultural processes in design is relatively limited compared with what has been done in social processes in design. This may be partially due to design researchers working more directly with psychologists on cognition in design (*e.g.,* problem solving). Or this may be because of the difficulty in defining and exploring the concept of culture. The areas to explore the cultural processes are like a mirror to those in the social processes. The areas for exploring cultural processes include collaboration in design (*i.e.,* how does culture viewpoints affect designers in teamwork), user-centred design (*i.e.,* how are artefacts received by different cultural groups), and the design process (*e.g.,* how does culture affect the design process, what makes up design culture). Namely, the research presented in this thesis is about the third area, as identified previously. There is a growing interest in the cultural processes; however, as research in this area is less cohesive than the areas of design cognition and social processes in design.

This is illustrated in figure 2.3.

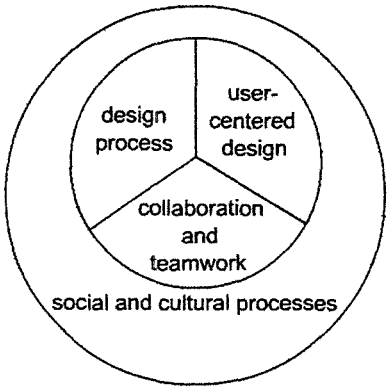


Figure 2.3: areas of exploration in the social and cultural processes of design

Furthermore, many of the following examples of research into the cultural processes in design are not explicitly defined as such. The following summary of work is intended to illustrate the growing interest in the area of cultural processes; however it is not an extensive review. The work reviewed here is considered to be research that is closest to the work described in this thesis. To date, there is no work found that directly relates to the research here.

Work in the area of culture and usability falls under the area of user-centred design. A case in point is the work of D. Loi (2004) that is a personal reflection on teaching design. Loi describes the use of *cultural probes,* which are objects or artefacts that provoke, reveal, and capture the motivational forces that shape an individual (*ibid* 660). The cultural probes that are discussed in Loi's research include disposable cameras and audio tape recorders. The students were asked to design probes for their projects in order to better understand the needs of their user group. Naturally, if a designer researches the cultural processes of the user, he or she may reflect on his or her own cultural values. Another example of user-centred design that focuses on culture is the work of Thomas Oosthuizen (2004) who creates an argument for marketing communication design beyond the lowest common denominator. Oosthuizen proposes a model where core values that are innate and universal are used in graphic design to communicate cross-culturally. He touches on issues that relate to diversity, localization, standardization and globalization. Oosthuizen creates a contradictory argument where he states that it is necessary to creating a converging of diversity that is against standardization (*ibid* 66); however, the model he proposes relates to how to standardize communication and work with universal symbols (a standardized system). Loi and Oosthuizen each explore the relationship of culture to users in a different way but do this as a reflection on their own experience and not as empirical studies.

Research into the cultural processes and the design process currently includes some examples of design culture (primarily in retrospect as described in chapter 1). One notable book explores the idea of design as a culture of creativity. The *Art of Innovation* by Tom Kelley and Jonathan Littman (2001) promotes risk taking while designing and begins to demystify the design process. This publication is a first-hand account of some of the techniques that the design consultancy IDEO uses for artefact innovation. Kelley and Littman dispel myths about the lone creative genius through describing a design culture that has been developed in this particular consultancy (*ibid* 12):

> *... they tend to believe that truly creative individuals are few and far between. We believe the opposite. We all have a creative side, and it can flourish if you spawn a culture to encourage it, one that embraces risks and wild ideas and tolerates the occasional failure. We've seen it happen.*

In *the Art of Innovation* design culture is described as fun and playful, hands-on and intimate (among team members and with stakeholders), collaborative and nonhierarchical, and user-centred. The design community has embraced this work as an excellent descriptive model of contemporary designing processes. Even so, at times Kelley and Littman's description of design culture reads as a promotion (*i.e.,* of design in general and of particular processes in design). After all, the book is written from the perspective of an insider to design and to the IDEO culture. Tom Kelley (along with his designer brother David) is one of the founders of IDEO and Jonathan Littman is the consultancy's general manager.

Bryan Byrne and Ed Sands' book is an example of research from the *outside* looking *into* the corporate culture of design (2002). They discuss design firms being organized and operated as studios that are versatile, fast paced and chaotic (*ibid* 53). Contrary to Kelley and Littman, Byrne and Sands believe that design studios are hierarchical institutions that include status-orientated activities and social cliques. In their article, they publish a description of one designer's thoughts on studio culture. Rob Curedale states that there are two types of design studios. One is driven by skills acquisition and he other is led by the design hero and inspires creativity (*ibid* 59). Having established and defined the culture of a design firm, Byrne and Sands provide suggestions on how to create a multidisciplinary and collaborative environment that combines the technical and the intellectual. They argue that, because design is based in an apprenticeship-type educational system, it focuses on skill acquisition and needs to integrate strategic design (*i.e.,* designers working with non-designers). Therefore, Byrne and Sands' work is primarily about collaboration and partnership in design and is secondarily about design culture. Both the work of Kelley and Littman and of Byrne and Sands seem to believe in

the notion of a generic design culture, even though they are clearly describing a limited range of cultures. Interestingly Byrne and Sands do not indicate how they come to know about design culture (*i.e.,* there is no indication of which design firms are being studied), which leads to the assumption that their description of design culture is based on a bricolage of personal experience, individual accounts, and secondary research.

Another example of research into this area of cultural processes is the work of Peter Lloyd from the DMG in Delft. Lloyd's work is predominantly in the area of design narratives (2000, 2002). Lloyd uses ethnographic methods in his research to examine the social and cultural aspects of design. Although ethnographic methods do not *belong* to anthropology, they are commonly used in the investigation of culture (see chapter 4 for more details). This is because ethnographic methods reveal aspects of culture by providing a breadth and volume of data. From his ethnographic studies, Lloyd provides descriptions of a British aerospace manufacturing company (Lloyd & Deasley 1998), a company that creates test systems for automotives (Lloyd 2000), and the depiction of design culture through television programming (Lloyd 2002). Of these three research projects, the work on British aerospace is about the design process within the cultural context of the company (Lloyd & Deasley 1998). Lloyd and Deasley look at one phase of micro-problem solving in design and describe a process that involves a mentoring structure among designers, reflective problem solving and what they term as a significant amount of 'messiness' in design work (*ibid* 108). Lloyd and Deasley's research exploits the notion of design culture as the inroad to understanding social processes, but fails to address how the particular design culture may be affecting the design process and designer(s).

Other researchers working on cultural issues in the area of narrative are Ann Heylighen, Humberto Cavallin, and W. Mike Martin (Heylighen *et al.* 2004; Martin *et al.* 2003). This project is called Building Stories and involves a case study of practice at the University of California, Berkeley USA. Building Stories is a project that involves the real-time telling of architectural stories that result from interactions between students, interns, and professionals (Martin *et al.* 2003). Building Stories is a first-hand narration about buildings in the process of being designed. Namely, these stories are about the experiences of the people involved in developing material culture. This project differs from other case-based design aids because Building Stories is as much about the context and the sociality of design as it is about the artefact being created. Although narratives do not necessarily relate to cultural processes, this project is an excellent example of *in situ* design culture that is documented in what is referred to as *best practice* (*ibid* 1). Currently, this project is

in an early stage of development; however, it will be interesting to see the detailed outcomes as these will be a valuable contribution to understanding an architectural design culture from the first-hand experiences of students, novices, and experts.

Benny Ding Leong in conversation with Hazel Clark reports Leong's east-west approach to designing and is a publication on a designer's reflection on culture (Leong & Clark 2003). Leong is of Chinese origin and is educated in Hong Kong, London, and Europe. In this paper he describes through dialogue how he began to consider traditional Chinese creative thinking as an alternative to homogenous western thinking (*ibid* 49). Leong focuses primarily on the philosophical as a point of cultural access and described a series of models that he developed in order to *visualize and capture the fluid concept of culture* (*ibid* 55). This work is a personal reflection on what is described as culture-based knowledge, which can be categorized as the study of cultural cognition. Leong's contributions in this publication are about his expertise in designing and the benefits of thinking outside of the western paradigm. Although this work provides models that designers may use to reflect on culture, it does not address the issues concerning the effects of a sociocultural environment on the design process. It is also questionable if these models are useful for other designers since the article reads as a personal journey and not a descriptive model.

The work of Paul Rodgers concludes this literature review on cultural processes in design. Rodgers (2003, 2004; Rodgers & Strickfaden 2003) uses the metaphor *cultural DNA* and speculates that there may be common cultural capital among designers. His work began as research into influences in design (Rodgers and Milton 2001) and evolved into exploring the 'memes' of designers. Memes are defined by Richard Dawkins as the stories, songs, artefacts (*i.e.,* cultural icons) that make up people's collective world (1989:192). Rodgers performed informal interviews with a number of well-known designers to get at and understand the cultural DNA of these designers. Rodgers' work is connected to the research described here as both projects are interested in the notion of cultural capital among designers. However, Rodgers' work is limited to designers in practice and does not investigate their broader context (*e.g.,* specific artefacts being designed, the backgrounds of the designers, the culture they are currently working in). In addition, Rodgers acts to construct a generic design culture based on relatively narrow examples from popular culture. Other work in this same genre is done by Strickfaden and Rodgers (2002) and makes up the pilot studies for this project, which are described in chapter 4.

It is clear from the examples on the cultural processes in design that this topic has not been researched extensively. The designer's relationship to his or her culture is considered to be at the core of cultural production and yet there is no indication of what role culture plays in the design process, nor of how culture may be reflected in artefacts. Investigating the references that occur during the design process milieu marks the beginning of a journey into understanding how artefacts design involves aspects from inside and outside of design.

2.5 'Intangibles' and 'references' in design

According to the *Oxford Dictionary* the definition of intangible is *something that cannot be measured or assessed* (Barber 1998). The term intangibles is considered to be a good label for the references to experiences, objects and events that the designer discusses because these are not physically or materially present These references are abstract, unusual, ambiguous, and idiosyncratic and occur outside of the design environment (*i.e.,* studio or school), therefore making them very difficult to measure. In addition the references discussed here are dynamic and relative to the individual and their sociocultural context. These are not fixed or measurable without a clear understanding of context. Finally, the intangible references discussed in this thesis are further from the task at hand, which makes them intangible relative to the artefact that is being designed. The term *intangibles* is chosen for this thesis as it best describes the type and range of references discussed during the design of an artefact.

At present, the term intangible is used infrequently and loosely in the design community. The term intangible was originally used to describe aspects of design including *...intuition, imagination, creativity...* by John Zeisel (1984). Zeisel uses the term to describe that which is not easily defined or easy to see. On the most part his use of intangibles describes aspects of cognition, that which occurs within the designers head and is enacted during designing. Concepts relating to cognition and design problem solving that may relate to intuition, imagination and creativity are being explored in current day design research. Many years following Zeisel's work, John Christopher Jones is said to have widely addressed the concept of intangible design (Mitchell 1996). Jones is referring to the intangibles of design as being the elusive experiences of the people who will use the artefacts designed. Jones' usage of the term intangibles relates to something that is difficult to measure that comes from outside of design. In his work, Jones identifies the intangibles as something that is not fixed and is dependent on context. Another example of the use of the term intangibles is in Filiz Klassen's (2002) paper titled *Tangible to Intangible* where he uses the term to describe a move from a relatively prescriptive

teaching scenario in design to one that is more collaborative. In this paper he is discussing the differences between teaching something that is tangible (the inside of design) versus something that is less tangible such as user-centred design. Both Jones and Klassen are referring to aspects of design that are considered elusive and difficult to define.

In John Hartley's (2002) book *Communication, Cultural and Media Studies – the Key Concepts* he states that the intangibles are *assets such as knowledge, competence, intellectual property, know-how ... culture ...* (*ibid* 118). He continues to state that these are being exploited by business and economics. Hartley's definition of the intangibles includes culture and knowledge, which are the social and cultural processes. His definition is a reminder that the intangibles include the cognitive knowledge and the cultural. For the purpose of this research the term intangible is coupled with the term references. This is intended to illustrate that it is discourse about things (*i.e.,* experiences, objects, events) that are being discussed in this thesis. In addition, in this work the use of the term intangibles is expanded upon and includes certain aspects of the designers internal world (experiences that are presented as memories) that are linked to certain aspects of the external world (the design studio, design school, and sociocultural contexts).

The term reference is used in this study to describe the mode of communication that contains the intangibles. Language is the medium within which individual-personal and sociocultural knowledge is acquired and communicated (Feidler & Bless 2001:143). It is well known that individuals work within the lexicon and rules of language(s) and that this builds a considerable part of an individual's knowledge. Word choices and sentence structures have rich implications for inferences (*ibid* 144) and for that reason words and sentences contain an immense amount of meaning (Chomsky 2002). There has been a considerable amount of work done on the intersection of language and cognition including: how social purposes are reflected in language and vocabulary, and how these may influence social perceptions and behavior (Durkin 2001:58). These concepts including speech and language are out of the scope of this work. As previously mentioned, references are part of language but it is not the implications or inferences that are of interest here, it is the actual reference that is defined by the context of the designer using the reference. References are defined here as the words or phrases that carry literal meaning which involves a relatively clear-cut relationship between the words and the world they describe (Good 2001:84). For example when a designer is talking about a bicycle rack other designers will understand that a bicycle rack is a structure than fits on

to the front or back of a bicycle. They may have a slightly different image of the rack, but details will be added if a significant point is being made. Although meaning is not always clear because the designer is working on something that exists in the real world, references tend to relate to the real world. It is necessary to clarify here that references are words and small phrases that are compared to the overall topic of conversation (the design of a meal tray or eyewear) and the context of design (local and universal design culture).

In design research, the term reference is not used frequently; however, one significant research paper is written by Gabriella Goldschmidt (1998) that describes 'references' as the precedents that designers openly reveal to have inspired them. She considers references to be a point of departure and not necessarily a precedent. Goldschmidt's definition of references is expanded upon in this research to include more than just precedents. For example, Lawson (2004) describes an interview with an architect who discusses precedents (or references according to Goldschmidt) for his work as historic buildings and other pieces of architecture. It is important to note that in Lawson's paper he indicates that he continues to use the term precedents because *most designers call them precedents* (*ibid* 449). References on the other hand are all encompassing and include all sources whether these are thought to have influenced the final artefact or not.

Goldschmidt (1998) elaborates on the nature of references by stating:

> *...reference, as a general class, is inclusive of sub-classes such as precedence. The architectural reference can be any building, part of a building or building system and components. Nothing is more dynamic than a collection of references: they represent known instances of design that can serve as arguments to be used in design reasoning. To be valuable, a reference must carry meaning and a designer must therefore have sufficient intimacy with it. It also has to relate to concerns that are on the designer's agenda, which may undergo frequent changes. Collections of references are therefore a rather personal matter and pertain to individual designers or to members of a micro-design culture, such as a design firm or a school of architecture.*

The research in this thesis explores the idea of reference considering many of the characteristics outlined by Goldschmidt. For the purpose of this study, it is necessary to find a way to look holistically at what is being described during the design process by the design students. The term reference is deemed suitable for this purpose because references are all-inclusive by involving all that is being discussed including those things that may not appear relevant to the task at hand.

Introducing two relatively new terms into design research can potentially cause confusion, especially if the terms are ambiguous. It was considered necessary in this case to use

new terms because the area of investigation is new to design research. By bringing in issues that relate to design from the inside and outside, and include a holistic perspective the terms intangibles and references are the key to defining the nature of this research.

2.6 Conclusion

In his book *Objects of Desire,* Adrian Forty (1986) makes the point that designers may unconsciously enact their own discourses into the artefacts they design. Furthermore, Lloyd (2002:120) speculates that designers, although focusing on specific problems, are contributing towards much larger social issues they may not be aware of. Both Forty and Lloyd recognize that there is a great deal to be understood about designing within the social and cultural environment, and especially about how this context affects the designer.

This chapter has highlighted that there is still much to gain from examining the social and cultural processes in design. The majority of the studies discussed in this literature review focus on the processes *inside* design. Furthermore, although there seems to be a growing interest in the social processes within design education, there are no examples of studies on the cultural processes therein. There are also few empirical studies on cultural processes in general, and none that investigate culture for culture's sake. There is thus a significant gap in providing holistic description of a studio setting and the events that are occurring in the studio environment, including the norms and values of that particular group.

This work is conceived as a combined investigation into the social and cultural processes from two perspectives including:

1. a description of these processes as part of the designers' studio-based environment / immediate sociocultural context (chapter 5) and
2. a preliminary look at how these processes move from the *outside* to the *inside* of design (chapters 6).

In addition, it acts to integrate the three areas of investigation described as the social processes, the cultural processes and design education. At the heart of this work are the references to sociocultural context and specifically to the (in)tangible references because they form the link to understanding how the individual relates to their sociocultural context(s). Through these references, the designer reveals a great deal about his or her worldview including his or her values. Finally, the design studio in an educational environment represents a highly socialised situation that involves complex relationships among the group, with people at the university and with others external to that environment.

Figure 2.4 illustrates how these three areas overlap in this research.

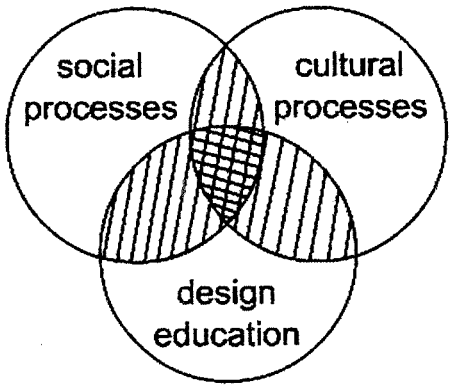


Figure 2.4: integration of the three areas of investigation

The work in this thesis focuses on design as a sociocultural activity and recognizes that the design of an artefact is a reflection or *multiple* reflections of the designer's social relations and links with culture.

3 Foundations and Models from Inside & Outside Design

3.1 Introduction

The first two chapters identify the need to investigate the social and cultural environments of design through empirical studies. A broad reaching literature review reveals a wide range of interest in examining design practice and design education, which illustrates a growing interest to investigate the social and cultural nature of design. The current body of knowledge presents an increased understanding of the social nature of design; however, there is a lack of cohesion in the area of cultural processes in design. An emerging understanding of cultural processes suggests that there is a need to develop ways in which cultural processes can be viewed, understood and represented in design. A starting point is to develop a framework to observe and analyse empirical data resulting from studies on the sociocultural processes of design. However, it is not a trivial task to provide a framework for research questions that involve both micro and macro issues. As previously identified, interdisciplinary approaches and methods are deemed most appropriate, yet these involve increased complexity. An interdisciplinary approach necessitates not only a systematic review of theories inside design research, but also theories that have been developed outside the discipline. The theoretical foundations presented in this chapter provide a framework to observe and analyse empirical data from a more holistic perspective.

The aim of this chapter is to present the theoretical foundations relevant to understanding the micro (specific references) and the macro (sociocultural context) in design. The theories reviewed herein come from inside and outside design. This chapter, therefore, continues along the same lines as chapter 2 by representing the theoretical foundations of this work with an interdisciplinary model developed particularly for the purpose of seeing design from an alternative perspective. However speculative this perspective may seem, it is based on well-known approaches to understanding design and to examining social and cultural forces. The interdisciplinary model created for this investigation is data

driven (*i.e.*, derived from the studies herein) and the result of the theories identified in the first two sections of this chapter. It is called hereafter the 'design process milieu' and links to theories about designing; theories on inside-outside culture; the theory of cultural capital; and theories about the internal and the external environments. By creating this model, the design process is looked at from a number of different angles simultaneously including what is expected to occur during the design of an artefact (the tangibles inside the design environment), as well as discovering the unexpected (the tangibles and intangibles outside of the design environment). The model is presented here along with how to map the references to the sociocultural environments and how to characterize the tangible and intangible references.

The first section in this chapter includes theories about designing. These are general theories that are accepted inside the design community and relate to the generic design process. The second section in this chapter includes theories from anthropology and social psychology about the sociocultural environment. The third section of this chapter includes the design process milieu model that has been developed for the purposes of interpreting and analysing a more holistic design process. The final section identifies how the theories in this chapter address the research questions.

3.2 Theories about the design environment

This section introduces the central issues around referencing in the design environment. The aim of this section does not include an in depth literature review on these issues, rather it provides the fundamental theories that inform the research methods and data analyses employed in this research. The theories are presented as models and concepts relevant to designing inside a specific environment that is affected by outside factors. A specific model has not been applied in this research, but rather, the ones outlined here act to inform the research through building an understanding of design from an alternative point of view. This section includes a brief review of design methods and then focuses on a generic design process model that is based on two well-known design methods theories. The model that is used in this research is a simplification and hybrid of two models. This generic model is used purely for descriptive purposes to approximate *what* types of activities the students are engaged in while working on their projects.

3.2.1 Generic design process

Some of the early research into the design process is detailed in the design methods subsection 2.2.2 in chapter 2. As previously noted, in design research generic aspects of process have been explored and generalized resulting in both prescriptive and descriptive models. On the most part the subjective aspects of the design process have merely been

suggested and have not been studied in depth. This is likely due to the fact that subjective design processes are ambiguous making them difficult, if not impossible, to pin down. The ambiguity of the design processes are described as: *making a creative leap* (Jones 1981; Cross 1984); *reaching an aha moment* (Cross 1984); *making an educated guess* (Vincenti 1990); *reaching eureka* (Zeisel 1984); relying on *non-verbal knowledge derived from experience* (Whiteley 1993); and involving a *surprise* (Schön 1983). Even though there have been a number of significant contributions towards understanding the design process over the past three decades, Heskett (2002) states that the phrase *design process* implies a unity that is non-existent. For example, *design process* may be interpreted in several different ways; including process as a generic cognitive problem solving procedure (descriptive), process as an official procedure of predefined steps (prescriptive management), and process as the actual sequence of steps that are carried out while doing a task (descriptive).

Two models have been chosen as best examples that fulfil the requirements of being descriptive and taking an interdisciplinary approach to designing. In addition, these two models have been chosen because of their focus on industrial design and because the authors break the design process into separate design subtasks, which is useful for approximating what the designers are doing in each field study. These models are used because they are relatively well known and accepted within the design community. The design methods models reviewed and synthesized here are Nigel Cross' (2000) descriptive model and Karl Ulrich and Steven Eppinger's (2000) interdisciplinary model.

Cross' (2000) model of the industrial / product design process focuses on how designing has been carried out by practitioners and is based on many years of research into designing. Cross has a background in architectural and industrial design practice, and has been involved in design research since the 1960s. Cross' approach to design processes is possibly the most well-respected in the discipline of design. His approach is realistic about the types of problems that face designers, therefore representative of a broad range of design issues. The model that is presented here is an integrative model that combines the procedural and structural aspects of design. In Cross' descriptive model he identifies four basic activity types in the design process consisting of: exploration, generation, evaluation, and communication (*ibid* 29). He continues to describe this four-fold process as having an iterative feedback loop between generation and evaluation. The four-fold process is further elaborated upon with an eight-stage process (*ibid* 31).

Both the four-fold and eight-stage processes are shown in table 3.1.

Four-fold process	Exploration		Generation		Evaluation			Communication
Eight-stage process	Need	Analysis of problem	Problem statement	Concept development	Selection schemes	Embodiment schemes	Selection and detailing	Working drawings

Table 3.1: Cross' two descriptions of the design process

Cross elaborates on the design process as being integrative, involving substantial periods of iterative activity where the designer moves between the problem and solution, sub-problem and sub-solutions. Although Cross' thinking on design processes involves a great deal of common sense towards design practice, for the purpose of describing what is happening in the two field studies in this research, the four-fold process does not contain enough detail and the eight-stage process contains too much. In both field studies in this thesis, the project begins with the *need* defined with a *problem statement* from the instructor. Furthermore, the types of exploration occurring (*i.e.,* design brief, research, thought processes) need to be defined more clearly to elaborate what types of information the students are gathering. Finally, Cross' positioning of communication at the end of the process is not an appropriate characterization of design communication here. That is, communication is all the verbal, visual and text references that occur throughout all stages of designing. Therefore, communication is not considered part of the framework here because references (communication) are the *focus* of the analyses.

Ulrich and Eppinger's (2000) model of product design and development is an interdisciplinary model developed to teach product development to engineering, industrial design and business students. Having backgrounds in mechanical engineering, they blend the perspectives of marketing, design, and manufacturing in a single approach that seeks to define product development with an integrative model. Although this model focuses predominantly on engineering design processes, they provide a comparison with industrial design processes.

Ulrich and Eppinger state that (*ibid* 211):

> *Industrial designers are primarily responsible for the aspects of a product that relate to the user — the product's aesthetic appeal (how it looks, sounds, feels, smells) and its functional interfaces (how it is used).*

Ulrich and Eppinger continue to discuss how industrial design may give a product a competitive advantage in the market place. The model that they introduce is designed to introduce engineers and managers to the industrial design process.

Ulrich and Eppinger provide a breakdown of the industrial design process into six phases (*ibid* 219-220) as shown in table 3.2.

Six-phase process	Investigate customer needs	Conceptualization	Preliminary refinement	More refinement and concept selection	Control drawings	Co-ordination with engineering, manufacturing, vendors

Table 3.2: Ulrich and Eppinger's description of the industrial design process

Ulrich and Eppinger define the primary role of industrial designers as providing an interface between user and artefact therefore a user-centred approach is at the heart of the process. Within this model, Ulrich and Eppinger define the customers' needs as including ergonomics (*i.e.,* ease of maintenance, quality of interaction, novelty of user interactions, safety) and aesthetics (*i.e.,* product differentiation, pride of ownership / fashion / image, team motivation) (*ibid* 216). This model is not always appropriate for studying the educational process, because sometimes the approach to designing an artefact may not focus on the user. That is, the focus may be on the technical, sustainable or another aspect of industrial design depending on the project objectives. For example, in one field study the focus was on user-centred design while in the other the focus was on the design process and visualization. Furthermore, the final two phases of Ulrich and Eppinger's process are appropriate for real world design but not for an educational setting unless the project focuses on interdisciplinary design. For the purpose of this research Cross' descriptive design methods model is combined with Ulrich and Eppinger's model of industrial design processes resulting in the generic design process model illustrated in figure 3.2.

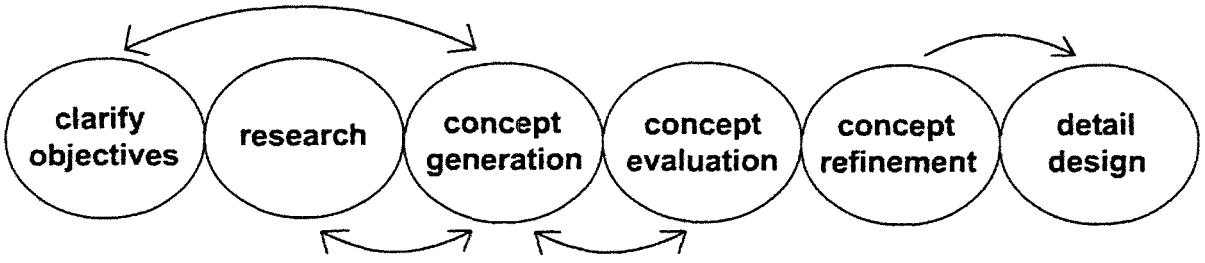


Figure 3.1: generic design process model

This model shows six stages of the design process beginning with clarifying objectives and moving through to the detail design phase. The arrows are placed arbitrarily to demonstrate that the process is iterative, as described by Cross, whereby the designer is not following a linear one-way stream towards the finish but he or she weaves to and from activities. The model is visualized as a chain of links that connect infinitely and are intrinsically linked to one another. Although both Cross' and Ulrich and Eppinger's models have stages or phases beyond detail design, the proposed model shown in figure 3.2

represents the typical phases when designing within an educational context. That is, in industry, the design team will move beyond the detail phase into prototype development and testing; in an educational context, however, the designer rarely moves beyond the detail phase because the design is speculative. None of the students in either field study represented in this research move beyond the detail design phase.

Table 3.3 represents the six-stage model shown in figure 3.2 along with Cross' and Ulrich and Eppinger's descriptions of the similarly named stages.

	Clarify objectives	Research	Concept generation	Concept evaluation	Concept refinement	Detail design
Cross' description of the design process (2000)	-procedural lists -establish functions (*e.g.*, consider problem level, purpose of device) -set requirements -set limits (*e.g.*, cost) -define problem -determine characteristics -determine product attributes (*e.g.*, comfort, durability) -define key features (*e.g.*, speed, cost, safety)	-look at product types, features and alternatives -look at competing products -match customer requirements with artefact characteristics	-understand the problem and look for solutions -generate many alternatives -make variations on themes -widen search and look for alternatives	-evaluate alternatives -through guesswork, by intuition, by experience -through others involved in the process (*e.g.*, stakeholders, colleagues) - weigh objectives/criteria - check against objectives/criteria	-improve details (*i.e.*, increase value for user, reduce cost for producer) -eliminate, reduce, simplify, modify, standardize -utility, reliability, safety, maintenance, lifetime, pollution	-final description of the artefact through a drawings, annotations, lists, mock-ups, prototypes (*i.e.*, general or specific)
Ulrich & Eppinger's description of the industrial design process (2000)	-planning (e.g., project mission statement, guide) -investigate customers needs	-primary research	-product form -user interface	-concept evaluation through models and visualizations	-preliminary refinement -further refinement and concept selection -hard models and renderings	-control drawings with product features and functionality (*e.g.*, features, sizes, colours, surface finishes, key dimensions)

Table 3.3: generic design methods model with descriptions corresponding to Cross and Ulrich and/ Eppinger

The descriptions provide a guide along with the generic design methods model. This guide aids in placing students' activities within one of the six categories shown in the model. It is important to emphasize here that this model is used to describe and reflect on what the designers have accomplished in their design projects, and is not intended as a

prescriptive model for what they *should* have done. The references are defined through this model, which provides a general guide for discovering their purpose.

Over the past three decades, a great deal of research has been accomplished on design processes that are represented by a sequence of steps to conceive, design and commercialize a product. Many of these steps are intellectual and organizational rather than physical (Ulrich & Eppinger 2000:14). Along with the models of systematic design, the designer synthesizes ideas through creative thinking that involves partial solutions, combining solutions, and solution plotting (Jones 1984: 11).

This section has reviewed two fundamental theories that are well known in the design community as descriptive models about the design process. Through these models a hybrid model of the generic design process has been developed in order to map the students' progress while designing. This provides a context for the references that are made. This context is recognized and understood by the design community.

3.3 Theories about the sociocultural environment

This section introduces the central theories relevant to investigating the sociocultural environment. The theories described here are predominantly connected to the disciplines of anthropology and social psychology. These are presented as part of the theoretical framework because it is with these in mind that the design process milieu model is developed. Figure 3.2 illustrates the three central theories deemed relevant to investigating the social and cultural forces in design.

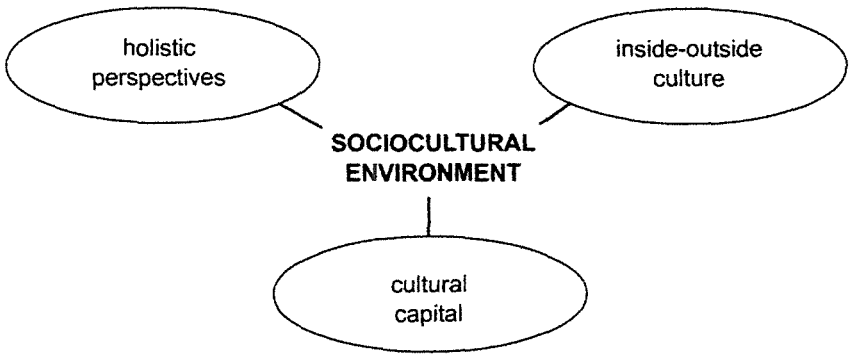


Figure 3.2: theories about the sociocultural environment detailed in this thesis

The first theory that is detailed in this section focuses on holistic perspectives. Holistic models identify a complex worldview that presents an individual as a product of his or her sociocultural environment. This subsection identifies three key models as significant to developing a foundation to describe what is influencing the designer during the design process. The second subsection is about the theory of inside-outside culture, which

recognizes two central perspectives when observing a culture. The final subsection addresses the theory of cultural capital, and explores related ideas of field and habitus.

3.3.1 Holistic perspectives

Holistic perspectives assume that meaning or beliefs are only truly understood when held in relation to the wider historical and cultural contexts (Edgar & Sedgwick 2002:177). Viewing the design process from a holistic perspective is defined in this research as looking at the observable background and contextual parts that are revealed by the designers. In order to see references to this context, theories of holistic perspectives are explored.

The worldview that describes individuals as intimately tied to their surroundings, personal histories and general histories (culture) is presented by anthropologists such as Edward Tylor. As elaborated upon in chapter 1 Tylor defines culture as including knowledge, belief, art, morals, laws, and customs. The idea of the accumulation of information in a collective society is also similar to Richard Dawkins' (1989) idea of memes. Dawkins uses the term meme as an analogy with the term gene, to denote the concept that an idea or information pattern (*e.g.,* slogans, melodies, icons) are replicated and transmitted from mind-to-mind (*ibid*: 192). Whether this collection of information is called culture or memes, the understanding that this information is transmitted among and retained by individuals is one of the base assumptions in this research. Along with anthropologists, cultural psychologists, such as Wilhelm Wundt, believe that the human mind is the product of history. Wundt claims that the higher workings of the mind depend upon (Gray 2002:19):

> *...culture — the language, knowledge, beliefs and other information that accumulates in a population over time and are passed from one generation to the next.*

Cultural psychology typically studies cross-cultural issues, histories of people, and involves long-term processes of human development (Gray 2002:20). On the other hand, social psychology is more about the here-and-now and, on the most basic level is about how people are influenced by one another. Field theory is situated within the branch of social psychology and was developed in 1948 by Kurt Lewin who was originally part of the Gestalt group. Gestalt involves understanding how individuals mentally construct and represent their world (Fiedler & Bless 2001:116) and tend to relate to the whole rather than the parts. Lewin's field theory differs from this by emphasizing the principle of interdependence and the situation of the field over the parts (Graumann 2001:16) and is about an individual's relationship *to* the whole. In field theory it is believed that each person exists in a psychological field composed of forces that push and pull people in

different directions. The psychological field is thought to exist on a dynamic plane that is continually changing according to the situation, the context, and the individual (Gray 2002:539). The forces are identified by Lewin as *psychological forces* and include goals, values, beliefs and expectations (*ibid* 20). The psychological forces are considered to come both from *within* and from *outside* a person. For example, an individual's inside forces might be self perceived desires, goals and abilities while outside forces include other people's expectations or desires (*ibid* 539). Psychological forces such as these are considered to exert social pressure on individuals, which then lead to different actions. Field theory is a holistic model of sociality. In 1979 Urie Bronfenbrenner developed a model of social ecology (*ibid* 454) as shown in figure 3.3.

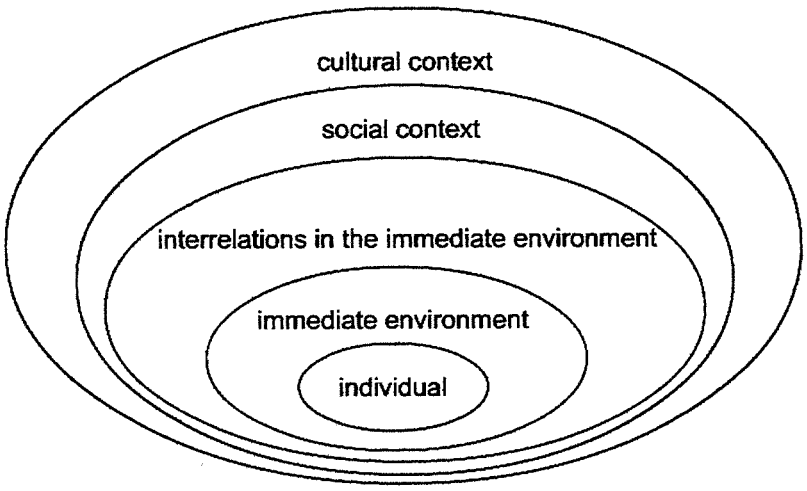


Figure 3.3: an individual's context (adapted from Bronfenbrenner in Gray 2002:454)

Bronfenbrenner's social ecology model illustrates the context that surrounds an individual. This model was originally conceived to illustrate the social ecology of a child, but more importantly integrates Tylor's notion of culture, Wundt's theory of cultural psychology, Lewin's field theory, and the current understanding of interpersonal relationships. Bronfenbrenner's depiction of social ecology demonstrates the complexity of the sociocultural *field* of an individual. Naturally the individual is at the center surrounded by a series of broadening contexts beginning with the closest or immediate environment and moving outwards showing culture as the broadest context. The holistic understanding of context and the belief that an individual's environment is highly complex is at the core of this work.

Hinde's (2001) model of interpersonal relationships shown in chapter 1 and figure 3.4 represents the social complexity of the environments and the contexts that influence the student.

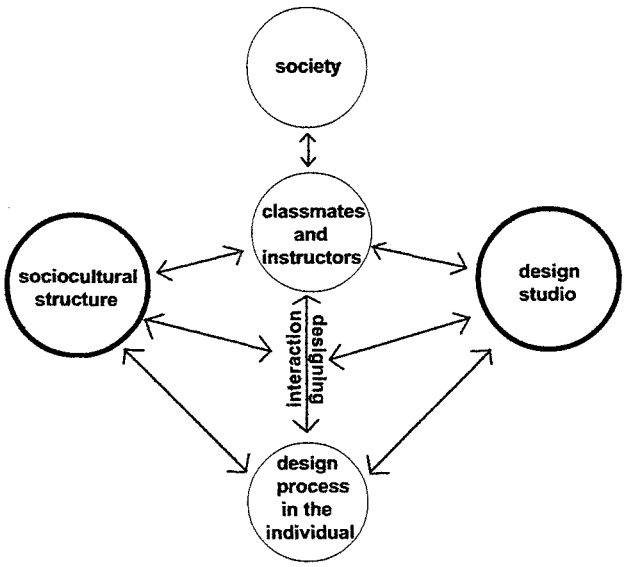


Figure 3.4: social context that surrounds the design student (adapted from Hinde 2001)

Hinde's model serves to illustrate the complexities of the social context of an individual. It differs from Bronfenbrenner's social ecology model in that it illustrates the interactions between the various fields an individual comes in contact with. Bronfenbrenner's model illustrates the existence of these aspects whereby Hinde's model addresses the multiple influences from the various fields to the individual. Attention to a more holistic context is given in both Bronfenbrenner's and Hinde's models.

A model that appears to be loosely derived from Bronfenbrenner's social ecology model is shown in figure 3.5. This model includes the details of an individual's contextual environment that represents two external environments including the micro-and the macro-environments and is considered to relate to human ecology (Westney *et al.* 1988). Human ecology is defined as:

> *[the]...scientific and holistic study of human beings, their environments and human-environmental interactions...* (*ibid* 129).

This approach to understanding people addresses the individual within an holistic environment that includes the internal, external, social, economic, cultural and material environments of individuals. The human ecology model encourages less fragmentation and isolated when looking at the individual and their context. For example, Westney *et al.*'s model identifies the individual as being at the center; and for the purpose of this thesis there is no doubt that the design student is at the center and is the key to exploring references to the sociocultural context. This model also presents some basic distinctions

between the internal / external and micro- / macro-environments, which provide guidelines for better understanding the nature of holism.

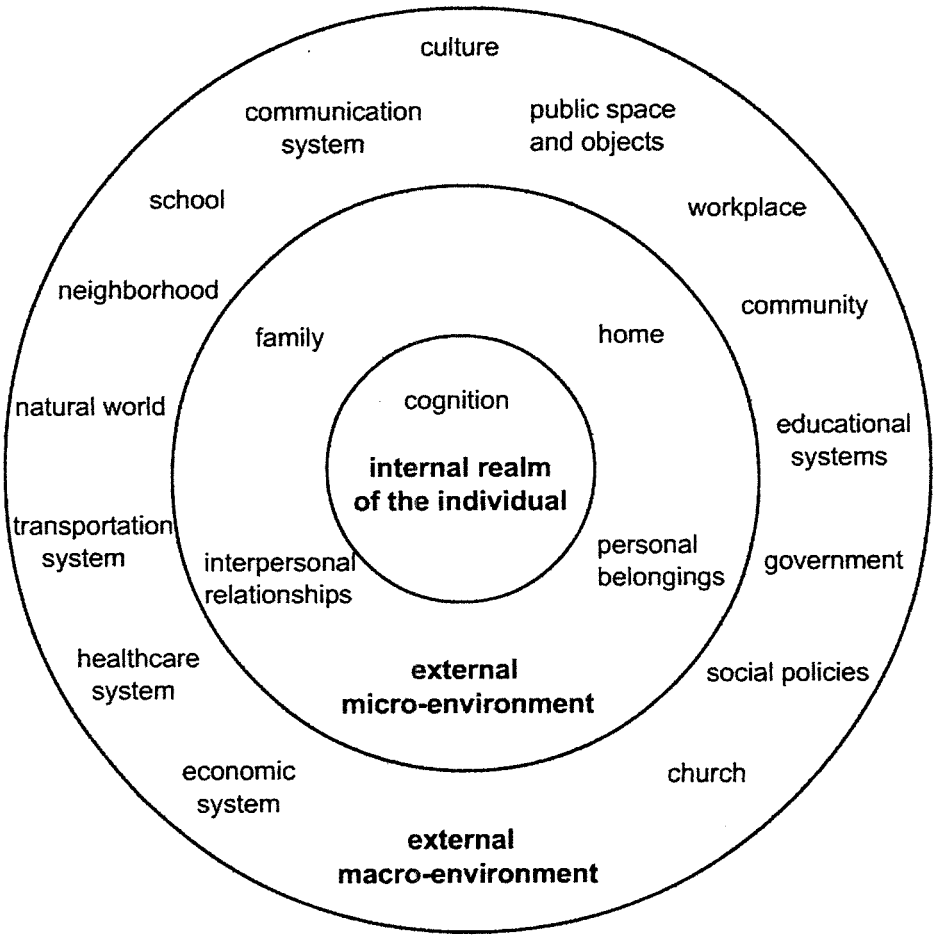


Figure 3.5: an individual's detailed contextual environment (Westney et al. 1988)

The external micro-environment is closest to the individual (*e.g.,* parents, friends, clothing, and place of residence) and the external macro-environment is at a greater distance and includes society and culture (*e.g.,* particular community group(s) or sub-groups such as school, neighborhood, church). Westney *et al.'s* model identifies specific details of each environment, which are itemized as a series of nouns including people (*e.g.,* family), places (*e.g.,* workplace), things (*e.g.,* personal belongings), and by experiences (*e.g.,* travel, recreation) and sociocultural systems (*e.g.,* economic and educational systems). Even though Westney *et al.* identify relatively strict boundaries between the internal, external, micro and macro they state that *the development of human beings is dependent on human interaction and the reciprocal relationships of the individual with persons in the family, neighborhood and community* (Westney *et al.* 1988:133). It is the notion that people are naturally affected by and affect their environment through interaction and the notion of holism that provide some basic guidelines to pin point the nature of the references. That is, the nouns, experiences and sociocultural systems shown in Westney

et al.'s model provide some of the basic categories within the design process milieu model presented in section 3.4.1 later in this chapter.

Three models are identified in this section include Bronfenbrenner's on social ecology, Hinde's on interaction and Westney *et al.*'s on human ecology. Each represent movement towards understanding concepts related to interconnectedness, the complexity of interaction between people and their sociocultural contexts. The first two models are devoid of specific details, therefore, of the three models, Westney *et al.*'s is more congruent with the approach adopted for this research. That is, the human ecology model informs the practical model created for this research primarily due to the major tenets of the approach; however, because the external environments are defined generically and not specifically for design it is not useful in totality (*e.g.,* the focus of the research herein is about the effects of the sociocultural on designers where their micro-environment is the design studio). The approach taken in this research is, therefore, based on the concepts outlined in this section including: integration of knowledge, the interconnectedness of environments, and the complexity of interaction between people and their environments all within the context of design.

3.3.2 Inside-outside culture

The notion of inside-outside theory is common to anthropology and is suggested in the Westney *et al.* model where there are internal (inside) and external (inside) realms of an individual and where 'inside' cultures (environments) affect and are affected by individuals. The human ecology model embodies the two levels of inside-outside theory including one that relates to the individual and the second are relationships to the sociocultural environments. In anthropology the terms emic and etic are used to describe the ideas of inside or within (emic) and outside or outwith (etic). The origins of emic and etic vary from what they mean today. Linguistic anthropologist Kenneth Pike (1954) created these terms. He parallels the notion that language sound systems can be studied from two perspectives and suggested that a society's cultural system can also be studied from two perspectives: the inside and the outside. What is particularly interesting about Pike's theory on inside and outside perspectives is that, by looking at things this way, descriptions and comparisons are possible. On the most part, research into design has involved an emic or inside approach. This is shown in the literature in chapter 2 where very few researchers look beyond the boundaries of the designer let alone the design scenario.

The first way to define inside-outside is shown in Westney *et al.*'s distinction between the internal (inside) and external (outside) realms of an individual. Geertz (2000) discusses the

research community's preoccupation with the psychology and the mind (internal) as the *cognitive revolution* (*ibid* 188). He indicates that by the late 1950s:

> *... bringing the mind back in* created a *whole generation of psychologists, linguists, brain modelers, ethnologist, and computer scientists* (*ibid*).

In this statement Geertz suggests that there has been an emphasis on a certain kind of research. This emphasis has been on the internal world of the individual. The research undertaken in this project moves towards looking outside of the internal realm of the designer and beyond. However, the outside forces are accessed through the *references to* internal world of the individual (*i.e.,* memories and experiences). Westney *et al.'s* model shows the range of things outside of design including the interactions with the sociocultural environment such as family.

The second definition of inside-outside theory is the more common one in anthropology. This refers to the individual's orientation to a culture or sociocultural environment. Wolcott (1999) explains that orientation is about having a relationship to culture and that this does not necessarily entail membership in that culture. The distinction between inside and outside are described by Bauman (1999:xxiii):

> *The 'here' versus 'out there', 'near' versus 'far away' oppositions, and so also the opposition between 'inside' and 'outside', recorded the degree of taming, domestication and familiarity of various (human as much as non-human) fragments of the surrounding world.*

In this statement Bauman describes the notion of something being close or further away, tame or wild, familiar or exotic. Bauman continues to describe the idea of inside by stating (*ibid*):

> *'Inside' is an extrapolation of 'being at home', treading familiar ground, known to the point of self-evidence or even invisibility. 'Inside' entails humans and things seen, met, dealt or interacted with daily, intertwined with habitual routine and day-to-day activities.*

An inside culture includes all those activities that are typically taken for granted within a specific sociocultural environment. For example, designers take for granted that they work in a studio environment and that creativity and problem solving are inherent to designing. A specific inside culture is defined as being any (sub)culture that is defined by a group of people. For example, a family group may have a culture very different from another despite similarities in ethnicity or their geographical orientation. Cultures and subcultures exist on small and large scales; for example, there is the culture of western civilization and then the subculture of skateboarders. Those things that are inside a culture are dominant over those that come from the outside. This is basic to human nature because the majority of people wish to remain stable and on familiar ground, therefore they adhere to the things that are inside or acceptable to the group. One of the

basic definitions of culture is that there are day-to-day rituals and interactions that take place (inside) and these dominate over random acts. For example in any learning environment this is emphasized by the student's desire to do well and learn, and to be accepted and respected by the group and their instructor.

Finally, when anthropologists study a culture they consider the inside-outside relationship from the position of how their own culture relates to the one being studied. This falls under the second definition of inside-outside theory in that it is about an orientation to a sociocultural environment (researcher to 'other' in this case). Therefore when engaging in a fieldstudy the perspective of the researcher is typically from the 'outside' focusing on the 'inside' of another culture. For example, the primary researcher in the studies presented here is a design practitioner but not a member of either group studied. This researcher is, therefore, simultaneously an insider and an outsider (*i.e.,* universal insider, local outsider).

In this research, design is investigated by comparing what is considered to be inside design (*e.g.,* design processes, problem solving, studio culture) with what is outside (*i.e.,* broader social and cultural context). There is no doubt that some of the things inside design may be new to certain individuals especially those who are in the early stages of learning. However, these inside things are relatively easily defined. For example, there may be some things that are common or universal to most design situations and other things that are local to a particular group. In order to investigate what is outside design, it is necessary to fully comprehend what is inside the culture of design, the inside environments of each field study are detailed in chapter 5.

The theory of inside-outside culture is a distinctive way to view the design process. In this way, the design process is investigated more broadly so as to include references to things beyond design that contribute in some way to the process of artefact creation. These outside things are best captured through references to an individual's cultural capital, as described in the next section.

3.3.3 Cultural capital

Pierre Bourdieu's work on cultural capital examines the depth of holistic environments by looking at the individual, interaction and the sociocultural environments through an integrative theory of capital, field and habitus. Bourdieu is a French sociologist and educationalist whose research is centred on the relationship between social power and the use of cultural products by different groups. Bourdieu's work, from both the theoretical and methodological point of view, maintains sociality at the core and is about

how the co-ordination of social activity is achieved (Calhoun 1993:74). Bourdieu's central questions are: who consumes what type of culture? And what are the effects of this consumption? In his work he uses the idea of *capital* to illustrate his point. Capital to Bourdieu can be used beyond the typical economic connotation, as a metaphor to explain his ideas. Although Bourdieu's work is predominantly concerned with class and inequality (Moran 2002:71) he is also concerned to a lesser degree with cultural production. Bourdieu's book, *Distinctions* (1984), is a good example of his complex and thorough research process. In *Distinctions* Bourdieu mentions over 50 separate studies, but focuses on his own empirical research that includes in-depth surveys that took place over a five-year period. *Distinctions* is divided into two parts: the first describing his research project and the second containing his analyses of the materials. Bourdieu's work is said to be a holistic portrait of French sociocultural life (Pressler 1985:75). In his book *Distinctions,* Bourdieu's theme is about consumption and status where he demonstrates how cultural tastes, values and hierarchies are established. Although parts of Bourdieu's work do not directly relate to this study, the three theories that make up the body of his work do; these include capital, field, and habitus.

The term capital has been used for a long period of time in the economic contexts, but has only relatively recently been used in the sociological context (*e.g.,* social capital). Bourdieu expands on the meaning of capital in his work to include a more encompassing list: economic, cultural, educational, social, symbolic and honorific (*ibid*). On a basic level, capital is defined as an individual's ability to exercise control over one's own future or that of another. Capital is necessary for people to move up the social ladder therefore it is a form of power. Bourdieu elaborates on two forms of capital, the material and the immaterial. The material form of capital is economic; and the immaterial can be cultural, symbolic or social (Bourdieu 1987). According to Bourdieu, it is difficult to convert the immaterial to the material (*ibid*). For the purpose of this research three types of capital are presented here in order to understand the idea of cultural capital.

According to Bourdieu (1984):

- economic capital is that which is immediately convertible into money;
- social capital involves social connectedness related to group membership;
- and cultural capital covers the resources used to improve social status, including educational credentials.

Economic capital is easily understood because it relates to the conventional definition that involves money and marketable commodities (Pressler 1985:75). Social capital involves the relationships and interactions that occur within social groups. In short, social capital is about the quality of relationships between people (Halpern 2001:373). It is known that

when individuals are supported socially, they achieve a great deal more (*ibid* 374). This concept has been explored by Ashton (2001; Ashton & Durling 2000) who focuses on design education and social capital, as indicated in chapter 2. Cultural capital is considered to be the most influential type of capital and relates to exposure to things that are considered to be cultural such as art, artefacts, music, and more. Cultural capital is linked to educational capital because the exposure, knowledge and values of culture are taught at schools, universities and colleges. However, cultural capital is not only acquired in an educational setting it is also the result of living in the world. According to Bourdieu, capital is seen as a resource — a wealth that can be used as power. People have less or more amounts of capital, which allows them less or more power in relation to other individuals.

Bourdieu's notion of field is seen as the basic organizing element in social life. The difference between this notion and other sociologists' idea of *social field* is that Bourdieu believes the field to be driven by the struggle for different capital (*e.g.,* economic, cultural) among individuals. For example, he believes that the field of cultural production is specifically concerned with the market for cultural capital (Bourdieu 1993). This is a reasonable statement since the field of design is clearly linked to industry, market and sales. Furthermore, the field of design is semi-autonomous, like all fields, and has its own accumulation of history and capital. Some of the capital of the field of design is described in appendix I, chapters 1 and 2. Bourdieu describes social-cultural field as an accumulated history that can be transmitted at a later date (Calhoun 1993:67), which is a basic hypothesis in the research in this thesis. Furthermore, the meaning and value of cultural artefacts are relative to the context in which they are placed and cultural products are a product of their field (Bourdieu 1984). Therefore, by understanding the field of design it becomes clear how the capital of design plays out in tandem with the capital of the individuals involved in that field. In the two studies herein the struggle among the individuals' is evidenced through a desire to perform well while designing a project for the instructor.

Habitus is the social environment that may be considered synonymous with what anthropologists called culture. The notion of culture has been described in detail in chapter 1. Specifically Bourdieu relays the notion of habitus as the disposition people acquire through life-long processes of learning and socialization (Edgar & Sedgwick 2002:30) and these are inherited just as children are said to *inherit their environments* (Tomasello 1999:79). These processes are not reducible to a known set of rules governing social behavior. Habitus involves *the feel for how to proceed in a situation*

(Edgar & Sedgwick 2002:30). According to Bourdieu, habitus is a system that integrates past experiences and functions as a matrix of perceptions and actions (Calhoun 1993:75). Where habitus differs from culture is that it is not limited to particular groups of people. That is, Bourdieu believes that there is a habitus for different hierarchical constructs in society such as the habitus of capitalism (Denning 2004:86). Within the habitus of capitalism simple choices in food, clothing and transportation become badges of distinction. Habitus is, therefore, knowledge and dispositions that are embodied through the non-discursive and practical aspects of everyday life (Hodder 1998: 70). The individual's relations with habitus are incalculable because people will encounter numerous different types of habitus throughout their lives. It is through interactions with habitus that capital is formed thus capital is the product of habitus.

Although Bourdieu's primary aim is to explore issues relative to class domination and class conflict (Denning 2004:106) and to provide people with a clearer understanding of their situation that will allow them to reflect and be emancipated from class systems, his secondary work on theories of cultural production is relevant to the work described in this thesis. The idea of cultural capital is particularly valuable, because it provides a forum to discuss the knowledge that is inherent to a designer (or according to Bourdieu, to everyone). Cultural capital is considered to be an individual's accumulation of cultural knowledge through education and life experiences, but also the over-riding cultural capital of the field of design. Consequently, cultural capital acts on two levels, the level of the individual and the level of design. In addition, Bourdieu acknowledges that individuals inherit habitus that will be enacted through their actions. Central to Bourdieu's argument on cultural production is that the artistic field of production is inseparable from the social forces of field and habitus (LiPuma 1993:18) meaning that individuals are enacting the knowledge and values of culture while designing an artefact.

Although sociological questions are at the core of Bourdieu's theories, he presents a holistic approach towards understanding these questions. Bourdieu's theories of capital, field and habitus enable a clearer understanding of the references made during the design of an artefact by providing a basis for creating categories and a model to interpret the data from the two empirical studies discussed in this thesis.

Three central issues relating to the sociocultural environment have been presented in this section. As previously noted, these theories act as guiding principles to understanding the relationship between individuals and the sociocultural environment by providing an holistic approach to investigating the design process. Theories about holism, inside-outside culture and cultural capital are integrated in order to inform the model presented in the

following section. The holistic nature of this approach considers the design student's understanding of their work as dynamic, interconnected, complex and interdisciplinary and enables subsequent organic analyses of data.

3.4 References and the design environment

The notion of holism is a central concept in anthropology; and as illustrated previously, anthropologists seek to understand the make-up of groups of individuals and are not concerned with the individual from an internal perspective (*i.e.,* cognitive) independent from the external (*e.g.,* sociocultural context). It is recognized that all individuals have a great deal of knowledge and understanding from their internal perspectives; however, it is the observable interactions among individuals that are the focus of anthropological studies. Cultural anthropologists work towards discovering patterns and meanings in these observable interactions. Theories deem this possible by indicating that all people read and maintain texts about their culture(s) at all times. Geertz describes these texts as a collection of symbols made up of words, gestures, drawings, natural objects, human-made artefacts and more (Robbins 2001); and Bourdieu illustrates this through the notion of cultural capital. These texts are referenced throughout all interactions and reflect the social, physical and cultural environments of people. In order to decipher and understand cultural texts, researchers look for patterns and meaning through the use of categories. Categories are specific to each context and sometimes even each research project.

Categories are thematic representations, and in this case, ones that help to define the source of the references. For example, categories of a tangible references are those that relate directly to something 'inside' design, therefore it is important to understand the nature of the inside sociocultural environment. Some of the general categories are discussed in this section, while detailed findings are presented in chapter 6. Categories are broad themes that are connectable to specific references to things, events and experiences. The categories used in this research have evolved by looking for patterns and themes in notes and transcripts, and are informed by the literature reviews on design culture, studio culture, industrial design (chapter 1), design in the studio environment, the act of designing (chapter 2) and the theories presented earlier in this chapter.

This section focuses on the design environment described through the framework developed for focused observation and analysis. In addition it also illustrates how the practical framework for investigating the nature of the references is linked to its theoretical underpinnings. The first subsection details the model developed from and for this research that includes eight general sociocultural environments presented here as categories. These include eight interconnected environments: inside, outside, local,

universal, inside-local, inside-universal, outside-local, and outside-universal. The second subsection illustrates specific reference indicators within each quadrant of the sociocultural environments. These aid in mapping the references into the sociocultural environments, which is described in the third subsection. In this way, this section introduces the design process milieu model and how it is applied in this research.

3.4.1 Design process milieu model

The design process milieu model is developed and used in this research as a generic guideline to begin to understand and identify the nature of the references made while designing. It has been outlined that references are linked to the designers' personal experiences (*i.e.,* influences from the external environments), which are encapsulated in their internal world (*i.e.,* memories). Before more specific categories are discovered and created, it is useful to have a generic model. Depending on the research question, the generic model may be very specific or more all encompassing. For example, if the anthropologist is specifically interested in kinship and family relations he or she may look at the roles of sexuality, love and wealth; the structures and dynamics of family life; and the forces that threaten the family unit (Robbins 2001:148). This example illustrates that although the details of a specific culture may be relatively unknown, a general feel for where the research might be going is established at the onset. Models in anthropology are notoriously fluid and provide simple guidelines that are used as a starting point.

The starting point in this research is to describe the framework that allows focused observation and analyses of empirical data with a focus on the sociocultural processes of design. This framework includes eight interconnected environments that are directly related to the notions of inside-outside theories and Westney *et al.*'s human ecology theory. The terminology relative to inside-outside theory is used in the model presented here, whereas only the general concepts relating to interconnectedness and holism are relatable from the human ecology model. For example, it is clear that the design environment encompasses a part that includes information that is 'inside' (*e.g.,* taught, relevant to task at hand) and a part that includes information that is from the 'outside' (*e.g.,* individual personal and sociocultural context). As previously identified Westney *et al.* define the individual as having two external environments, the micro and the macro. For the purpose of this research these do not provide adequate levels of distinction between the environments that the designer is involved with and / or may draw upon while designing. In Westney *et al.*'s model the inside is not distinguished from the outside; for instance, school (*e.g.,* university), culture (*e.g.,* studio culture, design culture), community (*e.g.,* student colleagues) and educational system (*e.g.,* ideology of the programme,

instructors, design school, university) are within the external macro-environment and interpersonal relationships are within the external micro-environment, yet on the most part these are considered to be part of the inside in this research.

Figure 3.6 displays the model of the design process milieu that is developed and used in this research. The model has eight permutations of environments including four basic levels (inside, outside, local, universal); and four combined levels (inside-local, outside-local, inside-universal, outside-universal).

Figure 3.6: model of the design process milieu

The individual's orientation to culture, specifically inside-outside theory as identified in subsection 3.3.2 is applied to this model. The inside and outside environments relate to the closeness of the activities and references that occur while designing. The inside, as previously described, is specifically relevant to design and designing and includes that which is self-evident, routine and taken for granted. The outside is all the remaining activities and references that are random or unusual compared to the inside.

Westney *et al.*'s model and general theories on sociocultural environments and holism have informed the other six levels of the design process milieu model. The local and universal begin to define an individual's relationship to the environment / culture by considering the relative closeness to that environment. This relationship is one that does not relate to how influenced an individual may be, but simply defines an association. The local environment is that which is closest to the individuals. Each individual's local environment has some things in common with other people and some things that are very different. For example, in each field study the students have their studio culture in common but different personal histories (*i.e.,* memories and experiences). The universal environment is that which is not in the immediate environment of an individual but nonetheless has an impact on them. The universal environment is more generic because it is far reaching and affects larger groups of people. For example, in the design community there is a large body of information about design that is impossible to teach in an entire programme let alone in one module. The universal environment or design culture is the broad notion of design that includes information that is disseminated through journals, books, and media.

The final four levels of culture are represented by the individual quadrants; these are inside-local, inside-universal, outside-local and outside-universal. These are best described by using the field studies in this research as examples. The inside-local environment is predominantly defined by the instructor(s) within the studio and design school. Most actions and references are connected to explicitly taught information that typically relates to the design brief, the studio or the school. Naturally a design brief is defined by the module[1] it is taught within; for instance, the module for one field study was called 'user-centred design' and for the second study the module was 'design studio' — the first involved instruction in the area of user-centred design, whereas the second had an implicit approach assuming that students would naturally place the user at the forefront of their project. In this example, the references to *user-centred design* are considered to be inside-local for the first study, whereas they are inside-universal for the second. This is because in one situation user-centred design was a local focus, whereas in the other it was not.

The inside-universal environment is specifically related to design and design culture, yet are those things that are not taught explicitly. The students gather design specific information that sometimes relates directly to their project and sometimes does not. They

[1] The term *module* is used synonymously with the North American term *course* and is defined as a single unit taken on a specific topic (e.g., material and manufacture, design studio, introduction to psychology). Typically a module is taught by one or two instructors. The term *module* is used to avoid confusion because the term *course* in the United Kingdom is synonymous with the North American term *programme* (*e.g.,* BA or BSc).

may, for example, get this information from other students or other instructors, or they may go to the library or the internet. Examples of references to the inside-universal environment made by the participants in the studies include design icons such as the *Eiffel Tower*, Marcel Breuer's tubular chrome *Wassily* chair, and Karim Rashid's *Garbo* rubbish bin. These design icons are typically defined as being culture with a capital "C". Other inside-universal references include discussions about the generic design process, philosophical questions around design or the notion of creativity in design. Both inside-local and inside-universal references are those references that relate directly to design content.

All outside references, whether local or universal, are connected to an individual's experiences and memories of events, people, places and objects. These memories and experiences may have occurred recently (*e.g.,* a night out dancing on the weekend) or sometime in the near or far past (*e.g.,* a trip the previous year, a birthday party when the participant was five). The outside references are not judged as having more or less influence on the individuals designing; however, by nature they are typically less relevant to the task at hand. References to the outside environment are often the way that students make sense of the work they are doing because these are the things that are part of their personal cultural capital. Therefore, the outside-local references are subjective and idiosyncratic. For example, they may include a specific childhood memory about learning to ride a bicycle or a visit to the museum on the weekend. Outside-universal references are connected to the broader sociocultural network, such as references to a particular religion or to a Hollywood movie. Some outside references may be both local and universal, meaning that these are simply 'outside' references. For example, the reference to a visit to the museum may be very personal, but it also relates to a broader cultural event. It is not always necessary to identify the exact nature of a reference, because in many cases it is enough to identify them as relating to either the inside or outside environments.

Finally, the design process milieu model is designed to be dynamic in two ways. The first way is that it must have flexibility to be used with many different field studies. For instance, what is described as an inside-local reference in one design environment may be an inside-universal reference in another design environment. By having flexibility any design environment, culture or subculture is interpretable through the model. For example, by using the design process milieu model any inside culture can be identified by looking at the overall references made over an extended period of time. The second way is that it is necessary for the model to accommodate definition shifts within the field

studies. For example, once a reference is made, it naturally becomes part of the inside-local environment especially if it is (re)used by other group members. This means that a reference may initially refer to the outside environment but moves to the inside because it is part of the inside-local culture. In this way the model of the design process milieu allows to account for the subjective, ambiguous aspects of the individuals within groups and also the subjective, ambiguous aspects of different groups.

On the most part the design research community has not explored things outside of the design environment. This neglect is one of the key aspects of research in this thesis. This subsection presents a model called the design process milieu that acts as a framework to begin to understand the breadth and levels of the sociocultural environments designers are engaged with. The details of the categories of this model and how it is related to the theories presented in section 3.3 are also identified. The following subsection identifies specific indicators for the four main quadrants: inside-local, inside-universal, outside-local and outside-universal.

3.4.2 Reference indicators

Eight general categories with four main ones (sociocultural environments) for identifying the reference types are presented in the previous subsection. Yet in order to map the references to the categories, it is necessary to identify specific indicators that direct us towards understanding the nature of references. Indicators are created that relate to the four main quadrants of the design process milieu model. These indicators may be combined in order to identify the indicators for the other four sociocultural levels.

The indicators for each quadrant are established by examining the theories presented earlier in this chapter, through extensive literature reviews on design and through engaging with the data resulting from the field studies in an iterative way. For example, indicators for the inside-local environment are relative to the design project, the design module, the specific studio, and the design school. Therefore it is necessary to have an intimate understanding of the details of this environment, which is accomplished through immersion in the local culture. As previously noted the nuances of the inside-local environment are those things that are routine, habitual and taken for granted by the group, therefore, these are not often easily identified by a group. For this reason it is the outsider who is best able to identify the nature of an inside-local environment. Chapter 5 describes the inside-local environment of each group of participants involved in this research. Indicators of references from this category include all things (*e.g.,* artefacts, places, people) related to the design brief, all interpersonal interactions and relationships relative to the school, and all previous projects and work completed at the school.

Figure 3.7 shows the indicators within each quadrant in the model of the design process milieu.

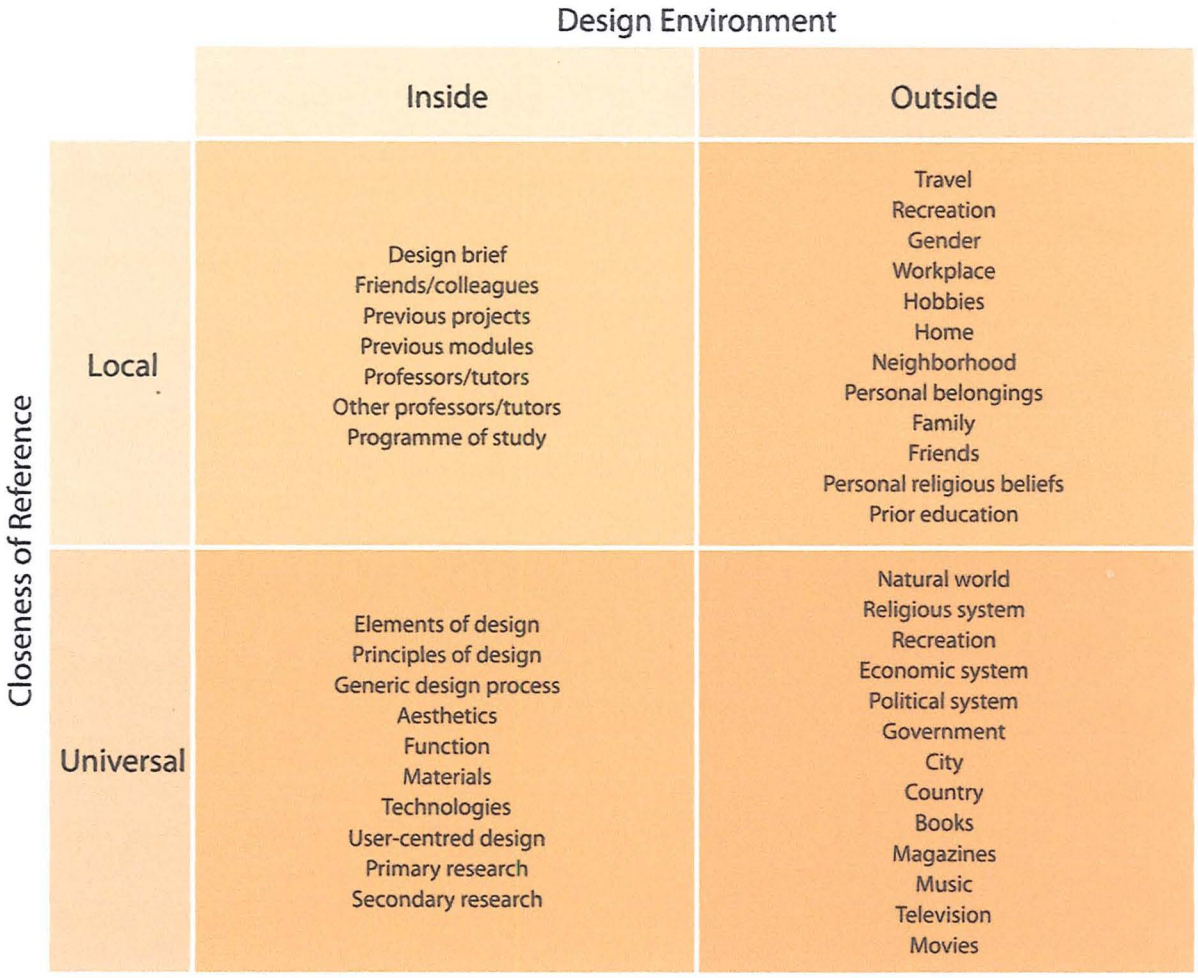


Figure 3.7: indicators within the design process milieu

The indicators within the inside-universal category are defined through literature reviewed on design education in the studio environment and the act of designing (chapter 2) and by comparing the information about design discussed in each inside-local environment. For example, there are many books written about design methods, design processes, the elements and principles of design, material selection and manufacturing methods, and user-centred design. Although there are likely many more indicators that point to the inside-universal environment the ones detailed here are identified by the two groups involved in the field studies undertaken in this research. It is important to emphasize once again the flexibility and therefore dynamic nature of the design process milieu model. That is, user-centred design (shown as an indicator for inside-universal) is an inside-universal indicator for one study and an inside-local for the other.

The indicators for the outside references are defined through the categories in Westney *et al.'s* human ecology model and through the data resulting from the field studies. For example, some of the indicators in the outside-local environment are found in the external

micro-environment in the human ecology model. These include the relationships with family and friends, and places and things the individual interacts with on a regular basis (*i.e.,* home, personal belongings, interpersonal relationships). In addition, some of the outside-universal indicators correspond with the external macro-environment of the human ecology model (*i.e.,* natural world, religious system, economic system, political system, government, communication system). Although the indicators in the outside-local and outside-universal categories are not identical to those in the human ecology model, they have one key characteristic in common — the indicators are all nouns, experiences and sociocultural systems. It is important to note that the indicators that include people, places and things in the design process milieu model are predominantly the result of the references made by participants in the two studies of this research. In general, outside-local indicators relate to those things that are in the individual's immediate environment, whereas outside-universal indicators are those that correspond with a broader sociocultural context. For example, an individual may be personally engaged in recreation (locally) but certain types of recreation may be outside-universal because of the value that is carried through the general culture, for instance, football and rugby are part of UK culture and hockey is part of Canadian culture. All mass media is considered to be outside-universal because these are generally understood to be part of popular culture and are common to western civilization in general.

The indicators for the four main quadrants (categories) are identified in this subsection to aid in mapping the participants' references from the field studies. These indicators relate directly to the two design cultures having been derived from them; however, the categories are generalisable to any design environment. The indicators are much like Schön's normative design domains (1985:45) about the inside of the architectural design studio. In Schön's research he identifies differences (nuances) in language between design schools because there are diverse frames of references (*ibid* 50). As previously indicated, there are subjective ambiguities between design schools and therefore between different groups of designers. Hence, the indicators in this research are presented as guidelines to aid in identifying the nature of the references.

3.4.3 Mapping the references to the sociocultural environments

The previous two subsections illustrate how the design process milieu model is developed based on well-known theories in anthropology and social psychology. The design process milieu model includes a framework and indicators for references made by participants that aid in focusing on sociocultural patterns by delineating between those things that are being referenced from the inside, outside, local and universal

environments. Data processing and the multiple analyses techniques are described in detail in the next chapter; however, prior to this it is necessary to illustrate through examples how the references are mapped to the indicators and categories in the model. This and the following subsection provide details on how to use the model and what can be expected through its use.

Content morphemes are used to deconstruct the participants' discussions into references. A content morpheme carries the meaning and intent of a discussion, which is essential to determining the nature of the references. For the purpose of this research three categories of content morphemes are used. These three categories are words or phrases that are:

1. nouns,
2. used as metaphors and analogies,
3. and /or linked to personal experiences and memories.

Words or short phrases that fit these three categories are taken from the word-for-word transcription where they are assessed for their content. Visual imagery and textual information is described in as few words as possible so that these are mapped along with the verbal references. For both field studies the majority of the references are verbal, followed by the visual, with very few textual references. This fits with the studio style of teaching where there is a great deal of discussion around visualized design work. The content morphemes of all participants and the instructors directly involved in the discussions (*i.e.,* UK instructor, CAN primary and support instructors) are mapped out as clusters in chronological order (as illustrated in chapter 4).

The most effective way to illustrate how to map the references to the sociocultural environments is through the transcripts and still photographs as a result of the two ethnographically oriented field studies. The transcript excerpts and still photographs that follow are randomly chosen but represent different designing scenarios (*e.g.,* desk critiques, group discussions, interviews), different stages of the design process (as presented in figure 3.1 earlier in this chapter) and represent a range of participants from each study.

Transcript excerpt 3.1 is from week 1 of the Canadian study. The primary instructor (PI) has just introduced the new design brief to create sports eyewear. He is leading a discussion that is clarifying the guidelines and objectives of the project.

CAN2: These particular sports, do we have to stick with them?

PI: Yah. Well windsurfing is on there. But we can add surfing. If you would like to add a sport then come and talk to me about it but I would like to stick as closely to the sport as possible.

CAN8: How about kayaking.

CAN5: There is sailing.

CAN8: I guess I have had experience with kayaking and you cant wear contact lenses and you need specialized eyewear. If you're under water and you open your eyes they float off and then…

PI: I used to have a buddy who played water polo and he used to have to suck out all the liquid and get a suction with the contact lens or something.

CAN8: You can get full eyewear that tucks underneath your eyes.

—Overlapped talking—

PI: Kayaking is good. If you want to do kayaking that is great.

CAN7: Water sports are interesting because you don't have much. You don't wear them when you are surfing because there are problems with reflection off the water.

CAN8: When you go under the water when you are kayaking in the Kananaskis the water is glacier fed and when you come up they fog up because they get cold instantaneously.

Excerpt 3.1: Canadian group clarifying their design brief through discussion

In the transcripts the content morphemes are highlighted and identified as nouns (green), memories / experiences (yellow) and analogies / metaphors (red). In this case there are references that are nouns and memories / experiences. Furthermore, in this excerpt the majority of the references relate to the design brief (sports and sporting experiences, eyewear); however, some references link to personal experiences outside of design. For example CAN8 discusses his personal experiences as someone who needs special eyewear for kayaking (he wears glasses), an event including his own lenses fogging up (he kayaks), and a specific place he has kayaked (a local river). In doing this, he makes reference to experiences and things outside of the design environment including recreation (specifically kayaking a sport not on the original list provided by the instructor), place (Kananaskis river located outside of the city he lives in), event (fogging glasses / goggles due to temperature variations) and the natural world (a general reference to glaciers, not common to the region). All these are considered outside-local references with the exception to the one to the natural world (glacier), which is categorized as outside-universal because of its generic nature. It is interesting to note that the primary instructor also makes a reference to his own memories / experiences by discussing his "buddy" who plays water polo.

Transcript excerpt 3.2 is from week 1 of the UK study. Having handed out the design brief to create an airline meal tray the previous week the instructor (I) is doing desk critiques with individual students about their perceptions of the project. Participant UK1 is

clarifying the objectives of the project by showing the instructor some early research and his preliminary sketches.

UK1: I have been doing some research. I took this book out of the library on Finish design. And here ... some sketches.

I: What were you hoping to achieve by looking through this?

UK1: Somewhere to start for shape and form. Elegant. Simplistic. Something that shows quality. Looking at this [pointing to an image in a book]. Incorporating this [pointing to image] sort of thing with contours.

I: Something organic.

UK1: Also went to see.... downstairs. To make [a] steel tray for [this] meal tray. Come as soon as possible to make it. I want to use something for a base and then cover it. That would be the main structure [indicating a sketch].

I: So what you are saying is that there will be a polymer coating on top?

UK1: So this other one is with sort of holes and bits to set a dish in [sketch showing divets].

I: is this just a single sheet then?[pointing to a different sketch with a fold in the tray]

UK1: Yah, to set things in ... and try to incorporate the 'V' for virgin. Graphics. Things set in. Then this one is about form. All ... have this idea from this [pointing to image from book]. The tray would look like these things got a move. Then this one ... [pointing to sketches].

I: Very good start here. It's encouraging. You essentially take it to the point but you haven't considered the actual user. How about the people that are using it? From a development point of view. And the people creating the meals. The airline meals. Producing that. Move that onto the stewardesses and the users. Most people eat them. We know that experience. We need to look a bit broader. Focused user. We need to do that as a group. The different ideas you've got here are great. The use of form and the 'V' section. At this stage this is really good. So what are you intending to do next?

Excerpt 3.2: UK instructor and UK1 discuss research and early concepts in a desk critique

The content morphemes highlighted here are all nouns. In this excerpt all the references are to the inside environment because these are focused on different aspects of the project. For example, there are references to research (library, books), visualization (sketches), user-centred design (people, stewardess) and the design brief (airline meals, 'V' for Virgin), which fall under the inside-local. Other inside references are those to industrial design including materials and manufacturing processes (polymer coating, structure) and the elements and principles of design (shape, graphics, elegance, contours, image), which fall under the inside-universal.

Transcript excerpt 3.3 is from week 3 of the Canadian study. In week 2 the group engaged in desk critiques and a formal intermediate critique where they defined the direction of their projects with a positioning statement and research on their user group (demographics). During the current week the students are preparing for another formal intermediate critique where they are expected to present twenty concept variations. The

primary instructor (PI) and support instructor (SI) are conducting a desk critiques with CAN5 to aid in concept development and to prepare for the upcoming formal critique.

CAN5: I wish I had that for my design brief. It sums up what I am trying to say… making my product (gesturing) say that rather than the person saying that. If they are on the line then they have to be paying attention to the track [talking about the mountain bike user]. It takes some mental effort to try to play mind games and try to throw your opponent off. If you can do that by simply by what you wearing you are then able to put all mental activity into getting down the track.

SI: You are making head gear goggles for the 21st century black knight.

CAN5: Yah sure.

PI: A lot of that gear is black.

SI: Sure, you want the gear to be intimidating. Frightening.

CAN5: Yah, you see this guy and they are intimidated. They talk about anger in this book. There are many sources of anger and what they lead to. If the source of our anger is frustration then we attempt to remove the obstacle the next one is the physical threat. Which is what I am looking at. If the person is smaller than us then we can take them. We don't feel anger, we just feel contempt. There is this big dog and he's just yapping at your feet. If we perceive them to be more powerful then we feel fear. If we perceive them to be our equal then we feel a mixture of anger and fear [user].

PI: Uncertainty.

CAN5: Yah, the idea here is that if they look at me and see a physical threat. Then they are going to fearful and that will throw them off [user].

SI: So you want to portray contempt. You want them to…. by looking at what they are wearing you want them to feel contempt [user].

CAN5: So not only does it make you feel fearful it makes me feel more powerful [user].

SI: Right. Very sadomasochistic.

CAN5: You've always gotta pull in the sadomasochism.

—Laughing—

PI: One thing I would like to suggest especially when you are going through characteristics I want you to develop a visual file. Of eyes, of brow profiles and that.

CAN5: Yah.

PI: Especially by taking those and abstracting them … Japanese anime is an abstraction of design.

CAN5: I am getting to that.

PI: There is almost a cartoonist abstraction of facial characteristics that you are studying. It is taking those forms and bringing them out. It is making that step. You have found some really really good quotes. You've done some good research. You have a good foundation here. I don't have a problem with your definition of aggression [user]. You have a solid established positioning statement. Your idea of warrior for this sport… I don't have a problem with that at all. Now start to build up a catalogue of eyeball profiles.

SI: yah.

PI: You know how you see cartoonists do that all the time.

CAN5: There was a poster up here for a long time on different facial expressions.

PI: Look at Japanese animations. They have this really interesting quality on how they handle eyes and eyewear. They tend to take a look at those sorts of things. So take a look at those images so you can begin to see how they are. So you can see this lens looks really, really cool with this thing … become astute about the eyebrow and the eye relative to the lenses. So that you can see how these inform the shape of lens and you can get into that kind of visual vocabulary. I appreciate

the research and this is powerful... especially when you begin to match those things.

CAN5: I think that is where I was going next with it. Is starting to catalogue the different faces. What makes an angry face...

SI: Were you thinking of going to a comic book store?

CAN5: Like Dragon Ball-z and that?

PI: There are some really good...

—Overlapped—

PI: In Mac Hall.

Excerpt 3.3: two CAN instructors discuss concept generation with CAN5 in a desk critique

The content morphemes highlighted here are nouns and metaphors / analogies. The latter are easily pinpointed because the participants are making reference to something being 'like' something else, for example, the "black knight" refers to a historical character, the "big dog" refers to the idea that something big and loud is more aggressive than something small and is easily paralleled with the idea of more / less aggressive people, and "warrior" refers to a person with the characteristics of a fighter. Each of these are considered to fall into the 'outside' because these are references to common cultural currency or things that are understood to represent specific characteristics that are easily understood by many people. It is important to note that the use of metaphors / analogies do not always fall to the outside environment. Some metaphors / analogies are part of the inside-local environment, for instance the use of the idea of "sadomasochism" as a metaphor is something that is commonly used by the support instructor. The notion of repeated use of themes or phrases is considered part of the 'inside culture', which is discussed in more detail in chapter 5. Other references in this excerpt are easily identified as relating to the inside-local (*e.g.,* design brief, user group, the structure of the face, goggles). References to comic books and Japanese animé are relative to the outside-universal (*e.g.,* media within the public domain) and the reference to "Mac Hall" is one to the outside-local because it is a place on the university campus.

Transcript excerpt 3.4, the final example shown in this subsection, is from week 6 of the UK study. Each participant was interviewed individually at the close of each study. At this time the participants were asked to reflect on their project, progress and process. In this case the participant was asked to consider where they thought their final design idea came from and he was asked to recount this through description.

In this excerpt UK11 describes this process.

> *I think it just came from development of the idea. I knew I needed something removable for the hot food and it fit into the shape. I was exploring different ways of it coming apart and am looking at different shapes. More square now. But I came to a compromise. The final is square edges. This one is the separate compartments and it would fold around and punched out. And then it would just close like that. I am still looking at ways of how to get it to seal. Hatches and bits to break into it. This is the best idea because it didn't involve loads of different parts. It's an easy one to do. Then I looked at the form a bit more. The outside aesthetics. The meal tray and then it hasn't done that, it has loads of bits. It looked like a bird feeder, so if you can punch holes in it like that then what parts have holes and how that works. Then I was thinking about how to get the cutlery and the other bits in and that is how I came up with the quarters. That's right. Then I continued to explore the shape. This was looking at how to keep it all together and to combine it. I was looking at how it fits together and how it would work when it got washed. I still have other ideas. Like having something that would slide over. You don't have the space to do that really. It is just showing you different ways of connecting it. The way I have decided to keep it together is not in my sketchbook. It's having something like a present. That is something that came out in the video from London and it should be a gift that people should be grateful to receive. So I am looking at ribbons. It also fits in with the Japanese bento boxes. So what I have gone for is a cord that wraps around the two edges and has a hook on the end. You can hook it with the full hooks. [showing presentation boards]. I think the rest is just the details. I am using the lid of the quarters like a separate tray. And then these are the boards I had for the formal presentation. It hasn't really changed since these. It has been the way that they all connect together. This is a model in Inventor and then moved them over to VIZ 4. Then I have gone to something to talk about food. It was quite interesting. Things that you think is normal to do is considered rude (handout on chop stick etiquette) the menu from Hong Kong [from a Virgin flight] was important. The presentation I was trying to show different ways of showing the food. I came up with this way to show representations of what the food would be. I scanned it in and then used these on the images (drawings of sushi like food). I was thinking of a fun way to do it and then I worked this out. This was sketches of how to present it. That was a fun thing I decided to do. Technical drawings at the end. These are ones that I have done on the computer myself. They didn't come up that well but they say what I need them to.*

Excerpt 3.4: UK11 describes his journey towards his final artefact

Again, the content morphemes highlighted here are nouns and metaphors / analogies. The majority of the references are again focused on the inside environment. There are, for example, references that fall in the inside-local are to the design brief (*e.g.,* food, meal tray, cutlery), visualization (*e.g.,* sketches, technical drawings, model, presentation boards); and those that fall in the inside-universal are references to industrial design (*e.g.,* manufacturing processes) and elements (*i.e.,* form). Less obviously mapped are references to the "menu from Hong Kong", the "bird feeder" and the "Japanese bento box". These are all inside-local references because the menu was brought in by the instructor as a sample of graphics created for Virgin airlines and the bird feeder and bento box references were ones made by the instructor early in the study. This illustrates the point that when a reference is recycled it becomes part of the inside culture, but also that

in order to place the references properly it is important to fully understand the design environment / context of the participants making the references.

Still photographs are taken throughout each study and include photos of sketches, diagrams, research materials (books), models and more. Photographs are taken *in situ* typically while the student is discussing something with classmates, instructor(s), making presentation or during interviews. Therefore, there is always a context (verbal transcript) that accompanies the item photographed. Determining the references from still photographs is relatively straightforward because these are directly related to the content of the photo and the context that it was presented. Five still photographs are presented here to illustrate how the photo references are mapped to the sociocultural environments.

Figure 3.8 is a photograph of sketches and research completed by UK2 from week 2. At this time, the participant was engaged in concept generation. UK2's sketch with notations shows him referencing and playing with form (elements of design), exploring the principle of stacking, notating questions about the 'user', referencing high design by writing "Lovegrove, Newson, Rashid" and referencing other modules through a list of things to do.

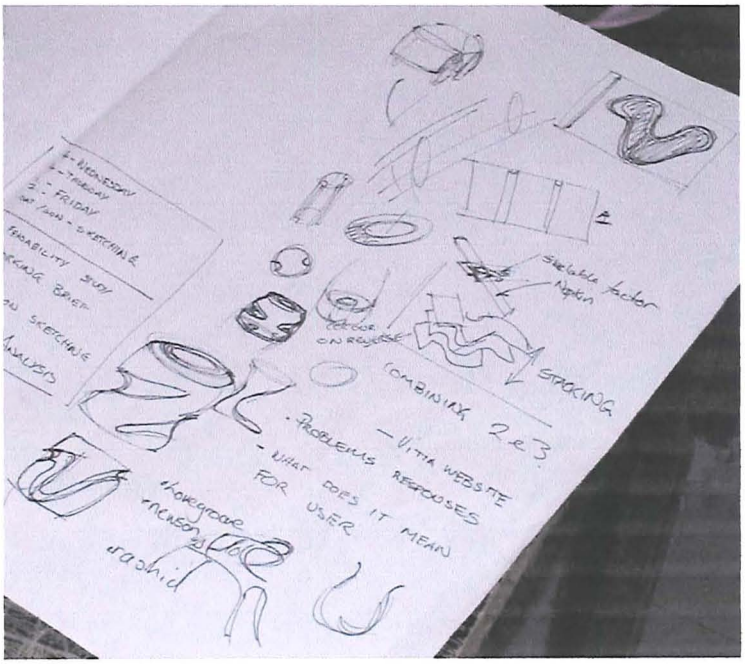


Figure 3.8: UK2's sketch with notations from week two

Figure 3.9 is a photograph of a page from CAN8's sketchbook from week 3. At this time the participant continues to clarify the objectives of the project and is involved in preliminary concept generation. This sketchbook page shows a focus on word associations with very few sketches of concepts. The word associations that CAN8 makes are to water and the equipment used for kayaking therefore the references are directly related to the design brief (the use-environment). Word associations are

considered to by highly personal and could easily be from an individual's memories and experiences, which is likely the case here; however, because the word associations here are directly linked to the chosen sport these are defined as being part of the inside-local environment.

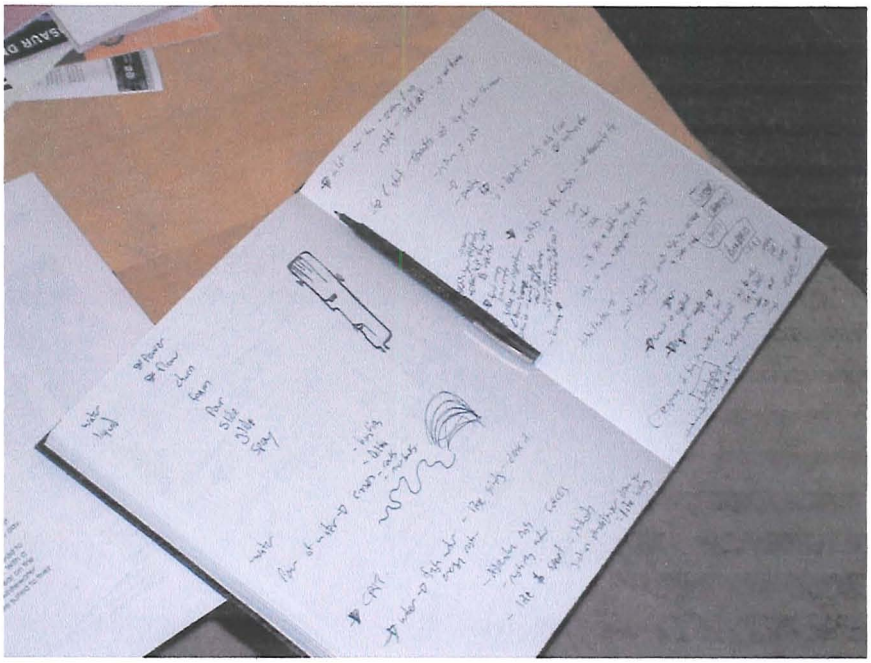


Figure 3.9: CAN8's sketchbook with word associations from week three

Figure 3.10 shows three concept sketches done by UK1 presented to the instructor on week 2. At this time, the participant was clarifying the objectives of the brief, doing research and engaged in early concept development. UK1's style of concept generation differed from others in his group, that is, he always placed images of various objects next to his sketches to create direct references to colours, materials, manufacturing techniques, and styles. The top image shows his sketch of a turntable-styled meal tray along with image references to a turntable, headphones and stainless steel products. The middle image shows a curved meal tray with references to game controllers and several colourful Allessi products. The bottom image shows a rectilinear-modular meal tray design with image references to more Allessi products, generic stainless steel products, a Rubik's cube and the word "games". References in this photograph made by UK1 include those relating to high design (Allessi, Newson) and popular culture (ordinary objects); however, all the references are considered to have been researched relating to the inside. Even so, the ordinary objects fall in to the inside-universal because these are not part of the known curriculum of design in this programme.

Figure 3.10 shows UK1's concept sketches as presented to the instructor:

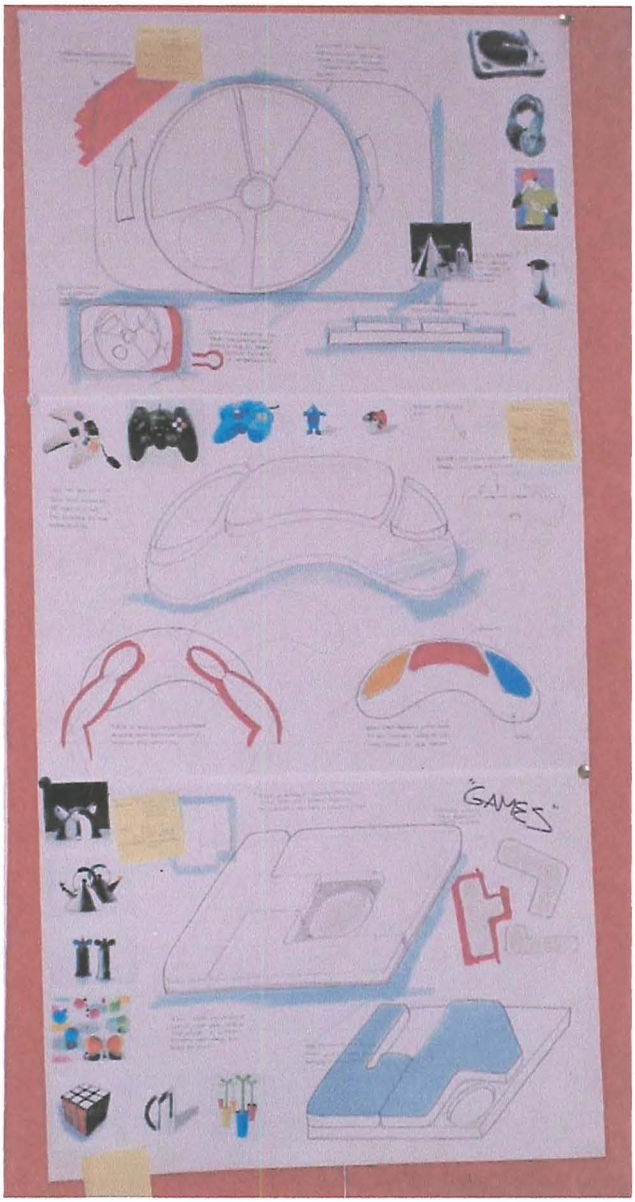


Figure 3.10: UK1's concept sketches with researched images from week two

Figure 3.11 are two different sketches from week 4 in the Canadian study. On the right shows CAN4 generating concepts and on the left shows CAN5's work area with two sketches and accompanied research. The sketches here are straightforward inside-local references representing the majority of the still photographs. That is, the sketches are simply a reference to visualization. In addition to sketches CAN5's work area also shows references to research.

Figure 3.11 shows CAN4 and CAN5's sketches completed in week 4:

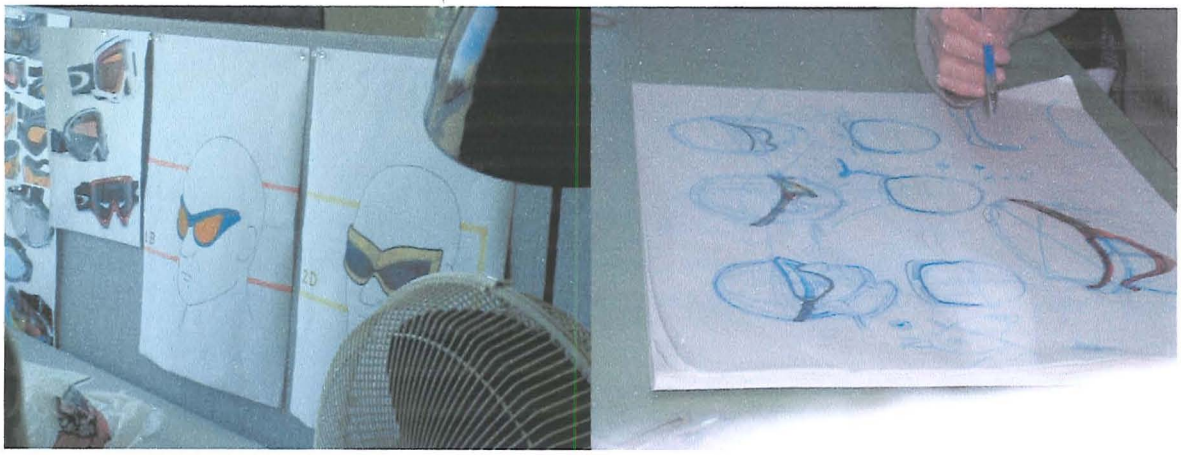


Figure 3.11: CAN5's (left) and CAN4's (right) concept sketches from week four

The reference indicators relative to the four main quadrants of the design process milieu model provide guidelines to identify the context for the individual verbal, textual and visual references. Four transcript excerpts and seven still photographs provide the details on how to map the references to the model. This process is made possible by understanding the context of each field study through ethnographic involvement with the groups. The ethnographically oriented research procedures are described in detail in the next chapter followed by a rich description of the inside-local environments of each field study in chapter 5. The following subsection provides details on how the intangible references are distinguished from the tangible.

3.4.4 Characterizing the (in)tangible references

One basic assumption in design is that things that drive the design process are always clear and evident to the work that this being carried out. It follows therefore that the references being made while designing will typically be tangible. Drivers and references may include material and immaterial things that are relatively specific to the subdiscipline involved. Eckert *et al.,* for example, define drivers as the *external factors that strongly influence the observable behavior of a design process* (2004:999) and they continue by stating that the drivers as *not inevitably causing particular consequences* (*ibid*). Some of the drivers in industrial design are the principles of design, which include safety, legislation, customization, and more, including for example, those that are elaborated on in chapter 2. Drivers may stem from the stakeholders (*e.g.,* customer satisfaction, economic viability, ergonomics) or from within the designer (*e.g.,* self-fulfilment, moral position on environmentalism). In the design community, drivers are always defined as being from inside design. In this research, it is considered that all reference, even those that seemingly have little to do with the project (intangibles), have the potential to drive the

design process because these could have some effect, possibly very minute, on the design of an artefact.

As part of exploring sociocultural forces, the research herein seeks to identify if and whether there are drivers that are less connectable to designing and the project at hand. The tangible and intangible references are introduced and defined in chapters 1 and 2 and this subsection illustrates through two transcript excerpts how to distinguish between tangible and intangible references. The references are first mapped to the quadrants in the design process milieu model. All the references that fall in the inside environments are tangible, whereas references falling in the outside environments may be tangible or intangible. It is at this stage that distinctions are made between the references being tangible or intangible.

The first example, transcript excerpt 3.5, is from week 3 of the UK study. The instructor (I) is conducting a desk critique with the student participants. In this excerpt UK3 describes his three concepts, which is followed by feedback from his instructor. UK3 is in the concept generation phase of design. He is exploring two principles: the first is user-centred design where he wishes to aid the airline stewards, stewardesses and passengers with rubbish disposal; and the second is sustainable design where he is interested in incorporating issues environmental issues into the design of the mealtray. The content morphemes are highlighted and identified as nouns (green), analogies / metaphors (red) and intangibles (pink).

UK3: The main problem as I identify it is the rubbish and getting up to the toilet and then the initial thing is having that. So I looked at having a metal something that would crush up the bag. Then I looked at picnics, but the main theme would be for it to get crushed up. It would arrive as a tray and then be turned into a ball. But then I thought it should arrive as a picnic and then containers and things could be used for that and flip it into the rubbish. You know the material toolbox? And then you open it and zip those up again. Then I was looking at the normal tray with a pocket in the corner and the bag folds out of that when you need it and you put all the rubbish away. That is inspired by those kagools you get that fold into their own pocket [jacket] I was thinking of that idea where it comes out and wraps around. I did a bunch of models that failed. One with a triangular tray that folded into itself. But it would take so much material ... that is the benefit to the sketch model. You can see it in an instant. I like the idea of it folding out and being a tablecloth but it wasn't very practical. It would have to be much more circular. I was looking at it having containers that would be stacked on top of each other. I liked the idea of the bag coming out. There wasn't really a clear development [looking at sketch book] I came back to the idea of the sack there [pointing at sketch model] and having that so that it would come up and have the bag thing. The way it would be arranged would be the main meal in the middle and it wouldn't be touched. It would be like the base. You know those pots of yogurt that have the foil that you peel off the top and then here... the corner could be something like that [indicating sketch model]. They could be foil sealed. What was I looking at? I was then looking at a satchel covered material like and you just open it and there is maybe a bit of Velcro on the seat back that it sticks to.

I: Is there something already on the tray or seat back that you could use like the Velcro?

UK3: Well there is the netting thing, the …

I: That is by the knee and below the tray…

UK3: Some have a coat hook on front. That is what I picked up on originally but then I wasn't sure that they had it on transatlantic flights.

I: The tray itself is held up by that little turn button.

UK3: —nodding—

I: Given it is almost the same format. Perhaps.

UK3: Well I was picking up on what [classmate] was saying about putting everything into the pocket in front of you and I thought that you could make a custom pocket above the table to put that in. You could fold it up and plop it into it. So then following from that. I was thinking that you could use the tray to jam it in there. You can fit magazines and such and they are somewhat adjustable. So I was thinking about having something sandwiched in there and suction seal things. Bottles. You can take that off and it would suction back. Seemed fiddly [making a face].

I: Techy. Quite interesting really. What about the glass?

UK3: I would develop something that would go in there and the glass would be the exception. It would have to go somewhere else but everything else could just plunk right in there. So that is about it really. This is stuff and having a shape [showing hanging].

I: Nice. Nice is done.

UK3: This is just a handle. The bag thing again. It would come out and it would have a handle to press it into the custom thing on the front. Then there could just be a bag and it would roll out. It would have thick walls and it would be like two little bobbins that rolled out. Shapes. Here is that idea again. Cross-section [looking at the sketches]. I am not so keen on that one.

I: What about the soft …

UK3: It just looks like a mini-bag and it would break easily. It would be thin. And if you wanted to use it again …

I: The green issue here.

UK3: I don't really like that [making face].

I: There is a lot here really…quite good. Um … pause *… um, I mean … this breaking packing section. How do you see this? Out of steel?*

UK3: This could be hinged steel. A door hinge...um, it could be maybe reseal it and blobs of polymer that you can blob each time. If I chose to develop this one … it could be …

I: I mean there is a lot of different concentration. They all have their merits. There is a tendency to be gratuitous … there is something quite nice about this one cracking folding.

UK3: This original idea?

I: [muttering] *… what about a combination of the two with a full proper hinge?*

UK3: Yah, uh huh, you could have that be part.

I: Functional hinges?

UK3: It could just be metal trimmings.

I: It could be, there are many things it could be. You need to make that work somehow.

UK3: And here, it is something that just snaps and goes to being rigid. This could possibly be reset. That is what it is.

I: I think it could.

UK3: Like in the dishwasher. Put this in the heat and it resets it. Yah, yah.

I: Heat makes it go flat.

UK3: This could be here [pause] …

I: The difference with that is that it is full. The container. One way to have this is that it could be re-used in a sense. Half a cup of tea, half a bottle of water. What happens when it isn't all used?

UK3: It must be completely water tight.

I: Yah. Move it onto the trolley. Plastic bag container. Duplicating the space required.

UK3: Is that until they are off the plane?

I: Nah, sometimes they are off the plane. But they don't do any processing or cleaning on the plane until the flight.

UK3: What I liked about this idea is that it takes away the trolley. And not blocking the way. Walking with baskets and clunking the stuff in. That doesn't block, they just carrying the basket.

I: How many trips up and down the aisle do they need to make?

UK3: Well obviously that would be worked out.

I: The trip up and down the aisle. Empty those, they very rarely are ...

UK3: —muttering—

I: If there are 120 people on it, how many trips?

UK3: The stewardess wouldn't be doing that many would she?

I: I don't know what the usual ratio is to passengers...

UK3: Maybe find that out.

I: How can you justify that? To have a different system. The brief states that you need to use existing equipment.

UK3: The trolley could still be the original trolley. But take out all the shelves and it is just a space.

I: The shelves are the trays.

UK3: Of course. So you would just put a bag in the empty space. Have like an IKEA bag, slightly rigid and it could cram in.

I: It is for you to talk through and articulate this some more. I think there is an issue of sealing here.

UK3: Innovation and hassle free. That defined the normal clutter.

Excerpt 3.5: tangible and intangible references during a desk critique between the instructor and UK3

The majority of the references in excerpt 3.5 are mapped into the inside environments. These include inside-local references around the design problem (*e.g.,* rubbish, tray, seatback, table, dishwasher, cup, trolley, aisle), concepts around food (*e.g.,* picnic, containers, bag, tablecloth, tea), and considerations for user-centred principles (*e.g.,* stewardess, passengers). Other inside-local references are to visualization (*e.g.,* sketching, modeling), and a reference to a classmate. Inside-universal references include those about the elements of design (*e.g.,* triangle, circular, shapes, blob), the principle of sustainable design (*i.e.,* green issues) and materials and manufacture in industrial design (*e.g.,* cracking, folding, suction seal). There are five references that are mapped to the outside environment and interestingly these are all intangible references. Some have a clearer relationship to the project such as a door hinge and toolbox, while others are less relatable such as kagools, bobbins and IKEA bag. These are all considered intangible references because these do not relate to the inside environment, nor do these directly to the task at hand. In this case, these references are to ordinary everyday objects. UK3 is

using these to objects to describe a system of organizing (toolbox), two methods for folding / rolling up materials (kagools, bobbins), a mechanism for folding rigid material (door hinge) and a material / method of storage (IKEA bag).

Transcript excerpt 3.6 is from week 3 of the Canadian study. The primary instructor (PI) and support instructor (SI) are conducting a desk critique with CAN2 a female student. In this excerpt CAN2 presents some of her background research and verbally articulates her initial design ideas. She has chosen to focus on designing eyewear for female motorcyclists. In this excerpt, CAN2 speaks about having interviewed a female motorcyclist who is defined as a "weekend warrior" or someone who only drives for recreational purposes. CAN2 also identifies five central sources of inspiration that she has researched and thought about. This excerpt shows CAN2 predominately clarifying the objectives of the project. The content morphemes are highlighted and identified as nouns (green), memories / experiences (yellow), analogies / metaphors (red) and intangibles (pink).

PI: One consistent comment that we are making to everyone today is to map out the image so you can see what that looks like. It's not a matter of just collecting the images but doing sketches of the images, which forces the hand to interpreting and trying to get at the essence of what it is all about. It is alike to an exercise in caricaturing or cartooning. Right. But I would say you have five avenues of enquiry into femininity and the notion of empowerment into femininity. Use those as an infrastructure for enquiry, but don't ham string yourself so that you end up with a transvestite biker

CAN2: No, no.

PI: You don't want to say like be like wonder woman and then wonder woman on a bike.

CAN2: In terms of the superhero looking at what they wear, the cape the mask or the dominatrix it would be about looking at the eyewear that they wear.

PI: And actually … yah, except for maybe the last one. The common theme is that notion of the mask. Behind the eyewear you can project out. But what you project outward becomes very different from what you are inside. In behind the eyewear you become anonymous. That is what makeup is all about. Some of the things you are looking at there [pointing at sketch].

CAN2: It is also about the nonconformity. An aspect of them that says I don't want to be like everyone else and then a notion.

PI: If belonging …

CAN2: And being noticed.

PI: Yah.

CAN2: The reason I am taking this route is because there is fantastic eyewear out there for males. I don't know about functionality and all that but there is some great stuff out there. So what I want to say is that if a woman wants to blend in with the male subculture it wouldn't be hard. They can still wear the same clothes and eyewear and stuff but this is about female empowerment and wanting to be noticed and wanting to stand out there. And one of the things that my the woman I interviewed says that when she pulls up at lights people give her the thumbs up because it is nice to see a woman on a bike. So I do want to…

SI: So where would you put the biker chick? Which one of those groups does she fit into?

PI: Is she an outlaw?

CAN2: I don't think ...

PI: An outlaw ...

SI: That mentality... the weekend warrior biker chick where does she fit in with this?

CAN2: This is for the weekend warrior chick.

PI: So she does encompass all of that?

CAN2: I think that she ... the whole idea of weekend warrior... during the week you fit into society and do your job and that. And on the weekend you break away from that.

PI: So I think this is about the mask. It is like putting on another face. So in that sense the five different characters that you showed are five different ways of putting on that face and different ways that can portray themselves. That's what it does but understanding that they provide and avenue to explore but you are not designing for any one of those five groups.

CAN2: No.

PI: You are designing for the über-biker chick.

CAN2: I am thinking that my eyewear doesn't fit into any of these but that I am drawing from them.

PI: That is good. From a thinking point of view you have identified five avenues of enquiry or five inspirations but you will still work with your intended audience.

SI: Yup.

PI: Your intended application. So you may have to drop some of your enquiry off when it gets extraneous.

CAN2: That is what always happens.

PI: But it just ... all it does is help you to get a handle on the problem.

CAN2: All that I am looking for is some ways to address this... you know when you get this feeling that you just know that all the ideas have come together from the beginning. But it happens late in the game. So you have to go through so much to get there. Another thing I wanted to mention. During the interview. This comes back to masks. I think this relates to everybody. Depending on what you wear. And it is something I noticed with myself. Depending on what you wear it will change your attitude. One of the things that the lady I was interviewing was saying is that if they wear leather, their whole attitude changes.

PI: That's the Bugs Bunny Cartoon I was telling you about.

SI: Yah, yah.

PI: That's the one where a whole truck load of hats gets lost and they are blowing through the forest and Elmer and Bugs are going through the forest and as different hats fall on their heads they take on the different characters of who would be wearing them

CAN2: That's true. I actually address that before like the day that falls on Halloween. But seriously. We acted different and people treated us differently. And it was a really interesting sociological experiment. I always wanted to do that too. I worked at Safeway

SI: —laughing—

CAN2: Sorry ... I worked at Safeway.

SI: Which Safeway?

CAN2: Elbow drive.

SI: Okay.

CAN2: And I always wanted to wear costumes at work because what an amazing sociological experiment ...

PI: Like at the check out?

CAN2: One of the things I really wanted to do was wear a blond wig with your dark hair sticking out of it. So that it would be really obvious that you were wearing a wig. To see how they would ...

—laughing—

CAN2: And some people would say I think your hair is sticking out of the wig.

SI: Of your five groups one that seems to be missing as far of the females archetype is the corporate woman. One who dresses for power.

CAN2: Wouldn't you say that is the masculine though?

PI: No, not necessarily.

SI: No, those are women in positions of power and authority and with great responsibility.

PI: Yah.

CAN2: But the point that they are women wearing power suits which are drawn from the masculine.

PI: I think it is a different archetype. The corporate. The power. Breaking the glass-ceiling group.

SI: Yah, which oddly enough is the one group that can afford to buy a $70 thousand dollar motorbike.

CAN2: And actually the woman that I interviewed is a managerial type too. She definitely has power over the people who she …

SI: … her minions.

—laughing—

CAN2: I don't know how to look into that.

PI: I will think about that. Oh how about Robb Reports. Spelled R-O-B-B and there is one with the Globe and Mail. Which often has some interesting insights into corporate culture. And they sometimes get into those issues.

SI: There is a magazine about women and business. Scarlet.

PI: There is the Robb magazine. Robb. It is all about things you can buy if you are wealthy.

CAN2: It is a tough one. I know women who are in positions of power and I don't see any real distinctive … you know what I mean … difference. They dress nicely. They wear expensive clothes.

PI: You know who would be an interesting role model for that would be Stronach the contender for the Conservative Party because she embodies that …

SI: Yah.

PI: What is her name Mary Stronach?

SI: Elana.

PI: Yah, Elana.

CAN2: Is she Canadian?

PI: Yah she is fighting Steve Harper for the leadership of the Conservative Party. There has been a lot of press …

SI: Some bad press the last week. But she is just grooming herself. She is not going to win. She knows she is not gonna win. She is just grooming herself for the next go around.

PI: I guess in terms of a woman's wear there are power glasses that women wear.

SI: Yah.

CAN2: The other thing is … those sort of … in terms of eyeglasses. I find it interesting how the bold frames.

SI: You are dealing with fad or fashion too. You will have to take it with a little …

PI: It is a bold statement but sometimes it is an ugly bold statement and sometimes you don't need it. Given your user market it has to be tempered by the functionality of being road worthy. You don't want to lose sight of that because it is your anchor. You might be looking at female empowerment and you might have five or six inspirations but remember that who you are designing for is the female rider. You need to go back to the hardcore functionality of that. You might just be

nuancing the lines on an otherwise functional eyewear. That may not be the way you go but it might be. You might just end up giving it a more cat-like profile

CAN2: The direction that I am going is I am not so interested in the sunglasses look.

PI: So you are going for goggles at this point?

CAN2: Because it has its links in aviator goggles.

PI: I am curious to see how that one takes shape.

CAN2: There will be padding and venting. There are a lot of practical things that I will be considering.

PI: Well start sketching that.

SI: We are not worried yet.

CAN2: Don't worry I will just get into the rhine-stone feather. Have you seen Pricilla Queen of the Desert?

PI: Yah.

SI: Yah.

CAN2: [Boyfriend's name] was talking about that today. They were going through the desert and there were streamers up [gesturing] at the end of the car.

PI: I liked his breakfast cereal. A bowl full pills and milk.

SI: Oh yah.

Excerpt 3.6: tangible and intangible references during a desk critique between the two instructors and CAN2

The references in excerpt 3.6 are mapped into the inside and outside environments. These include inside-local references to visualization (*e.g.,* images, sketching), the project (*e.g.*, biker, eyewear, goggles, sunglasses, mask, weekend warrior, face), and the inside-local culture (*i.e.,* a Halloween party hosted by the first year students that took place four months prior to the study). Inside-universal references include those about the elements of design (*i.e.,* line, shape), aesthetics (*i.e.,* fad, fashion) and industrial design (*e.g.,* padding, venting, function). In this excerpt the proportion of inside to outside references is much more balanced and the outside references are a mix of tangible and intangible ones. The tangible references that fall to the outside include the outside-local ones (*e.g.,* sociological experiment, Conservative Party, Stephen Harper, Elana [Belinda] Stronach) and the outside-universal (*e.g.,* the desert, wonder woman, cartooning, Bugs Bunny, Robb report, Globe and Mail). The majority of the intangible references in this excerpt are outside-local (*i.e.,* power suit, costume, rhine-stones, Safeway, Elbow Drive) with some that are outside-universal (*i.e., Pricilla Queen of the Desert*, feather). The outside-local references are objects (apparel), materials and places and the outside-universal references are a film and natural object. CAN2 uses these references in a much more abstract and conceptual way compared to UK3's in excerpt 3.5. She tells a personal anecdote (her desire to do the "sociological experiment" at a grocery store) to describe primary research and explore the notion of identity (Safeway, Elbow drive, costumes) and continues by considering identity by referencing apparel (the power suit). CAN2 concludes her discussion with the instructors by using a reference to the film *Pricilla Queen of the Desert* and the use of rhine-stones and feathers, in doing so she is

emphasizing that she understands how to avoid clichés, the tacky and over-the-top design that would not be suitable for her notion of the female motorcyclists. Interestingly, the use of personal anecdotes is more common to this group of design students, this is described more in detail in chapter 5.

Tangible references are easily defined in the design environment as all those things that relate to the artefact being designed. That is, anything from the inside environment and many things from the outside are considered tangible. Intangible references are more often connected to personal experiences and memories and are those things that are less identifiable with the design project. For example, it is through ethnographic observation that it is known that the Canadian group had a Halloween part (inside-local) and through the questionnaires and interviews that it is known that CAN2 had a background in sociology hence her interest in sociological experiments (outside-local). Without this information, the Halloween reference appears to be an intangible reference. The sociological reference would have been difficult to map without understanding both the programme of study and the individual involved. The two transcript excerpts in this subsection provide the details on how to characterize the (in)tangible references along with further illustrating how to map the references to the sociocultural environments. This process is again made possible by understanding the inside environments of each field study.

The categories and indicators in the design process milieu model provide a foundation for understanding the less visible processes in design (the broader sociocultural context) while simultaneously creating a boundary around the investigation (the types of references). A specific language for interpreting the visual, verbal and textual references is defined in the form of general categories and indicators within the design process milieu model. The eight categories presented provide a framework to identify the various levels of sociocultural environments that may be contributing to the design process. The indicators reflect particular types of things, events and experiences that allow a reading of the group being observed.

3.5 Applying theory to the research questions

The six research questions identified in chapter 1 are restated here as these relate to the theories presented in this chapter. It is important to acknowledge that interdisciplinary theories are needed to address the range of questions that are asked in this research.

The questions are shown here itemized with the corresponding theory that is deemed most appropriate for answering them.

- What personal and cultural experiences are referred to in the context of designing an artefact?

To answer this question, the design process milieu model is used to define the references that relate to the inside or outside of the design environment. This model further defines the reference as relating to local or universal environment. Furthermore, the design process milieu model provides a representation to look at all the references made during the design process. In this way, the design process milieu can be used to map out the references of any individual.

- When do the intangible references occur within the design process?

The generic design process model and the design process milieu model are used in tandem to answer this question.

- Are the intangible references driving the design process and if they are, in what way?

To answer the third question the theories of holism are combined with the generic design process model to provide a broad context for each study in order to understand when the references occur. In addition this question is addressed through an understanding of the act of designing and the characteristics of being a designer as described in chapters 1 and 2.

- Are there any patterns, similarities and differences within each field study or between the two?

Again, the design process milieu model is used to answer these questions.

- What is the proportion of tangible references to intangible references?

After mapping the references to the design environments the tangible and intangible references are characterized by looking at their relationship to the project and discussion contexts.

- Are there any links between the sociocultural references and final designed artefact?

As previously indicated, the final question is not explored in detail. This question is addressed by asking the participants to reflect on their work at the close of each ethnographically oriented study. Therefore, this question is not addressed throu0gh the analyses of data and does not require a theoretical foundation for interpretation.

3.6 Conclusion

It is clear that sociocultural environments differ from one another in both small and large ways. It is also clear, as described by anthropologists such as Geertz that a complete and whole view of such an environment is not entirely possible. However, this does not mean that we cannot glean an understanding of the nuances of what goes on inside the design

studio, and in doing so address the design process as a greater whole. This involves looking at the inside and outside forces that affect the decisions being made while designing an artefact. Although these forces are invisible, they are discovered through listening and looking at what is being referenced by design students in their studio environment.

This chapter has introduced an interdisciplinary theoretical model that involves three domains. This is illustrated in figure 3.12.

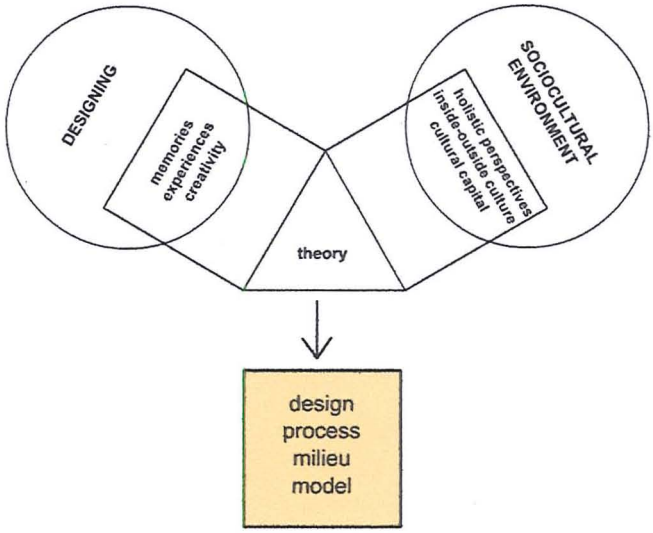


Figure 3.12: interdisciplinary theoretical model for understanding design processes

The two theoretical domains drawn upon in this research are designing and the sociocultural environment. As described in this chapter, these domains comprise well-known theories from design, anthropology, and social psychology. Along with using some of the theories from the domain of design, particular theories from the two domains have been synthesized to develop a model for understanding the design process, which is shown in figures 3.6 and 3.7.

Within the domain of designing two theories on design methods have been identified as significant to understanding the relationship of the sociocultural forces to the design process. Many of the references, particularly the intangible ones, are deeply rooted in the subjective memories and experiences of individuals. These memories and experiences are the key to understanding the larger sociocultural network of an individual, and how this may influence his or her design process.

The theoretical foundations relevant to understanding the micro and the macro in design have been presented in this chapter. Relevant theories have been reviewed including those from inside and outside of design. These intersect to create a hybrid interdisciplinary research model. In the next chapter the methods employed in the pilot studies and two field studies are outlined as these relate to the theoretical foundations.

4 Ethnographically Oriented Research

4.1 Introduction

In the previous chapter theory was presented as a framework for interpreting the data that are gathered in the two field studies presented in this thesis. It has been identified that there is no single theory that can explain the design process. This is emphasized by presenting a number of different theories that are understood inside and outside of design research. This approach is representative of a shift in research in general, not just in design. According to Norman Denzin and Yvonna Lincoln the grand narratives have been eliminated and replaced by local, small-scale theories fitted to specific problems and specific situations (2003:22). This shift in research is described briefly in the following section called anthropological perspectives and traditions.

Design schools in universities throughout the western world are engaging in thoughtful, traditional academic research and developing theories about design practice. How academics engage with design research is an area of growing interest (Durling & Friedman 2000, Blessing 2003). There are many varied approaches that are applied to design research (Strandman 1998) with no single approach adopted by the design community to date. It is unlikely that a single generic design research methodology will ever exist even though some consider this a weakness in design research (Blessing & Chakrabarti 2002, Wallace & Blessing 1999, Blessing *et al.* 1998). Like many other disciplines, design research will likely continue to adopt the practices of interdisciplinary research. The predominant approaches used for gaining information about designing to date are based on the methodologies of psychology. Psychologists typically prepare laboratory-type experiments and approach their research problems deductively in order to gain objectivity, but also use methods in the field. Fieldwork considerably differs from laboratory experiments in that it does not manipulate a situation because it takes place in the natural setting. In addition, fieldwork is typically approached inductively.

Denzin and Lincoln (2003:3) write that fieldwork researchers:

> *Study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them.*

Both social psychologists and anthropologists engage in field research. It is understood that laboratory experiments are not considered to be better than field studies and vice versa. Each simply encourages the advancement of different kinds of knowledge while restricting other kinds. Research techniques used for gathering data must be sensitive to the nature of the phenomena that are the subject matter of the research questions (Ackroyd & Hughes 1981:7). Therefore, the research methods are a set of tools designed and suited to particular jobs. Geertz (2000:93) writes that, in order to understand social and cultural forces, and why people behave as they do, observation from very close up is required. This observation in the form of real-life real-time methods is used here in order to gain data that describe naturally occurring sociocultural phenomena within the design studio.

The term 'ethnographically oriented' is chosen to characterize the methods that are used in this research. This term is chosen because pure observation does not provide the information to answer all of the research questions. Therefore, the methods here resemble something called methodological pluralism. More than one method is used, yet the central method is ethnography. Ethnography aims to observe reality as holistically as possible. Ethnography recognizes that the visual, the textual, and the verbal are part of this whole. Because 'references' during designing involve all of these, ethnography is chosen as the primary method. Second are methods that include making field notes, conducting semi-structured interviews, and performing questionnaires. These are discussed in detail in this chapter. The methods used fit within a predominantly qualitative framework; however, some of the data can be handled quantitatively. In addition, methodological pluralism allows interplay between deductive and inductive approaches, which is common in anthropology and most social research (Peacock 1986:85). Finally, in order to look for meaning behind sociocultural context, the researcher needs to do more than just observe the participants' actions and this is done through methodological pluralism.

The primary purpose of this chapter is to document how the research was performed, and how the data were assembled and then displayed. This is presented beginning with the theoretical underpinnings of the methods used, then through the presentation of the layers of data collection and processing, and concluding with an overview of the studies performed in the empirical studies.

4.2 Anthropological perspectives and traditions

Mats Alvesson and Kaj Sköldberg (2000:6) explain research as follows:

> *The research process constitutes a (re)construction of the social reality in which researchers both interact with the agents researched and, actively interpreting, continually create images for themselves and for others; images which selectively highlight certain claims as to how conditions and processes — experiences, situations, relations — can be understood, thus suppressing alternative interpretations.*

The research process involves data collection, processing and interpretation no matter which perspective is taken. The researcher interacts with the participants in order to acquire data that answers particular questions. Research is a complex process that is layered with different approaches. The approaches are better described as theories, and these theories relate to all aspects of the data including collection and processing. According to Stephen Ackroyd and John Hughes, no method or technique can be atheoretical (1981:9). There are theoretical commitments that make up the fundamental questions and postulations of that method. This is because methods have been developed within specific theoretical perspectives and traditions. In addition, all data are interpreted to produce conclusions that never capture an accurate representation of reality. Data are mediated through the researcher, therefore, interpretations are not neutral or value-free. Various paradigms, perspectives and concepts are the foundations of data collection, processing and interpretation. These theoretical underpinnings are presented here as the three perspectives and the five traditions of anthropology.

Anthropology represents an anthropocentric holistic endeavour that is not unified by a single theoretical perspective. Competing perspectives lay the foundation for different approaches to research and to the subsequent data analysis. Alan Barnard's book *History and Theory in Anthropology* (2000) provides an excellent overview of the theoretical perspectives of anthropology. He describes three core perspectives (*ibid* 8-10), which include:

1. Diachronic - the relation of things through time.
2. Synchronic - the relation of things simultaneously.
3. Interactive - all things are dynamic, cyclical and relative to cause-and-effect relationships.

These three perspectives can be identified as hierarchical because historically they occurred in the order presented here. Further to this, anthropology is classified into the two broad categories of social and cultural, as discussed in chapter 1.

Barnard continues his discussion on the theoretical perspectives by elaborating the five traditions of research in anthropology as relativism, structuralism, poststructuralism, interpretism, and reflexism. Relativism opposes the notion that there are universal values

and that cultural universals exist. Franz Boas and Clifford Geertz are considered the fathers to cultural relativism, even though their positions on the notion differed slightly. However, they agree that cultures are rich and diverse, which is the core of relativism. For structuralists, meaning comes from knowing how things fit together as a system. These systems are all about patterns that can be broken into distinctive features or binary oppositions. Claude Lévi-Strauss is famous for his work on structuralism, especially the notion of the 'collective unconscious'. This work clearly contrasted with the notions of 'diversity' in relativism, which has and continues to be highly criticized. Poststructuralists are theorists who directly oppose and reject classical structuralist categorization. Poststructuralists challenge the authority of the researcher and mainstream anthropological work. Structuralists are model-oriented and poststructuralists move towards a theory of practice. Pierre Bourdieu and Noam Chomsky are considered poststructuralist theorists. Interpretive anthropology denies the idea that anthropology is a science. Interpretivism rejects scientific writing and advocates writing as the focus in research. This shift in focus recognizes that the richness of culture is only reportable as thick descriptions. Interpretivism can be viewed as a trivialization of culture in so far as it focuses on minute details that are generally highly specific to the situation at hand. Geertz's writing is significant in the arena of interpretist theories and remains today as one of the most influential figures in anthropology. Debates within anthropology continue as academics continue to critique the approaches and methods that are at the core of the discipline. James Clifford and George Marcus's book *Writing Culture The Poetics and Politics of Ethnography* (1986) attack the notion that ethnography can represent holism. This book opposed scientific truth by embracing the notion of narrative, thus moving towards reflexivity in research. Reflexism is when the researcher reflects on his or her position in the research process. In case of extreme reflexive research, the topic of exploration becomes the backdrop for the researcher to explore his or her own cultural and social identity (Alvesson & Sköldberg 2000).

Although the five traditions of research have some contrasting characteristics, it is important to note that they intertwine, overlap and intersect. Therefore it is not surprising that anthropologists mix approaches and draw on the different theoretical traditions (Barnard 2000:174). Much like Pierre Bourdieu's approach to research, the field studies here fit in more than one of the anthropological traditions. That is, the research herein is guided by theories that are considered structuralist and poststructuralist but are based on facts discovered through observation that is reported both as descriptions (interpretist) and as a theoretical model (structuralist). Even so, a holistic approach through

ethnography is at the core of this research and aims to understand the influences of the sociocultural processes during the design process.

4.3 Ethnography

The primary method of scholarship in anthropology is fieldwork, which is specifically termed ethnography. Ethnography is:

> *A style of research that is distinguished by its objectives, which are to understand the social meanings and activities of people in a given 'field' or setting, and its approach, which involves close association with, and often participation in, this setting* (Brewer 2000:11).

On a basic level ethnography involves direct observation of a specific group in their natural setting. Typically this observation is long-term and sometimes includes multiple data collection methods. Long-term fieldwork is called longitudinal research and typically lasts for six months or more. Multiple methods are used in data collection during observation in order to allow for triangulation and a more holistic engagement with the setting. Ethnographic methods are appropriate for research questions that relate to cultural forms including everyday activities. Geertz argues that ethnography is a way of looking at the local in a tense interaction with the global (Barnard 2000:163). There is an emphasis on the minute (micro) aspects of culture as part of the larger system (macro). The minute details are often identified in anthropology as looking at the *idiosyncratic tendencies* of the participants (Wolcott 1999:137). Ethnography is commonly used when doing an anthropological study because it is well suited to the holistic framework (Clifford & Marcus 1986).

Ethnography is an observation of reality. Part of this reality, however, is constituted by the constructed stories that are represented through media such as images. Images are everywhere. They permeate our everyday lives through media, conversation and dreams. There is the recognition in ethnography that the multi-faceted construction of reality involves the verbal, textual and visual. These are explored more in detail later in this chapter.

The role of the researcher is not simply to observe as an invisible bystander, but involves a defined degree of interaction. The interaction between the researcher and the participants preferably takes shape in a non-hierarchical relationship since this allows for rich data to emerge. In the past two decades the ethnographic researcher's role has been that of participant-as-observer as he or she gains valued data in a natural setting. In this role, the researcher looks, listens, enquires, and records events and relationships within a setting. The participant-as-observer does not participate fully in the activities of the group being studied. They do get to know the group, often creating enduring

relationships, because they are aware that doing fieldwork involves a series of relationships with people. There is no preset sequence established for studying a group because ethnography is an investigation into ordinary social situations that are not orchestrated. The researcher is trying to gain an understanding from an insider's view by disturbing the lives and events of the participants as little as possible. In the past, ethnographers always took the role of the outsider (*e.g.,* the western researcher studying an eastern culture). Outsiders are said to have an important advantage because they can be naïve and probe into the details of a system more easily. Ackroyd and Hughes (1981:151) indicate that:

> *The juxtaposition of familiarity with unfamiliarity may furnish a proper combination of phenomenological distance with interprebility.*

The notion of being an outsider to a particular group is well taken. However, the researchers' inside and outside perspectives are viewed in degrees. For example, it is useful to be familiar with the group-type that is being studied (design in this case) and for western researchers to study western cultures. What is not appropriate is for the researcher to 'go native' and become so part of the group to the extent that they be attached and subjective. Therefore, the researcher should not be a complete insider but maintain some separation from the group being studied. In current day ethnographic observation, the degree of the researcher as insider or outsider is less important than it was in the past, according to Wolcott (1999:137): *every view is a way of seeing, not the way*. In ethnography it is most important that the researcher is forthright about how the study was completed and about the nature of his or her relationship between with the participants. The researcher's relationship to the participants in the two field studies presented here are discussed later in this chapter.

Using ethnography as the central method in these two field studies clearly presupposes an understanding of its basic assumptions, along with the theoretical perspectives. Having established this background the next section presents some of the ethnographically oriented research that has occurred in design research.

4.4 Ethnographically oriented research studies in design

The basic premise of ethnographically oriented research is that it is rooted in ethnography, which was born within and is typically related to anthropology. However, ethnographical methods do not *belong* to anthropology but are *informed* by anthropology as discussed previously. The focus of ethnographically oriented research, like ethnography, is on the collection of qualitative data. Qualitative research is a field of enquiry that crosses disciplinary boundaries and subject matters (Denzin & Lincoln 2003:3) and is currently considered to be interdisciplinary. Qualitative research

emphasizes qualities and processes that are not experimentally examined or measured (*ibid* 13). Approaches for gathering qualitative data are popular in social research because they provide a snapshot of diversity as well as commonality. Quantitative data gathering is also a part of ethnographically oriented research, but is secondary to the qualitative data gathering. In design ethnographically oriented research is not as wide spread as other approaches such as protocol analysis, yet is still more common than some approaches such as conversation analysis. Many examples of ethnographically oriented research have already been discussed in the previous chapters; however, noteworthy examples are elaborated upon in this section.

As illustrated in figure 4.1, there are two ways that ethnographically oriented methods are used in design: in design practice and in design research.

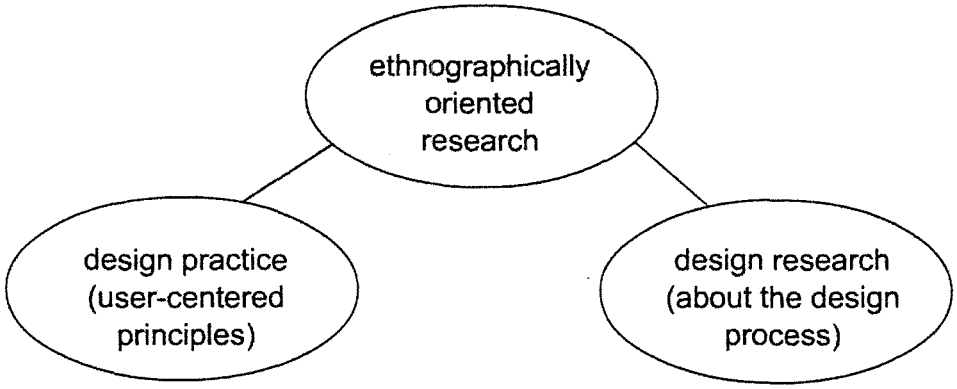


Figure 4.1: use of ethnographically oriented methods in design

Examples of how ethnographically oriented methods are used in design are described here beginning with its use in practice and followed by its use in research.

In his book *User-centred Graphic Design*, Jorge Frascara (1997) presents visual communication design as a user-centered activity, much like Patrick Jordan presents industrial design in *An Introduction to Usability* (1998). Both Frascara and Jordan provide sections on design methods in their books. In Frascara's book, Zoe Strickler described participant observation as the immersion of the researcher(s) for long periods of time in a particular environment. She states that it is the most expensive and time-consuming of data collection methodologies (Strickler 1997:47). The interview is also described as a form of ethnography in this book (*ibid* 50). Although this book introduces two ethnographically oriented methods to gain information about the user there are no examples of how these could be approached. The goal of Jordan's book is similar to Frascara's in that he describes the best use scenario of specific methods. However, Jordan takes this further by explaining how to implement the methods. Jordan presents field observation as a way of providing a *real use context* where fieldwork enables an

understanding of how a product performs under natural conditions (1997:63). He further argues that, although it is beneficial to see how products are used under natural conditions, field observations are usually carried out on finished products and lack flexibility in the context of analysing usability (*ibid* 65). Frascara and Jordan both endorse using ethnographically oriented methods within the design community; however, the key book on ethnographically oriented approaches in design practice is *Creating Breakthrough Ideas – The Collaboration of Anthropologists and Designers in the Product Development Industry* edited by Susan Squires and Bryan Byrne (2002). In a series of essays they present the idea of investigating user research from the anthropological perspective, in short *design ethnography*. Squires and Byrne (*ibid* xiii) present the goal of design ethnography as the discovery and subsequent use of cultural knowledge to assist designers and marketers in creating products through using ethnographically oriented methods. They further define the work presented in their book as *applied ethnography*, meaning that it is not about creating what Geertz calls thick descriptions but about creating practicable guidelines provided by insights into culture (*ibid* xiv). This book recounts successful collaboration between designers and sociocultural anthropologists. The three books detailed here provide an introduction to ethnographically oriented approaches used by design; however, the focus of this project is on these approaches as they relate to design research.

A number of design researchers previously discussed in this thesis use qualitative ethnographically oriented approaches. Bucciarelli (1984,1988,2001) is one of the first known design researcher to act as a naturalistic observer in the role of participant-as-observer, whereby he researches real-time design processes in industrial practice. Although Bucciarelli's research was introduced quite some time ago, the approaches are not commonly adopted in the research community. This may be because Bucciarelli does not elaborate on his approaches to gathering and processing his data, therefore he does not provide a clear research model making his approaches difficult to replicate. Schön (1987) also uses some observational work in his explorations of the instructor-student relationship in design studio situations. Again, the shortcoming with this research is that Schön provides only superficial information about his methods of observation. Tang (1989) uses a method involving videotaping naturalistic design activities. He embraces inductive research approaches that are advocated in anthropology whereby the empirical data are examined throughout the research gathering process in order to glean information from the data rather than presupposing a hypothesis. Minneman (1991) uses a method similar to Tang's. He believes that ethnographically oriented methods get at the bigger picture, engineering design in this case, while simultaneously getting at the

particulars of interactions that arise in a setting (*ibid* 64). More recent examples of ethnographically oriented research methods in the design community are, for example, Langdon *et al.'s* (2003) work called *integrated ethnographic and empirical methodology*, which is a study on aerospace design. The objective of this research is to seek an approach that allowed insights into the nature of knowledge searches used by aerospace designers. Langdon *et al.'s* research draws upon cognitive ethnography and participant observation by placing a designer-researcher *in situ* thus making him part of the aerospace organization. The designer-researcher is asked to reflect on the design process while observing the other designers also reflecting. Langdon *et al.* determine that using ethnographically oriented methods have certain strengths and weaknesses. The advantage is the naturalistic situation and the fact that the designers reflected on their knowledge-base. Reflection provides a forum whereby the designers understood more about their own activities, which helps deepen the understanding of these processes in design in general. Langdon *et al.'s* work is an important contribution to design research because ethnographically oriented methods are being evaluated as these are used. However, like Bucciarelli and Schön's work the gathering and processing techniques are not elaborated in detail.

Examples of ethnographically oriented approaches in design are somewhat limited particularly those that provide detailed descriptions of the gathering and processing techniques employed. This lack of specific description is a serious shortcoming for the design research community because it limits how ethnographically oriented methods can be used to understand design from this perspective. As previously discussed data collection, processing and analyses in all research projects are activities that are rooted in perspectives and traditions. There are a particularly high number of perspectives and traditions related to ethnographically oriented methods, which means that these are performed in a multitude of ways. Without a clear recount of how the research has been approached it is not easy to assess whether these approaches are appropriate to answering certain research questions. In design *practice*, it is not essential to elaborate upon research methods because the information is generally gained in collaboration with social scientists for the purpose of *designing*. However, in design research it is essential to provide detailed reports on the methods employed in order for the research to be valid and reliable. The following sections provide a detailed account of how the research is conducted in the two field studies presented in this thesis.

4.5 Data gathering

This section describes the data types, the gathering techniques, and the procedures that are used for this empirical research. All data in this research are related to things that are referenced by the participants as observed while designing a project in their studio environment. References are intimately tied to the individuals' experiences and memories, and are a reflection of the thoughts made meaningful that a person brings into their current experience of design. Furthermore, references are defined as all things that the designers *may* use (directly and indirectly) towards the design of an artefact. In this research all references are considered to have equal meaning. The data gathered involves an approach that recognizes the interconnectedness of texts, objects, and images from the everyday lives and identities of individuals. In her book on visual ethnography, Sarah Pink indicates that researchers who use this method (2001:6):

> *... explore how all types of material, intangible, spoken, performed narratives and discourses are interwoven with and made meaningful in relation to social relationships, practices and individual experiences.*

Pink's description of visual ethnography is not unlike common descriptions of ethnography in anthropology. This is because the data collection and analyses perspectives of visual ethnography are deeply connected to those of ethnography. Methods of visual ethnography are not the focus of this work; however, it is important to acknowledge that visual components make up many of the references made by designers. Along with visual data, verbal and textual data make up the rest of the references. These will be detailed in the following subsection about data types.

In order for the empirical study to answer the research questions established in Chapter 1, it is necessary to establish what types of data are needed and the best way to gather these. This section defines the data types and the data gathering techniques, followed by the research procedure. It is important to note here that this section pertains to how the data are gathered for one pilot study and the two field studies in this research. The first pilot study does not use this data gathering approach; however, the similarities and differences of approaches in each pilot study are described later in this chapter.

4.5.1 Data types

The design processes and the context of designing define the required data types because the central goal of this research is to look at the details of the design process more holistically. The references made while designing *are* the data. References in design are defined as visual, verbal, and textual; however, there is no such thing as pure image or pure word references (Pink 2001:17). This is because conversations, especially in

design, are often about visualization. These conversations draw upon absent imagery including images from media through verbal descriptions and through referencing them.

Visual data are comprised of images, objects, and certain types of descriptions. Images are representations of reality. In design different types of images are used: either created from the individual's perspective (*i.e.,* photographs, sketches), or found in print media (*e.g.,* glossy pictures, illustrations, charts). Objects are sometimes also physically present in the form of an actual thing. Like images, these may be either from the individual's perspective: made by the student (*i.e.,* models, mock-ups) or mass-produced (*i.e.,* all things in the built / material environment; *e.g.,* apparel, electronic items). It is not uncommon for designers to use real objects as reference points for discussion. For example, one student brought in *Allessi* salt and pepper shakers to illustrate a desired look in his own design work. Visual data that come from the individual's perspective mirror things that the individual has seen and experienced. In this situation the researcher is temporarily taken into the worlds of the participants. These worlds are incredibly ambiguous but reflect the sociocultural context.

Verbal data include references that are arguments and descriptions. A great deal of designing involves communicating with colleagues and instructors about the artefact being designed and the personal design processes of the individuals involved. Verbal data are rich with references to the visual and experiential world. The designer commonly presents similarities, metaphors and analogies in speech to compare and test ideas. The complexity of verbal language is not the focus of this work; however, it is the references to people, places, experiences, and things that make up the bulk of this work. Verbal data are found throughout the participants' formal presentations and informal conversations, as well as in the interviews with the researcher.

Textual data are all the written documentation that the participants present to the instructor(s), each other, or the researcher. Textual data are made up of flow charts, tables, lists, sentence fragments that support sketches, and paragraphs of description. Textual data types also include the responses to the questionnaires performed at the onset of each field study. The responses are written individually by each participant and reviewed later by the researcher. The questionnaires are designed to provide a context for cross-referencing the visual and verbal data. These textual data are minor in comparison to the visual and verbal, making up a very small part of the data in each field study.

The data types in the two field studies result from in-depth observation whereby nothing was specifically requested from the participants. The data reflects what happened *in situ*

and are viewed as a natural representation of the design process. Obviously, the presence of the researcher may have affected the data to some extent. One example of this phenomenon is the claim of a participant that the instructor was *showing off* for the researcher. This example illustrates that, although all efforts were made to keep a reasonable distance from the participants, the mere presence of a researcher has an effect. Although this is one of the limitations of this type of study, these data types reflect the design process more holistically *in situ* because the data types were discovered as a result of the research. The gathering techniques that revealed the data types are elaborated upon in the following subsection.

4.5.2 Data gathering techniques

All the data gathered in this research is rooted in observation and collecting real-time information about the design process. It is recognized that in order to observe the design process more holistically, this requires a snapshot that represents a part of the design process as completely as possible. Although ethnography defines a longitudinal study as a minimum of six months, this research represents a project from start to finish (*i.e.,* a complete unit of time) and is therefore considered an abbreviated longitudinal study. A set period of time for each study is established at the onset of the research in order to limit the length of the projects and, in doing so, establish a boundary around the data being collected. In addition, the observed material is approached from a variety of angles and includes a broader context that is from the participant's perspective. These are common characteristics to ethnography, which observes the microscopic (the references) within a specific context (design process). While this level of meticulous attention to detail is not always present in anthropological studies, immersion in a particular culture is. Along with observation, two other techniques are used: performing semi-structured interviewing and questionnaires.

Figure 4.2 identifies the data types and the collection mechanisms used in this work.

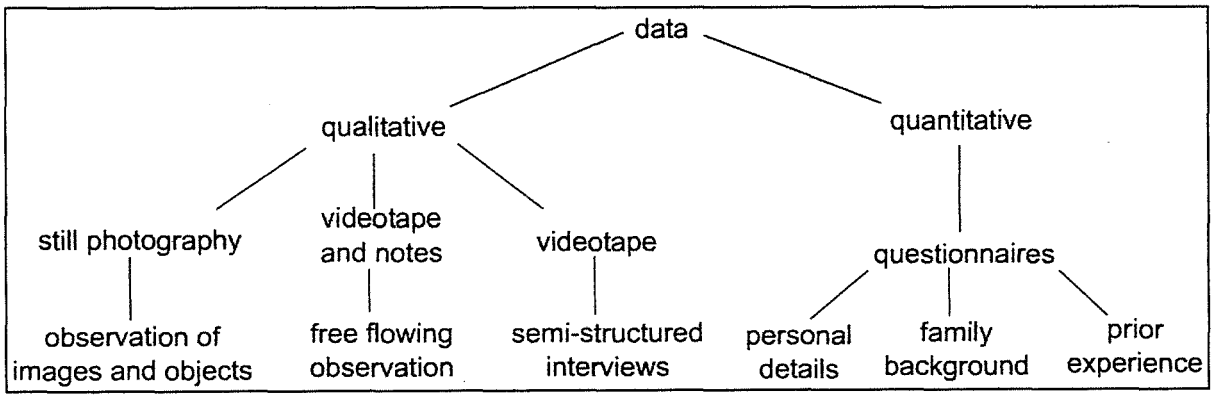


Figure 4.2 data types and collection mechanisms

The data gathering techniques are used in several different ways with the students and instructors, as summarized by the following descriptions:

- Observation is used to view naturally occurring information during the design process.
- Semi-structured interview questions are derived from the observation during a pilot study and in the first field study.
- Questionnaire procedures are used to query personal details about the students in order to contextualize what is happening during observation. Questionnaires are also used to cross-reference with the observation.
- Questionnaire procedures are used to query details about the instructors' backgrounds, teaching philosophy and expectations. These provide a context to determine the difference between inside-local and inside-universal materials.
- Interviews are completed with the instructors involved with the students.
- Observation is used to investigate the design studio and school contexts.

The three techniques are supported by several collection mechanisms for capturing and retaining the references, such as videotape, still photography, and notations. These collection mechanisms are used in order to review the material again and again. Following are detailed accounts of the approaches to observation, semi-structured interviewing, and questionnaire procedures adopted in the field studies.

Observation involves all three modes of data: the visual, the verbal, and the textual. In addition, a fourth category not yet mentioned is that of meta-narratives, which include overt gestures and body movements. Although these are not the focus of this study, there are times when these provide an obvious additional layer to what the participants express. Observation is something that we do as members of society everyday. People make observations of their surroundings and the people around them. Observation in research differs from everyday observation in that it is considered to be relatively non-interventionist. Observation contrasts with interviewing, where interviewer and interviewee directly interact through questions and answers. The observation occurs in a natural setting, as established by the participants. For example, for one field study group the observation took place entirely in one design studio. The other field study group was more mobile, therefore observations took place in the design studio, two classrooms, and a fabrication workshop. The roles of involvement between the participants and researcher vary in observational practices. The role adopted here is that of participant-as-observer. This is defined as partial participation rather than complete observation. In each field study the researcher maintained a professional distance from the group but was not invisible. During observation interaction was kept to a minimum, even when participants explicitly asked for the researcher's opinion (typically about their project) the researcher reminded them that it was not appropriate for her to respond. Some of the participants

used the interview time as an opportunity to query the researcher's background and project. The researcher revealed general information about the research and her background as a designer, but was careful to evade all specific questions about the project.

Semi-structured interviews are primary made up of verbal references, although in some situations the participants show something that represents or supports what they are speaking about. The semi-structured interview procedure resembles a friendly chat. The tone of the interview is focused on the participant, who is treated as an equal. The researcher listens without taking notes in order to be completely attentive to the participant. Because the interviewer is a designer, the concerns and outlooks of the participants are shared. Interviews are used in combination with observations to complement the materials and findings and constitute a more focused representation of what is happening in the design studio from the perspective of each participant. The interview also provides a standardized methodical representation of what is happening. See appendix V for the interview schedule used with each participant. Even so, the semi-structured interview procedure allows for flexibility in the length of the responses and in the content provided, because all questions are open ended. As a result, some of the participants provided a great deal of detail where others kept their responses to a minimum. A small number of participants discussed topics well beyond the questions, which is considered reasonable given that the researcher played the role of listener. The answers to the questions presented are considered to be a representation of the attitudes and beliefs of the participants at the time they responded. Because the questions across the length of the study overlapped and are somewhat repetitious, the responses could be cross-referenced. In addition, the interview questions were designed to complement the observation and the research questions without asking the participants directly about individual personal and / or sociocultural influences.

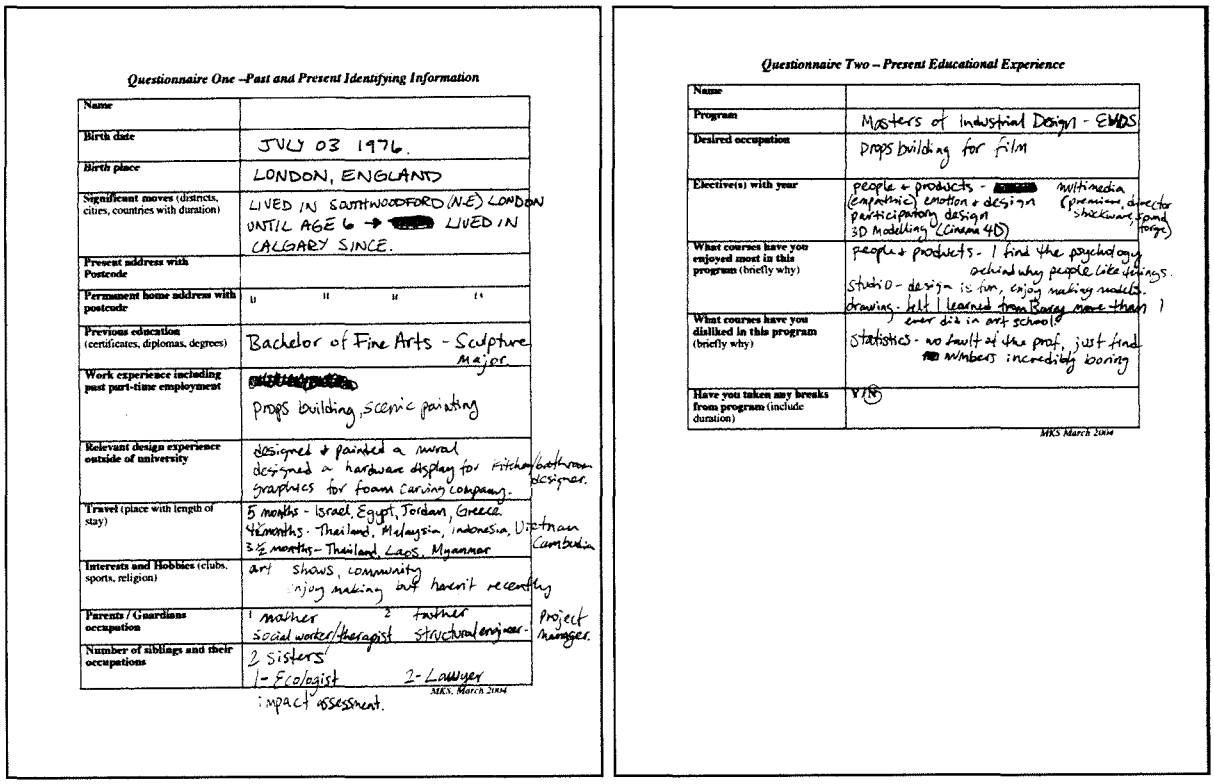
The questionnaire is a way of measuring some variables (personal detailed experiences) at the time that it is handed out. That is, it is recognized that the attitudes reported at the time of the survey may change over time; however, these represent the current attitudes of the participants. The questionnaire is not used to generalize the population, but to query individual things in order to reveal the sociocultural references. The data presented in questionnaires form a textual representation of the participants' self-schema. The majority of the questions asked are open-ended. This means that there were no fixed choice answers such as in multiple-choice questions. The open-ended questionnaire is designed to query idiosyncratic information. There are two fixed choice questions in the

questionnaire that both require a yes or no response. These are: 'did you receive direct entry into your programme of study?' and 'have you taken any breaks from your studies?' In general, the questionnaire is kept simple using keywords explained by the researcher. The participants were told that they did not have to respond to any questions they were uncomfortable with; even so, only one participant chose to omit two questions about his family (see the questionnaire summary in appendix IVb).

The main collection mechanism used for observation is video camera, supplemented with notations and still photography as secondary mechanisms. It is used as non-intrusively as possible and is set up appropriate for each situation. For example, the camera is set to wide angle and is kept in the periphery of the studio or classroom for group discussions and critiques. For the more one-to-one discussions between students and instructors, the camera is more mobile and moved from desk-to-desk in the studio. In all cases, a sound sensitive desk microphone is placed in close proximity to the group or the individual speaking. This microphone is non-intrusive as it lays flat on a desk. The video camera is on a tripod and operates with the built-in battery or by being plugged into an electrical outlet. A VHS camera is used in the UK and a *Sony Hi8* camcorder in Canada. The Hi8 tapes are used over and over again since all tapes are transferred immediately to VHS format. VHS tapes are the medium for storing the verbal data. Audiotape is used on one occasion for observation in the Canadian field study when the group was too mobile to transport the camera. There is less than 30 minutes of audiotape, which is stored on one cassette. Notations are used to focus on the daily activities and to establish a framework to follow the participants' conversation. Therefore, the notes were taken during the studies in order to track who was speaking when, and to focus on the points of particular interest. Notes are also taken during observation to maintain a professional distance and to avoid unnecessary interaction with the participants. Notations are kept in chronological order in a single notebook for each study. These are used for establishing a framework to transcribe the videotapes. Still photography captures the images and objects used and created by the students (*e.g.,* sketches, models), as well as the overall culture of the studio and the design school. A *Fujifilm FinePix* digital camera is used for ease of photo storage. The still photos are stored on CD's in chronological order according to week-and-day and by participant. The completed documented materials (data) include the videotapes of verbal discussions along with the still photography including images, objects and context.

The data collection technique used for documenting the semi-structured interviews is the video camera. Audio recording is used on one occasion for interviews during the

Canadian study when the camera was malfunctioning. This recording is approximately 1.5 hours in length and stored on one audiotape. It is important to note that using video- and audiotape has limitations that may affect the data collected. The first limitation is that the videotape captures *actual conversations relative to behavior* and not the motives behind the behaviors (*i.e.,* cognition). This research project aims to look at the conversation and behavior of the participants and therefore the use of videotape is not considered to impair the study. The second limitation is that videotape only captures what *actually occurred* during the observed time period. All interactions among participants during the established class times are videotaped. It is recognized that many activities occur outside of this time; however, it is not possible to follow all participants at all times. The interviews are designed to *catch up* with what students were doing outside the studio. Since it was more important for the participants to work as naturally as possible (*i.e.,* following their usual work patterns), it was respected when a student preferred to work away from the studio. Videotaping observations and interviews are approached as focused activities in this research because a large amount of time is needed to process the data. Therefore, the video camera was turned on during focused design activities. The hours of verbal data translated into transcripts and the number of images captured by still photography of each study are reported later in this chapter.



Questionnaire One –Past and Present Identifying Information

Name	
Birth date	JULY 03 1976.
Birth place	LONDON, ENGLAND
Significant moves (districts, cities, countries with duration)	LIVED IN SOUTHWOODFORD (N-E) LONDON UNTIL AGE 6 → [redacted] LIVED IN CALGARY SINCE.
Present address with Postcode	
Permanent home address with postcode	" " " "
Previous education (certificates, diplomas, degrees)	Bachelor of Fine Arts - Sculpture Major
Work experience including past part-time employment	[redacted] Props building, scenic painting
Relevant design experience outside of university	designed + painted a mural designed a hardware display for Kitchen/bathroom designer. graphics for foam carving company.
Travel (place with length of stay)	5 months - Israel, Egypt, Jordan, Greece. 4½ months - Thailand, Malaysia, Indonesia, Vietnam Cambodia 3½ months - Thailand, Laos, Myanmar
Interests and Hobbies (clubs, sports, religion)	art shows, community enjoy making but haven't recently
Parents / Guardians occupation	1 mother 2 father Project manager. social worker/therapist structural engineer.
Number of siblings and their occupations	2 sisters 1- Ecologist 2- Lawyer impact assessment. MKS, March 2004

Questionnaire Two – Present Educational Experience

Name	
Program	Masters of Industrial Design - EMDS
Desired occupation	Props building for film
Elective(s) with year	people + products - [redacted] multimedia (ergonomics, emotion + design (Premiere, director participation, design shockwave, sound 3D Modelling (Cinema 4D) design)
What courses have you enjoyed most in this program (briefly why)	people + products - I find the psychology behind why people like things. studio - design is fun, enjoy making models. drawing - felt I learned from Barry more than ever did in art school
What courses have you disliked in this program (briefly why)	Statistics - no fault of the prof, just find [redacted] numbers incredibly boring
Have you taken any breaks from program (include duration)	Y (8)

MKS March 2004

Figure 4.3: sample questionnaire

A sample from the Canadian study is shown in figure 4.3. The detailed responses to this questionnaire are shown later in table 5.4. The participants filled out the questionnaires

individually by hand. In all cases in this research, questionnaires are preformed face-to-face with all participants present. The separate groups were given the questionnaires collectively, and although the researcher explained each question one at a time, the participants were free to jump ahead and finish the questionnaire as they saw fit. The questionnaires form a text representation directly provided by the participants in response to particular questions. The responses are charted on Excel spreadsheets where the participants are only identifiable by the researcher. The spreadsheets document all the responses word-for-word written by the participants, which allows for easy cross-referencing with the verbal and visual materials.

The data collection techniques and mechanisms used in this research are designed to capture the design process milieu from several different angles. Once captured by videotape and still photography, the data are analysed over time again and again from several different perspectives. It is argued here that, in order to understand the design process more holistically, a more natural and open way of looking at what designers are doing is necessary. In this way, patterns of references through interaction during the design process are discovered. It is not uncommon for anthropologists to take the ethnographically oriented approach that is described here. Anthropology research teams will call in ethnography before developing a questionnaire (Bernard 1995:287) much like in this research. Furthermore, according to Russell Bernard (*ibid* 288):

> *The combination of ethnography and survey research is hard to beat when it comes to improving the description of complex human behavior patterns and unraveling important questions about how variables interact to produce those patterns.*

This empirical study combines observation and semi-structured interviews (ethnography) with questionnaires (surveys) in order to describe the complex nature of design. In the two field studies, the patterns and themes of references are revealed along with the similarities and differences in the studio cultures. These collection techniques are considered to capture designing in an educational context with as little interference as possible. However, creating two comparable studies requires a strict set of procedures.

4.5.3 Research procedure

In order to allow for a reasonable comparison between the UK and Canadian field studies a research procedure is developed. It is recognized that no situation can be duplicated exactly because participants and contexts always differ. The procedure is as follows:

1. Select a group comprised of senior industrial design students and an instructor who are willing to be observed over an extended period of time. The preferred size of the group is below sixteen due to manageability of data. When choosing a second group, it should be in a different location with a different context.

2. Select an appropriate design brief preferably from outside of the educational setting (*i.e.,* a design competition or industry liaison). The whole group should be working on a single brief as individuals (*i.e.,* not in teams), so that each participant is working independently towards a common goal. The design brief should represent approximately 6-8 hours of work per week for the duration of 7-8 weeks. The design brief should represent a brief typically done in an educational situation.
3. Communicate closely with the instructor(s) of the study by establishing an understanding that the research process is non-threatening and will not involve criticizing the particular teaching philosophies. Provide documents that reflect a partial picture of what is being researched. Adhere to all ethical requirements by submitting documents that address all ethical concerns that relate to human subjects.
4. Visit the site in advance to assess technical needs, become familiar with the building layout, and de-bug any potential technical issues.
5. Brief the participants on the study including duration (the length of one project), expectations (the researcher is a participant-as-observer), the general goals of the research (to observe the design process as it naturally occurs), and the potential outcome (research dissemination). Present the ethics documents for review and emphasize that participants can withdraw from the research process at any time.
6. Perform the questionnaires that query personal details.
7. Observe the design process as it naturally occurs by collecting data with video and digital camera. After two weeks of pure observation begin the interviews in short segments once per week for three weeks.
8. Approximately half way through the study, interview the instructors as regards their explicit teaching methodology (see the interview schedule in appendix V).
9. Begin to transcribe the videotapes while collecting data.
10. Debrief the participants with a follow-up lecture illustrating some of the early findings and the value of being involved in a research project.

This section has described the data types, the gathering techniques, and the research procedures used for this empirical study. The data gathered represents raw materials in the form of tapes, notes, documents, and photographs. A good storage and retrieval system is imperative for storing and organizing the data to enable efficient retrieval and processing. The questionnaire responses are recorded into spreadsheets where the participants are made anonymous. The still photographs are ordered linearly according to times and dates, as well as according to individual progress. The videotapes are ordered chronologically and thematically (*i.e.,* pure observation, interviews with students, interview with instructors). The storage of all raw data is kept under lock and key to maintain anonymity and the intellectual property of the participants. The collection of data is sometimes the most enjoyable phase of research because the researcher is learning something new every moment from his or her participants. Data gathering involves establishing a rapport with a new community and getting to know the group, while maintaining the distance to intellectualize and reflect on what is happening in that community. Where data gathering is social, data processing is the opposite. It is best

described as a repetitious and lengthy sequence of activities. At the same time, data processing is an iterative process that involves a series of stages revealing a great deal of information about the participants and their context. It is described in detail in the next section.

4.6 Data processing

There are a variety of different approaches to processing and analysing qualitative ethnographic data. Currently different software systems called computer-assisted qualitative analysis (Weitzman 2003:310) manage large volumes of materials by linking data types and searching for indicators. Some of the software systems currently available are, for example, NUD-IST, Nvivo, and Code-A-Text. Computer-assisted qualitative analyses are not ideologically neutral because their structure imposes a linear, rational and sequential framework to analyse the data (Denzin & Lincoln 2003:53). Furthermore, researchers are known to be distanced from their field study and empirical materials when they use these tools (*ibid* 54). For these reasons, a more traditional hands-on method of analyses was adopted, which has the advantage of exploiting the researcher's understanding of design. However, whether software or traditional methods are used for analysis, the approach must be data driven and involve a recognizable structure.

After data gathering, the two levels of data processing begin with a goal to inform the research conclusions. Douglas Harper (2003:181) characterizes these two levels as reduction and display. Figure 4.4 illustrates the research analysis process.

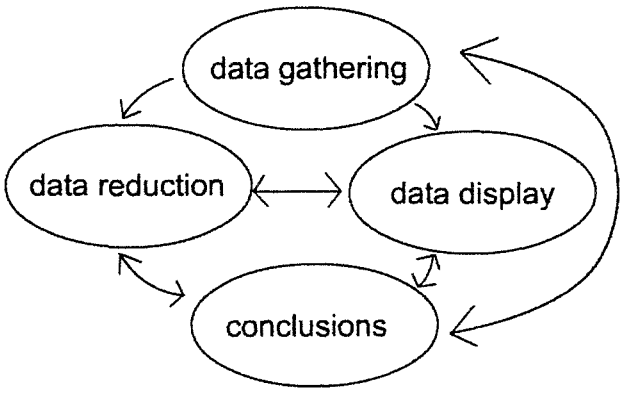


Figure 4.4: the iterative stages of data analyses

Data reduction involves choosing research questions, the collection instruments, and a conceptual framework as illustrated in chapters 1 and 3. Data reduction also involves summarizing data, coding, finding themes, clustering and writing stories. Data display is when data are organized, compressed and assembled in order to work towards conclusions. The first phase of data display is described in the previous section. The second phase involves establishing an order, structuring summaries, vignettes, and using matrices with text. Coding schemes are established in order to look at the details of the

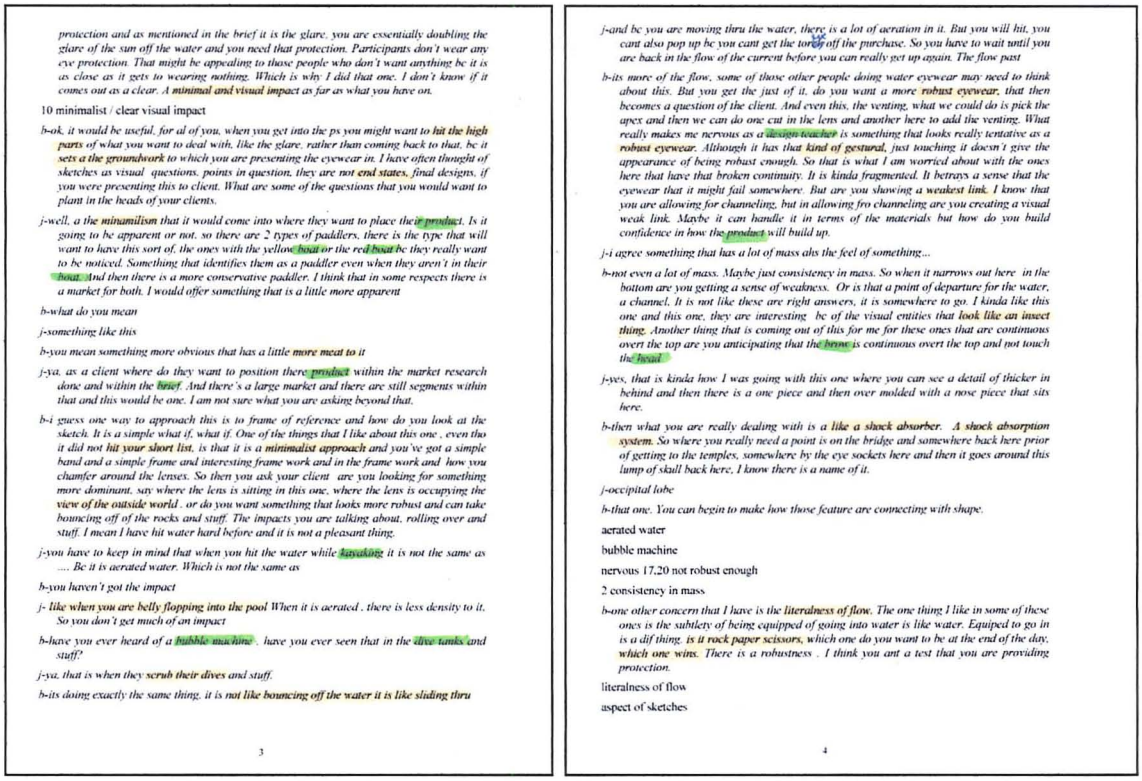
data. Following successive iterations of data reduction and the display of the conclusions begin to form. Data conclusions are drawn by deriving meaning from the displayed data. This is accomplished through comparing and contrasting, noting patterns and themes, through clustering, looking for negative cases, following up surprises, and finally checking preliminary conclusions with the participants.

The data from each study are processed and stored separately as two distinct field studies. The final stage of data processing is to compare the two studies. It is, therefore, essential that the data is processed in the same systematic way. The data represented in this research are predominantly qualitative. The questionnaires are considered quantitative data because the information is finite and easily processed. The questionnaires, as previously described, are documented on spreadsheets and used for discovering the references, particularly those that come from *outside* design. Qualitative data are less straightforward to process and are described in two levels. This section provides a breakdown of the data reduction and data display. These are followed by a summary of the iterative process in the subsection called multiple analysis techniques.

4.6.1 Data reduction

The first stage described is data reduction involves summarizing the data. Summaries are particularly relevant to the verbal data. To begin this process the data must be transcribed. There are many different ways to present the transcribed data depending on the analysis approach. Researchers in the social sciences believe that transcribing data is the first phase of analysis because it is not simply about collating data, but assumes a theoretical approach. For example, ethnomethodology and conversation analysis pay attention to the structure of talk, including every pause, overlap and intonation. The transcripts for conversation analysis are incredibly detailed and filled with codes that represent all things uttered by the participants. Oak's work on talk in design critiques is an example of this type of transcription and analyses (2001). Across the board, the transcripts of anthropologists vary extensively. The earliest examples are not word-for-word conversations but field notes taken by the researcher that approximate the situations, conversations, relationships and contexts observed. These early examples of transcripts are very controversial as these are considered to represent the values of the researcher more closely than those of the participants. Therefore, many contemporary anthropologists choose to combine field notes with audio or video recordings. Both are written up as transcripts that are considered either as one or as two sets on par with one another. Figure 4.5 shows two pages of the transcript from the Canadian study. For the empirical studies in this research, the data from video (verbal) and notes (researcher's

observations and reflection) are kept separately. The notes are not considered raw data and are merely used to aid in transcription. Therefore, all verbal data are recorded on videotape. These are transcribed word-for-word following the conversation in chronological order like a movie or play script.



protection and as mentioned in the brief it is the glare, you are essentially doubling the glare of the sun off the water and you need that protection. Participants don't wear any eye protection. That might be appealing to those people who don't want anything be it is as close as it gets to wearing nothing. Which is why I did that one. I don't know if it comes out as a clear. A minimal and visual impact as far as what you have on.

10 minimalist / clear visual impact

b-ok, it would be useful, for al of you, when you get into the ps you might want to hit the high parts of what you want to deal with, like the glare, rather than coming back to that, be it sets a the groundwork to which you are presenting the eyewear in. I have often thought of sketches as visual questions, points in question, they are not end states, final designs, if you were presenting this to client. What are some of the questions that you would want to plant in the heads of your clients.

j-well, a the minamilism that it would come into where they want to place their product. Is it going to be apparent or not, so there are 2 types of paddlers, there is the type that will want to have this sort of, the ones with the yellow boat or the red boat be they really want to be noticed. Something that identifies them as a paddler even when they aren't in their boat. And then there is a more conservative paddler. I think that in some respects there is a market for both. I would offer something that is a little more apparent

b-what do you mean

j-something like this

b-you mean something more obvious that has a little more meat to it

j-ya, as a client where do they want to position there product within the market research done and within the brief. And there's a large market and there are still segments within that and this would be one. I am not sure what you are asking beyond that.

b-i guess one way to approach this is to frame of reference and how do you look at the sketch. It is a simple what if, what if. One of the things that I like about this one , even tho it did not hit your short list, is that it is a minimalist approach and you've got a simple band and a simple frame and interesting frame work and in the frame work and how you chamfer around the lenses. So then you ask your client are you looking for something more dominant, say where the lens is sitting in this one, where the lens is occupying the view of the outside world , or do you want something that looks more robust and can take bouncing off of the rocks and stuff. The impacts you are talking about, rolling over and stuff. I mean I have hit water hard before and it is not a pleasant thing.

j-you have to keep in mind that when you hit the water while kayaking it is not the same as .... Be it is aerated water. Which is not the same as

b-you haven't got the impact

j- like when you are belly flopping into the pool When it is aerated , there is less density to it. So you don't get much of an impact

b-have you ever heard of a bubble machine , have you ever seen that in the dive tanks and stuff?

j-ya, that is when they scrub their dives and stuff.

b-its doing exactly the same thing, it is not like bouncing off the water it is like sliding thru

3

j-and be you are moving thru the water, there is a lot of aeration in it. But you will hit, you cant also pop up be you cant get the tore off the purchase. So you have to wait until you are back in the flow of the current before you can really get up again. The flow past

b-its more of the flow, some of those other people doing water eyewear may need to think about this. But you get the just of it, do you want a more robust eyewear, that then becomes a question of the client. And even this, the venting, what we could do is pick the apex and then we can do one cut in the lens and another here to add the venting. What really makes me nervous as a design teacher is something that looks really tentative as a robust eyewear. Although it has that kind of gestural, just touching it doesn't give the appearance of being robust enough. So that is what I am worried about with the ones here that have that broken continuity. It is kinda fragmented. It betrays a sense that the eyewear that it might fail somewhere. But are you showing a weakest link. I know that you are allowing for channeling, but in allowing fro channeling are you creating a visual weak link. Maybe it can handle it in terms of the materials but how do you build confidence in how the product will build up.

j-i agree something that has a lot of mass ahs the feel of something...

b-not even a lot of mass. Maybe just consistency in mass. So when it narrows out here in the bottom are you getting a sense of weakness. Or is that a point of departure for the water, a channel. It is not like these are right answers, it is somewhere to go. I kinda like this one and this one, they are interesting be of the visual entities that look like an insect thing. Another thing that is coming out of this for me for these ones that are continuous overt the top are you anticipating that the brow is continuous overt the top and not touch the head

j-yes, that is kinda how I was going with this one where you can see a detail of thicker in behind and then there is a one piece and then over molded with a nose piece that sits here.

b-then what you are really dealing with is a like a shock absorber. A shock absorption system. So where you really need a point is on the bridge and somewhere back here prior of getting to the temples, somewhere by the eye sockets here and then it goes around this lump of skull back here, I know there is a name of it.

j-occipital lobe

b-that one. You can begin to make how those feature are connecting with shape.

aerated water

bubble machine

nervous 17.20 not robust enough

2 consistency in mass

b-one other concern that I have is the literalness of flow. The one thing I like in some of these ones is the subtlety of being equipped of going into water is like water. Equiped to go in is a dif thing. is it rock paper scissors, which one do you want to be at the end of the day, which one wins. There is a robustness . I think you ant a test that you are providing protection.

literalness of flow

aspect of sketches

4

Figure 4.5: sample of the transcripts

The transcription includes notations regarding the participants' references to particular sketches, objects or images that were present at the time of conversation. These notations direct the researcher to the chronological files of still photos that relate to the verbal data. In this way, the word-for-word transcription is combined with the visual data session-by-session in chronological order. Besides summarizing data, data reduction also involves coding, finding themes, and clustering ideas. The general categories for analysis are based on the design process milieu model developed to target the references that come from inside or outside of design.

Figure 4.6 illustrates a break down of these categories for the inside of design.

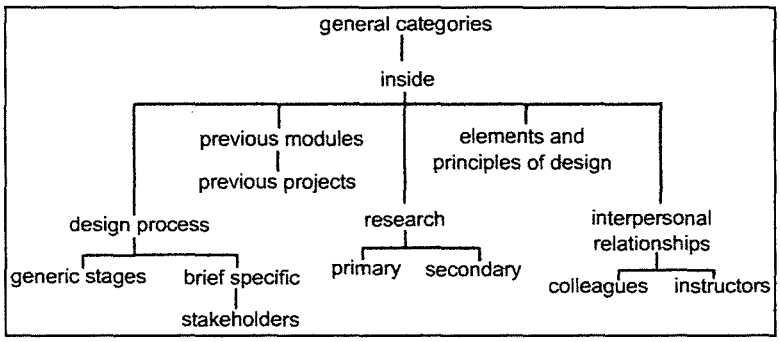


Figure 4.6: general categories relating to the inside of design

Figure 4.7 illustrates a break down of the categories for the outside of design. The general categories represent the initial stages of a coding system. In order to understand these categories, examples of references to these are sought.

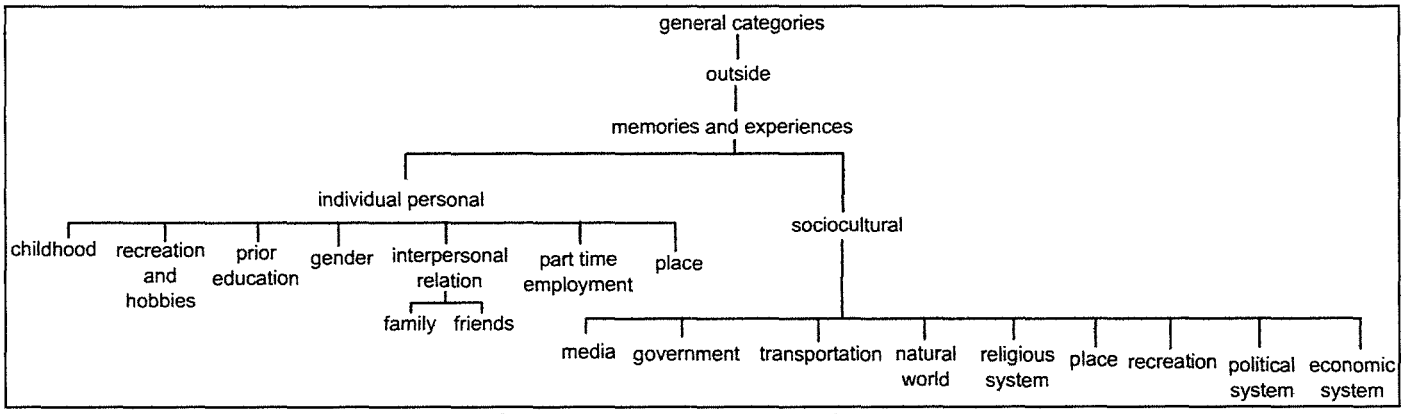


Figure 4.7: general categories relating to the outside of design

Data reduction, as previously described, is an iterative process. Therefore coding, finding themes and the clustering of ideas continues after data display. It is not necessary to describe data reduction and display chronologically as occurred in this study; therefore, the basics of data display used in this research are presented, followed by a combination of each in the subsection called multiple analysis techniques.

4.6.2 Data display

Data display involves organizing, compressing and assembling data in order to begin to work towards conclusions. From the general categories, coding tables in the form of matrices were created. The data are initially compressed and assembled according to these coding tables. All the transcripts are combed for indicators of these categories, which are shown charted on the coding matrices. The codes act as mnemonic devices to identify specific themes in the transcripts, a technique commonly used by anthropologists (Denzin & Lincoln 2003). By using coding tables, links are made within and across categories, thus allowing for themes to emerge. To these general themes more themes

and sub-themes were added during the analysis of each study. In this way, the list of codes is expanded throughout the process as new examples emerge that relate to the design process milieu model. Figure 4.8 shows a sample of the UK coding matrices.

Figure 4.8: coding matrix

For example, the codes relating to the inside of design (*e.g.,* structure, aesthetics, form) and the outside (*e.g.,* language, religion) were added as these were presented by the participants The specific categories used in the coding matrices for each study are shown in appendix VI.

4.6.3 Multiple analyses techniques

Having reduced and displayed the data into a form that is workable for analysis, a series of techniques are developed. Figure 4.9 illustrates this multiple analysis technique.

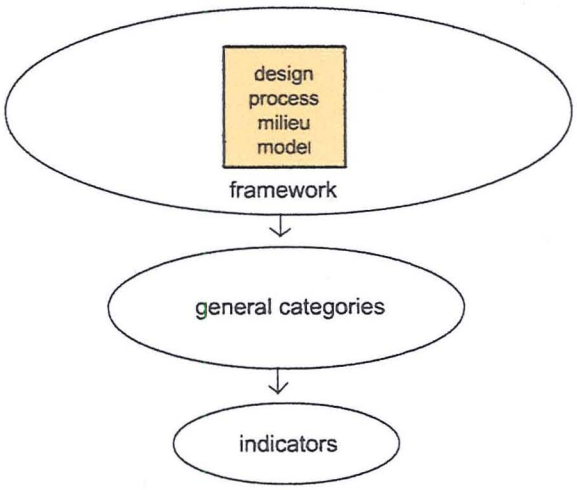


Figure 4.9: three stages of the multiple analyses technique

The categories and codes have been established in order to organize the observational data in a more objective form. Following this, a rigourous standard of analysis is completed. The data are initially sorted by session and by participant in order to provide a logical sequence and a sound foundation. Subsequently, the data are coded in order to

begin to establish the general nature of the references. The verbal and visual data are then posted by participant on large sheets as a time line and reviewed carefully.

The timeline includes all data — verbal, textual and visual references — and is displayed chronologically by day. This is an example of displaying the data differently in order to move towards further data reduction. The individual timeline is a vignette showing all the references of one participant. In addition to the themes and patterns emerging as a result of this display, the references are quantifiable by counting the totals. Additionally, they are charted-out as belonging to the inside or outside, the local or universal. Examples of this type of quantification are shown in chapter 6 by illustrating all the references of two participants from each study. These are displayed in the design process milieu model, which provides a clearer way of defining the references than the timeline. Furthermore, by expressing the individual participants' timelines, the design process is traceable on a general level.

Figure 4.10 shows one day of an individual participant's timeline from the UK study.

Figure 4.10: an individual participant's timeline

By itemizing the individual participants' timelines and reflecting on the coding matrix a simplified coding scheme is developed. This coding scheme (Geertz 1973, 2000), called the specific indicators here, involves searching for content morphemes, which are the parts of a sentence that carry meaning. These are nouns, verbs, adjectives, and adverbs that stand for objects, events, characteristics and relationships (*ibid*). References *are* content morphemes. For this research, these are divided into three different categories:

1. nouns (people, places, things);
2. metaphors and analogies;
3. and the individual's personal experiences and memories.

For each participant, the content morphemes of verbal references are combined with the visual references. These are charted out systematically week-by-week. References from

different participants are kept separate from one another, but are mapped out in parallel. These indicators relate to one of the quadrants in the design process milieu model. The specific indicators are colour-coded as nouns, metaphors and analogies, experiences and memories. As shown in figure 4.11 noun references are green; specific references to memories and experiences are yellow; and references to analogies and metaphors are orange. All the transcripts were coded according to these specific indicators and charted out systematically. The charts for each study are substantial in detail. The UK indicators are detailed over approximately 1 x 7 metres of chart; the Canadian over 1 X 10 metres. These charts provide an effective way of breaking down the references according to understandable references indicators, which are then placed within one of the four quadrants of the design process milieu model. The model is further used to define what the references refer to and acts as a system to display them.

Figure 4.11 shows a portion of the content morpheme chart from week two in the Canadian study.

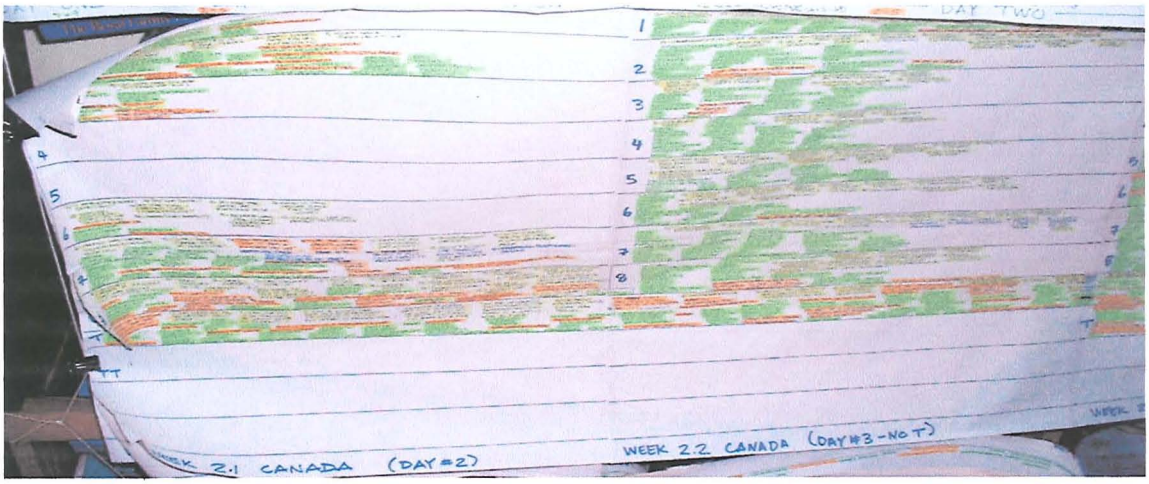


Figure 4.11: specific indicators

This section has illustrated multiple analyses techniques through an iterative research process combines data display and data reduction. A system that includes a coding matrix, individual participants' timelines, and defined indicators is described. This system used for processing the material is derived from the data and is used in both studies. The validity and reliability of the data depend on careful and thoughtful processing and analysing methods such as these. The reliability of data gathering and processing is further discussed in the next section.

4.7 Validity and reliability of the data

> *Validity refers to the accuracy and trustworthiness of instruments, data, and findings in research. [...] Reliability refers to whether or not you get the same answer by using an instrument to measure something more than once* (Bernard 1995:38).

The issues of validity and reliability are important while collecting and processing data. Bernard indicates that validity is about accuracy and trustworthiness whereas reliability denotes to what extent the same results will be obtained when repeating similar types of research. In ethnography, part of the validity of data is based on the time spent with the group being researched, not the number of participants in the study. This is because the data are collected under natural conditions where there are thousands of things that vary, including the number of participants involved in an activity. In addition, ethnographically oriented studies have high internal validity (Cuff 1991:6); that is, when the resulting descriptions ring true to the insiders these are considered to be valid. The ethnographically oriented study is deeply rooted in the observation of the naturally occurring design process and, as a consequence, the experiment is not truly controlled by the researcher. Furthermore, the researcher is considered one of the instruments in an ethnographically oriented study therefore a change in instrument has deep consequences on the resulting data gathered (*ibid* 63). Even so, the researcher acting as participant-as-observer has inherent characteristics of validity. According to Bernard (*ibid* 140-2) such research involves the following:

1. Being perceived as an insider is positive because complete strangers are not trustworthy, whereas friends and colleagues are.
2. Being perceived as an insider reduces the problem of reactivity. That is, the researcher is less of a curiosity and people are naturally more comfortable with him or her. Lower reactivity means higher validity in the resulting data.
3. Understanding the culture being studied helps to formulate sensible questions, which provides higher levels of confidence among the participants.
4. The role of participant-as-observer comes with an intuitive understanding of what is going on. This means that stronger statements about the facts being collected can be made.
5. The methods used for collecting data as a participant-as-observer can result in quantitative and qualitative data. These inform each other and may be used for cross-referencing, thus producing deeper levels of insight and understanding.

Participation-as-observation is a non-hierarchical interaction between the researcher and participants and a respected way to gather data. In this empirical study the researcher is an industrial design practitioner and educator. This enables a relationship of participant-as-observer because the participants are made aware that the researcher understands the nature of design. Furthermore, longer studies allow to develop a less invasive relationship since the participants are accustomed to the researcher's presence. The field

studies take approximately two months each, which is long enough to develop such relationships. Care was taken in this research not to become over-familiar with either students or instructors. Since the key participants are the students, it was particularly important for the researcher not to appear too close to the instructors. The students had to feel assured that the research had nothing to do with their final grades. Hence, the researcher carefully chooses modes of communication that are appropriate for both the student group and the instructors. For example, the researcher engaged with the students on a fellow-student level, whereas with the instructors the engagement was more on a fellow-instructor level. Even so, greater distance was maintained with the instructors than with the students due to the amount of time spent interviewing the students (*i.e.,* three interviews with the students and one with the instructors).

In this empirical study a single researcher fulfils the primary task of data gathering and processing. She gathers the data, yet other researchers can review the documented material on videotape. The same researcher also completes the data processing procedure; however, two additional researchers crosscheck the data processing. Involving more than one researcher implies that the validity and reliability of the data gathering and processing is tested.

Besides playing in her role of participant-as-observer, the researcher collected data — both quantitative and qualitative — with a variety of tools, with an eye on triangulation. Bryman (2001) refers to triangulation as a process of crosschecking information to ensure validity. Therefore, triangulation constructs a more encompassing perspective on specific analysis and cross-references information. Figure 4.12 illustrates the three methods used to triangulate and subsequently cross-reference data.

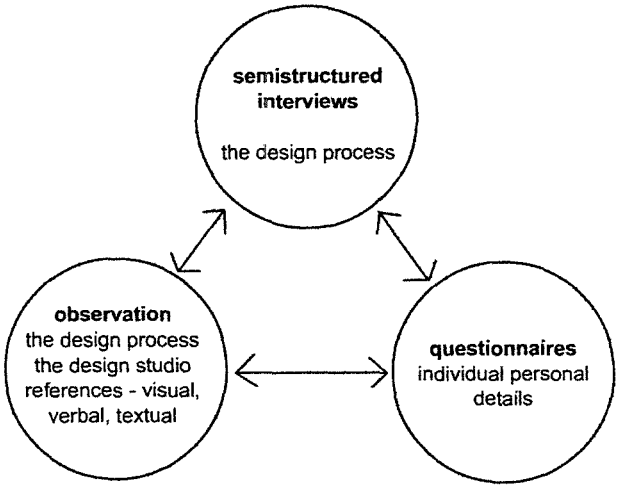


Figure 4.12: cross-referencing the data

Repeatability of the research depends on the attention to details in gathering and processing qualitative data. This is why these are described in thorough detail here. Data gathering methods involve a great deal of pre-planning prior to the onset of the field

studies. This results in a systematic approach that can be easily mirrored in more than one study. The data processing techniques search in detail for categories, codes, and indicators that provide an accurate representation of the references used during the design process of each study. The theoretical foundations for creating this coding system are also discussed in detail in chapter 3, in order to provide a reliable system of analysis. Finally, two different research sites are examined because of the speculative data processing system being used. This allows for cross-referencing between the sites and for preliminarily checking the reliability of the gathering and processing techniques.

Ultimately, one of the goals of this research is to produce a reliable method of description for looking at all references during the design process, including those created by forces *outside* of design. The work described here represents a first step towards understanding the design process from a different perspective, which necessitates the use of speculative approaches. In such case at least one pilot study is necessary. The following section provides an overview of the studies conducted in the context of this thesis. These include two pilot studies developed and used first, along with the two field studies that make up the bulk of this research.

4.8 Overview of the studies

When conducting research, it is common to engage in pre-studies or pilot studies in order to test the research methods. Prior to the two field studies, two pilot studies have been completed. It is important to note that, although the pilot studies provide some interesting answers to parts of the research questions, the primary goal of the pilot studies was to test the methods. Since the research results are not the focus in this section, the published materials that address these results are noted here, but the results themselves are not elaborated upon.

Pilot studies are completed in a variety of different ways; however, it is customary in research into sociocultural processes to conduct partial pilot studies, because complete studies are too time consuming. Compressed or partial pilot studies are used to test some of the methods with an eye to refinement. The pilot studies were completed in the order shown here beginning with pilot study 1. Pilot study 1 was completed independent of context whereas pilot study 2 was conducted as an ethnographically oriented study much like the actual field studies.

The focus of each study is as follows:

1. The preliminary pilot study [pilot study 1] compared the influences of design students at two institutions using semi-structured interviews only. Reflection on

this study allowed the semi-structured interview procedure to be refined. In addition, a comparative study established a method for approaching the two field studies in two different locations. Finally, pilot study 1 provided a comparison of different levels of design students, which provides a guide for choosing the group level for the field studies.

2. The complete pilot study [pilot study 2] is a mock field study using the observational methods as described earlier. This study is completed in order to de-bug and streamline the details of the research procedures. Along with this, the questionnaires were tested and the semi-structured interview questions were established. The variables were also reduced as a result of this pilot study (*i.e.*, design brief, gender).
3. The UK field study [UK 1] used the complete ethnographically oriented methods that incorporate observation, semi-structured interviews, and questionnaires. Data were processed prior to beginning the Canadian field study in order to develop a systematic method for data processing.
4. The Canadian field study [Canada 2] mirrors the gathering and processing methods used in the UK study.
5. The two field studies are compared.

Figure 4.13 illustrates the two pilot studies that informed the two field studies; yet fulfiled different purposes.

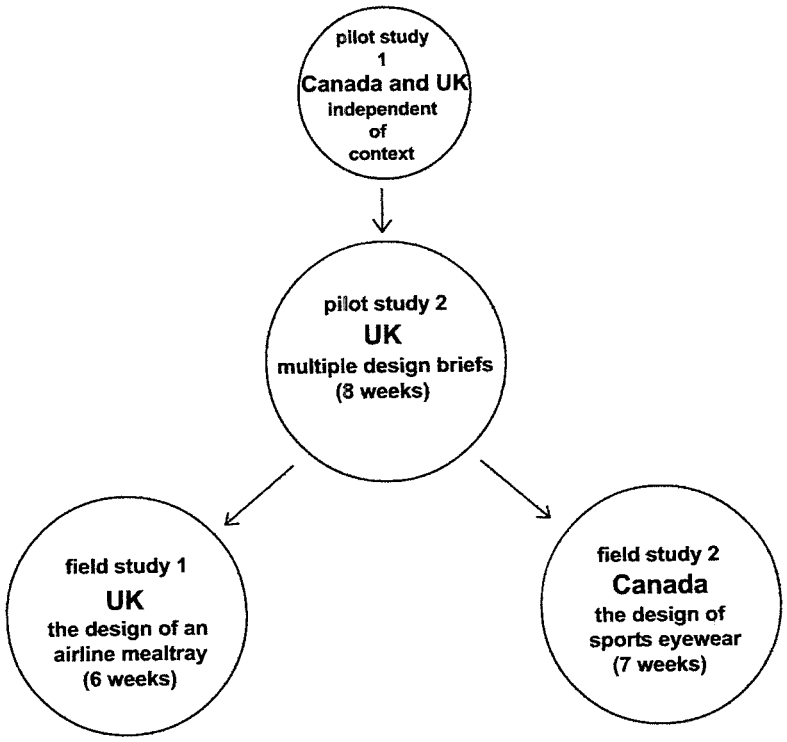


Figure 4.13: the two pilot studies as these inform the field studies

The aims and outcomes in relation to the methodology, and the lessons learned during the two pilot studies are described in the following subsections. The information about the pilot studies is followed by the specific details of the two field studies as they relate to these pilot studies. The subsections on the field studies introduce the similarities and differences of the data collected, which demonstrate to what extent these are comparable.

4.8.1 Pilot study 1 – interviews only

Pilot study 1 was set up to practice the semi-structured interviews, to establish the purpose for interviewing, and to develop a method for approaching and comparing two studies. Along with the interviews, the dynamics of the design studios and university contexts were informally observed and compared. The researchers had been engaged with design in practice and through teaching for a number of years prior to this study. The responses to the semi-structured interviews were loosely placed in the context of design education and the university. However, due to the informal nature of the observations on the most part this pilot study is considered to be independent of context.

Four groups of undergraduate industrial design students at three different design schools make up the participants of pilot study 1. One group was in the UK, the other three were from two different schools in Canada. Two of the groups were junior level students in their first year of study (UK and Canada); one group was comprised of second year students; and the final group involved senior year students. The interview procedure was identical with all four groups and involved a semi-structured situation using keyword prompts. Each participant was asked one question prior to the keyword prompts. They were asked to relate in each keyword category one example from the past or present that inspires or informs their present design work. Table 4.1 shows the eight keyword prompts.

Inspirational Source
Building
Three-dimensional product
Author (*e.g.*, fiction, non-fiction)
Automobile / vehicle
Movie / film
Music
Magazine
Designer including architect

Table 4.1: keyword prompts for the semi-structured interview procedure in pilot study 1

The students were interviewed individually in a setting familiar to them (*i.e.*, their studio or classroom). Due to the semi-structured procedure and the minimal information provided (the keywords), the interview is treated like an open-ended questioning period. However, notes are taken only for the responses to the keyword categories. The only documentation of this procedure is the notes taken by the researcher and the responses written by the participants. Prior to beginning the interviews the researcher introduced the research project to each classroom grouping as being about the design process. At this time the researcher emphasized that the interview was not a test and did not relate to

their class work whatsoever. The specific topic of inspirational sources was only revealed when the participant was one-to-one with the researcher, at which point they were asked not to discuss their interview with their peers until indicated by the researcher (*i.e.,* upon completion of all interviews). The participants were arbitrarily chosen from several specific class groupings. Ideally each member of the class was interviewed, but when this was not possible, an attempt was made to balance the participants chosen for the study in terms of gender. For example, one group interviewed consisted of 90 students and only 30 of which were randomly interviewed. The individual interviews took between 10 and 30 minutes each, depending on the participant involved. No attention was paid to the participants' current work (*i.e.,* the design brief's they were engaged with) or particular area of interest in design studies (*e.g.,* specific products, social science approach, technical approach) at the time of the study.

Data processing involved two spreadsheets for each class grouping. One spreadsheet included the country of origin, programme of study, year of study, gender, and age of the participants, the second detailed the responses to each keyword prompt. Detailed comparisons between two of the groups, one in the UK and one in Canada, are published (Strickfaden & Rodgers 2002). More important to this research are the details that inform the subsequent field studies. For example, it became clear through analysing and cross-referencing the spreadsheets of the four groups that, in general, the year 3 and 4 students gave more specific and detailed responses. This factor led to choosing senior year participant groups for the actual field studies. Several other significant outcomes lead to broadening the research questions to include 'references' and 'intangibles'. One key outcome of pilot study 1 worth mentioning was the high number of idiosyncratic responses and a lower number of design related responses. For example, one student responded to the query 'designer' by saying that he could: *spout off a number of designers, but that his response had to be 'God'*. This response was further supported with the statement that: *nature was the best source of inspiration*. Other idiosyncratic responses to the query of 'vehicle' include: *my feet, Kona bicycle, go-cart, and stretch-limousines*. This led the researcher to question whether the students were really referring to inspirational sources or whether their responses served another purpose. It is speculated that, in order to get to the root of inspiration, the responses need to be contextualised by associating the references with the project, the design studio and the design school. Furthermore, it was determined that tracking the references made by the participants requires a multi-dimensional research gathering approach.

A great deal of information was gained from engaging in pilot study 1. This includes understanding the need for clearer research questions, for broader testing procedures, and the best group profile to conduct the research with. In addition, the purpose of the semi-structured interviews changed from gaining specific information to being a support function for observing the design process holistically in real time. Pilot study 1 also served to develop a clear method for comparing two studies. All but the final point on comparing different groups were applied to pilot study 2.

4.8.2 Pilot study 2 – mock field study

The central purpose of pilot study 2 was to complete a mock holistic study using all data collection techniques and collection mechanisms, in order to de-bug and streamline the details of the research procedures.

A group of 23 undergraduate students and one instructor of design in the UK make up pilot study 2. Unlike the students, the instructor was aware of the aims of this research. The group was observed for an eight week period, in which students worked on a number of different design projects. Students had a choice of fourteen different design briefs, all from the annual *Royal Society for the Arts* (RSA) student awards design competition held in the UK [1]. Eight design briefs were chosen by the group and worked on by between one and six students over the period of the study. Table 4.2 shows the breakdown of these design briefs.

Design brief	Description	Number of students
Red	Exhibition design	4
Guerilla Graphics	Graphic design	5
Food On the Go	Packaging design	1
The Next Craze	Toy design	6
Re-innovation	Product design	4
Get Washed	Product design	1
Medical Devices	Product design	1
Mind Your Backpack	Product design	1

Table 4.2: the eight different design briefs

Pilot study 2 began with two questionnaire procedures that queried personal details about the participants including age, gender, design-relevant likes and dislikes, childhood, and educational background. These questionnaires closely resemble those used for the

[1] 'The Royal Society for the Arts' <www.rsa-design.net> Accessed on November 10, 2003.

field studies shown in appendix III. During the first session the student participants were introduced to the study as an investigation into the design process. Semi-structured interviews support the observation of the group and occurred once per week. The interview questions were carefully constructed in a non-leading manner, but were intended to dig deeper by finding connections with the participants' personal experiences and the artefacts being designed. The interview questions were determined from the information revealed by the participants, the RSA briefs, and the work occurring in the design studio. These questions are generic in nature and include the following:

- Summarize where you are going and where you have been in relation to your design brief.
- In terms of your design, where are you going?
- You've described your progress and shown me your work. Do you have any idea where your ideas are coming from?
- Can you relate your movement from this idea (sketch) to that (sketch) or to any particular event or experience you've had?

Queries such as these were relayed to each participant as systematically as possible. The interviews took place from the second to eighth week of this study. Observations during this pilot study were particularly challenging because of the eight design briefs. In addition, the instructor encouraged the larger group to breakaway into smaller brief- or theme-related groups. This is a common teaching strategy; yet, it is impossible to follow everything occurring within the classroom without numerous cameras and researchers. Furthermore, the studio activity was extremely dynamic, which produced poor quality audio with a great deal of overlap. Approximately four weeks into the study it was decided that only three of the design briefs would continue to be followed in detail. *Red*, *Guerilla Graphics*, and the *Next Craze* were chosen because they were taken by half of the group. Nevertheless, the interview questions were completed with all participants throughout the eight weeks even though complete observation was impossible. All interviews and observations of design activities were captured on video. There are 38 hours of video footage for the observation and interviews with students and five hours for the interviews with five different instructors involved in the programme.

Because of the large volume of video footage and the fact that this study was designed to de-bug and streamline the research procedures, only a portion of the data would be processed. The participants who were involved with the design briefs *Red* and *Guerilla Graphics* are transcribed word-for-word; these are selected because proportionately a great number of students were involved with these two design briefs. The results of this study are summarized and reported in a paper presented at ICED 2003 (Strickfaden & Rodgers 2003a). Along with providing an interesting forum to begin to examine the design

process more holistically, this study served two other main purposes as described earlier. The ethnographically oriented approach potentially provides an excess of data that is difficult to process through data reduction and display. Pilot study 2 provided the opportunity to establish necessary boundaries around the next field studies. These include using a single design brief, involvement with a smaller group, and considering the reduction of other variables such as gender. In addition, the instructor in this pilot study, who was familiar with the overall research project, made some leading remarks about influences and individual personal information. This highlighted the need for a more generic description of the project, along with treating the instructors involved in the research as participants. In addition, the details of the procedures were pre-tests, such as the questionnaires and the semi-structured interview questions.

Pilot study 2 provided a forum to pre-test procedures and to refine the details for the field studies. This mock pilot study using the observational methods allowed for the observation, semi-structured interviews, and questionnaires to be integrated in the most effective way. Most importantly, pilot study 2 emphasized a need for close communication with the instructor to understand his or her plans and enable a more streamlined observational procedure while keeping the central research question confidential. The ethnographically oriented research procedure is conducted as systematically as possible; however, because the design process is so dynamic part of the procedure is to remain flexible from the perspective of the researcher. For example, despite all efforts to have two studies of equal time and overall length for the actual studies the UK group used their time in the studio very differently from the Canadian group; moreover, the Canadian group was given extra time to finalise their project whereas the UK group formally did not have an extension but had the rest of the year to finish the project. The UK and Canadian field studies represent different design contexts as the result of numerous variables. The following two field studies also considerably differ in terms of approaches to teaching design and studio and design school contexts. Some of these will be discussed in chapter 5.

4.8.3 The UK and Canadian field studies

Methodologically the field studies mirror pilot study 2 in that they follow the ethnographically oriented procedures described earlier in this chapter. Key differences; however, include:

- specific times were booked for videotaping observations and interviews;
- interview questions were set and established in advance of each session;
- and the data were processed systematically.

The instructors for each study communicated classroom procedures in advance, which assisted in streamlining the research process significantly. These procedures provided greater focus, continuity and ease of repeatability. The research procedures are presented earlier in this chapter; however, for clarification these are reiterated here. During the first session of each study, the participants were presented with general information about the investigation. They were informed that the research was about the design process and asked to engage with the design brief as naturally as possible. In addition, the ethics review documents were presented and the participants were informed of their rights as research participants. Subsequently, the participants were asked to fill out two questionnaires (see appendix III): one about personal identifying information and the second about their present educational experience. The remainder of the session comprised of observation. A detailed breakdown of all weeks in each study can be found in the appendix VII. The interviews took place in the third, fourth, and final week of the UK study; and in the third, fifth, and final week of the Canadian study. These were paced so that the participants were accustomed to the researcher before the interviews took place. The interview schedule (see appendix V) had been established from pilot study 2 and followed systematically.

Examples of the questions are as follows:

- What have you been looking at that is informing the work you are doing right now?
- What do you do to get your ideas forming and moving?
- Tell me about your weekly routine.
- How do you find juggling four different modules, your social life and part time work?
- What is moving you along in this project?
- How did feel about this project in general?
- How did you decide which concept to choose?
- How do you feel about your final solution?
- Where did the ideas of 'x' come from?

Along with interviewing the students, a one-hour interview was conducted with the key instructors involved with the students in order to document their personal and professional backgrounds. A questionnaire (see appendix III) was used as to guide during these interviews. The information from these interviews provides material to cross-reference with the student observations and interviews. It also aids in determining which references relate to the inside processes of design and which to the outside including the intangibles. Moreover, the interviews with the instructors provide a broader understanding of the studio culture and the particular approaches to teaching design.

The data collected from each field study are processed as described earlier in this chapter. Table 4.3 compares the volume of raw data and transcripts of each field study.

UK	Canada
25 hours of video footage of observation and interviews with students	40 hours of video footage of observation and interviews with students
3 hours of video footage of interviews with instructors	3 hours of video footage of interviews with instructors
221 still photographs	590 still photographs
159 pages of transcripts	443 pages of transcripts

Table 4.3: raw data and transcript comparison

Table 4.4 illustrates some of the key similarities and differences between the two groups involved in the field studies.

UK	Canada
BSc (Honours)	MDes
Industrial Design	Industrial Design
4th Year students of a 4 year programme	2nd Year students of a 3 year programme
11 Students	8 Students
Design & Media Arts	Environmental Design
Social Sciences	Interdisciplinary Studies
In-flight Meal Tray	Sports Eyewear
2nd Brief of the year	3rd Brief of the year
1 Primary Instructor	1 Primary Instructor
1 Support Instructor (not present during studio time)	1 Support Instructor (present 50% of the studio time)
1 Support Instructor (not present during studio time)	1 Visiting instructor (rarely present during studio time)
3 x 1 Hour interview with Instructors	3 x 1 Hour interview Instructors
6 Weeks	7 Weeks
6-7 hours per session	3-4 hours per session
Once per week	2- 3 days per week
Emersion in the design school 8 months prior to and during study	Emersion in design school only during the period of the study

Table 4.4: comparison of the two field studies

It is clear that the data from the two field studies considerably differ in terms of volume. This variance reflects the differences among the two groups including different work patterns, work loads, teaching strategies, and sociocultural systems. Despite the considerable volume of data they generate, the systematic procedure described earlier in

this chapter is completed for each study. Ethnographic and qualitative studies are notorious for being extremely time consuming. Completing the combined transcription, data display, and reduction took more than eight months. This time spent in the field gathering data combined with the display and reduction is the key feature of ethnography. Procedurally the data gathering was identical in each study; however, the resulting data are remarkably different, reflecting the distinct characteristics of each group and the different approaches to design education and teaching. Each studio culture is presented in greater detail in chapter 5 and chapter 6 elaborates on the nuances of the studies (similarities and differences).

The field studies introduced in this section make up the bulk of the empirical study and the remainder of this thesis. Chapter 5 and 6 display the data in two different ways. Chapter 5 represents a rich description of the two design studios (the macro contextual environment of these studies); and chapter 6 uses the two models presented in the previous chapter to investigate the microscopic nuances of the design process.

4.9 Conclusion

The holistic, contextualized worldview of design and the questions posed in the research project described here necessitate the use of a variety of methods. Ethnographically oriented research methods are chosen because these involve methodological pluralism that embraces collecting quantitative and qualitative data, and that embraces the ongoing interplay between inductive and deductive approaches. In addition, the emphasis on the sociocultural context necessitates observational methods that focus on the complete experience of the individual (micro) as part of a collective (macro). In this way, the design process is seen from many viewpoints at once and the information can be crosschecked and examined for connections between all the design activities. The use of multiple-methods and the three collection devices provide vibrant, suggestive, engaging and passionate examples of the design process where a range of information about the subjects, objects and context of design creation are revealed.

This chapter has presented the theoretical underpinnings of the methods used for gathering and processing data along with how the research is performed, and how the data are assembled and displayed in two pilot studies and the field studies engaged in during this research. The next two chapters present the data in two forms followed by the conclusions. Chapter 5 is a description of the inside sociocultural environment of each field study, which provides the context to look at the references. Chapter 6 describes the references in a variety of different ways, including using the generic design process model and the design process milieu model. Chapter 7 wraps up with the conclusions.

5 Inside-local Environments of the Two Studies

5.1 Introduction

Chapters 1 through 4 have presented the theories and methods to investigate some of the macro and micro issues that relate to the sociocultural processes in design. Relating literature is identified in chapter 2 and the theories that guide and result from this fieldwork are described in chapters 3. Chapter 4 continues by identifying ethnographically oriented methods as the tools to enquire in a more open-ended way (inductive approach) but also as those that allow an investigation into specific references (deductive approach). The holistic perspective taken in this research allows the parts (references) to be seen as wholes (environments) where these are understood as intimately connected (Peacock 1986:17). The aim of this chapter is to present a rich description of the inside-local environment of the two field studies. The individual references are meaningless without context, particularly those that are more abstracted and furthest from industrial design and the artefact being designed. When the references are paralleled with the context (whole) meaning is revealed therefore understanding the contexts of each study is shown here in detail in the form of rich description. It is in the convergence of inductive and deductive approaches that sociocultural references are explored in detail in this thesis.

Field studies in anthropology treat the group's interactions with one another and their time spent together as a whole. This whole is defined as 'culture' in anthropology and is found in the multiple influences on the inside-local environment making up the design studio culture. According to Peacock, *culture does not float in a vacuum; it is sustained by persons who are members of society...*(*ibid* 34). As previously indicated, culture is created and defined by specific groups. All design groups have their own particular culture, but are also involved in the broader cultures of neighborhoods, the cities, the nations and of western civilization. On the most basic level, understanding culture includes observing what is happening inside (internal) a group and defining that which comes in from the outside (external). An inside-local environment consists of a network of

persons involved in a group including how those people relate to one another. That which is brought from the outside is linked to the sociocultural capital of the individuals who are part of the inside-local network. Along with the design process milieu model the descriptions of the design students' inside-local environments or 'cultures' are outcomes of this research. This chapter looks at the inside perspective by revealing some of the characteristics of the studio cultures in the two field studies separately. These inside-local environments include the sometimes tightly knit, thickly textured interactions, and the rituals that are embodied and sustained within each of these groups. The collective, shared cultural framework is described in each context including specific and general details about each group. Chapter 6 continues along the same line by examining the internal and external perspectives, but does this through deconstructing the design process and including specific details about each environment (inside-local, inside-universal, outside-local, outside-universal).

In particular, this chapter zooms in on the information that is relevant to the focus of this research such as the programme of study, the design school, the educational approaches and instructors, and each studio culture. Some of the descriptions relate back to the materials on design education and the studio environment previously reviewed in chapter 2 and appendix I. More specific details about the design briefs and the populations of each study are provided in appendix II and IV. The details about the design brief provides the basis for the discussions that take place over the course of each study and the details about the population provide important information pointing to the cultural capital of each participant. This chapter begins with the UK field study that took place in Scotland and is followed by the Canadian study that took place in western Canada. These are followed with a description of the characteristics of each studio culture.

5.2 Inside the UK field study

This section provides a context for the field study that takes place in Edinburgh Scotland in the UK. The UK is considered to be the place where industrial design and industrial design education were born. This strong tradition remains today unmatched by other westernized countries, as illustrated in appendix I. There are more design schools in the UK than in any other country in the world, many of these being affiliated with prestigious universities and others have emerged from polytechnic schools. There are several design schools in Edinburgh that act in competition and collaboration with one another. For example, it is not unusual for instructors to teach at more than one design school in the city, which leads automatically to cross-fertilization. It is also not unusual for instructors to

change positions by moving from one school to another. The notion of design and design education in Edinburgh, and Scotland in general, is likely more similar to British education than to American or European. This is partially due to closeness of geography and the fact that people tend to be educated at several different institutions. For example, the numerous instructors teaching at the design school in this field study are English and / or had been educated in England.

The context of the UK study sketched in the following subsections relates to the relevant information about the inside-local environment in order to better understand what is coming from the outside. The following descriptions are derived from the questionnaires done with students and participant-instructor, private interviews with four instructors from the programme, interviews with students and observations over the course of the six-week field study. This description of the UK inside-local environment includes information about the design school, the programme, participant-instructor and educational approach.

5.2.1 Design school in Edinburgh Scotland

The design school is situated in a university that has provided design education for over three decades and is considered to have one of the premier design programmes in the UK. This is verified by the UK's annual national review of universities, and the high number of international awards won by current and former students of the programme. The design school offers honours level degrees in design, which indicates that students have likely chosen the programme as a career move towards a design-related profession rather than having taken the programme for general or recreational interest. The design school offers degrees in three-dimensional design, lens-media and multi-media design. The three-dimensional design programmes include industrial design, consumer product design, design futures and interior architecture. All these degree programmes are taught in a school of design and media arts in the faculty of humanities and social sciences. Traditionally the school of design and media arts has taught the students an interdisciplinarily-guided programme with a philosophy of providing rigourous professional training set within the creative arts and informed by critical theory and research practice[1].

In this school industrial design is considered to be a bridge between the arts and sciences and is seen as a hybrid in the UK university education system. The strengths of the programme according to the industrial design programme leader are illustrated through an interview with him.

[1] The details about the programme are taken from information published on the university's website.

He says that the industrial design programme at this university was:

> *The first programme that tried to marry the arts and sciences. It is classed as a hybrid — not proper engineering and no artistic freedom like artists. We tried to bridge the two. The strengths that the students leave with are technical competence and an ability to present a well-argued presentation about products. In general the ideas that are produced are not as creative as at an art college but what you see is pretty realizable not just concepts.*

Excerpt 5.1: description of some of the programme strengths

The industrial design programme offers a BSc degree that is predominantly taught within the school with service modules taught through the school of engineering. While this was considered one of the strengths in the past, it is now considered one of the key weaknesses. In the same interview the programme leader states:

> *We have struggled to get enlightened engineers to deliver their end of it. We had a really good team 10 – 15 years ago when we had some good engineers who understood the role of design. For example, we had a strong input form the polymer area. One of our students came out with a high expertise in polymers. But this was in the past.*

Excerpt 5.2: description of one of the programme weaknesses

The participant-instructor echoes the strengths and weaknesses noted by the programme leader. In a separate interview conducted at the onset of the field study, he says:

> *One of the strengths of the BSc programme is its breadth on paper. They have a range of different things that are brought together — theoretically they know about materials. The breadth of the programme is a reflection that they have to be generalists and not specialists in their fields. But there is a cultural difference between what they want [the engineering teachers] and what we want [the design teachers]. The students cannot answer simple questions about materials because it is taught too abstractly. It needs to be taught more practically.*

Excerpt 5.3: participant-instructor describes the strengths and weaknesses of the programme

This design school challenges the notion of industrial design by encouraging students to think critically through combining design, theory and technology. Industrial design embraces product design, manufacturing technology, entrepreneurial studies and material culture. The current BSc industrial design programme is phased out and will continue as a BDes in consumer product design within the next two years. There is some concern about this shift; however, it seems as though there has been a natural progression towards it. The instructors in the programme agree that the programme no longer fits the original vision. An instructor emphasizes this during an interview by stating that:

> *They [the group of instructors teaching the BSc students] had their doubts and were uncertain if the BSc stands up in comparison to others.*

Excerpt 5.4: an instructor describes the perceived state of the BSc programme

This interview excerpt and the overall discontent with the service modules identify the general state of the BSc programme as not meeting the instructors' expectations. Whether these perceptions were the impetus for change or the result of the pending change is unknown. However, the shift from the BSc industrial design to the BDes consumer product design where all modules are taught in-house by design instructors is regarded as a move towards more control of the teaching materials.

The facilities for this industrial design programme are considered to be fairly typical to most design schools. Figure 5.1 shows the fourth year industrial design studio door and the university computer barns.

Figure 5.1: BSc industrial design studio door and the school's computer barns

The students have 24-hour access to the studio and computer barns. The design school also has a workshop for fabricating models, mock-ups and prototypes. The workshop accommodates woodworking, plastics forming (*e.g.,* a vacuum former), and metalworking equipment. The design studio is comprised of a blackboard for instruction, a larger central meeting table, a computer linked to the Internet and a spray booth for painting models. Figure 5.2 shows some of the equipment in the design studio including the computer, meeting table, and spray booth.

Figure 5.2: design studio and equipment

The fourth year industrial design students have their own design studio, modified to suit the needs of the instructors and this particular group. The individual students have their own drawing tables and boards for pinning up work.

Figure 5.3 shows several drawing tables and one of the boards.

Figure 5.3: individual students' workspaces in the studio

This design studio is a vibrant and dynamic space that changes on a daily basis. The students along with their instructors enable these changes. The changes in the space depend on what projects are due and what stage of the design process the students are engaged with. For example, the design studio at this school is used for all types of design activity including instruction, discussion, researching, drawing, model making, and critiques. Therefore the room is constantly being modified to enable these activities. On average the students spent at least 30 hours per week in this studio space. Spending such a concentrated amount of time in one space means that the studio becomes highly valued by those individuals using the space. This is considered part of the studio culture and will be discussed later in this section.

The UK design school boasts a well-established interdisciplinary programme that is one of the earliest hybrid arts and sciences industrial design programmes. The students attracted to this design school are primarily from Scotland and England; however, on occasion there are international students. In addition, students who wish to spend a year at another design school are supported to do so. Of the students currently enrolled in industrial design at this school, one had just returned from an exchange in North America. The resources and facilities available to the students are considered to be above standard (*i.e.,* the university library is stocked with an excellent range of design books). The design school as described in this subsection is one of the major contributing factors in defining the inside-local environment.

5.2.2 BSc industrial design programme

The first year of industrial design is a non-specialized year of studying the foundations of design. The first year of study predominantly focuses on teaching the skills necessary for designing. Following this the students choose their design major. The second and third years of study are comprised of design studio; debates in design including theory and history; contemporary design issues such as sustainability, materials and manufacture, design management and a variety of electives. All the modules are delivered as separate units within the 15-week term. According to the programme leader the module system has an enormous impact on how design is taught because there is less opportunity for team teaching and subsequent fluidity in the delivery of materials. In an interview the programme leader states:

> *The modular system is limited because of the large blocks of time. The experience is gone and this has an enormous impact on design. You cannot always teach something in 15 weeks, especially because everything is problem-based and about multiplicity. With the modular system you say we did polymers last year and we wont do it again so we cover something else.*

Excerpt 5.5: description of the limits of the modular system

Three male instructors, including the participant-instructor, teach within the industrial design programme. Among the three there is a range of teaching and industry experience. The programme leader has been at the university for over twenty years. He has a diverse background in teaching and industrial practice. The programme leader is educated in the UK but has a Scandinavian / Norwegian family background. His interests lie with the social aspects of design including human factors, longevity of design, and green issues. He states that design:

> *Is not for the self but for people to engage with other people's conditions and not reflect their own. [...] Design shouldn't just keep the wheels of consumerism going.*

Excerpt 5.6: programme leader's core view on design

Fritz Schumacher and Victor Papanek, influential pioneers of design-for-need form the 1960s and '70s, personally impacted the programme leader during his studies. The industry experience the programme leader accomplished is considerable. He worked on a range of products including electrical heaters, an MP3 player, and a range of wooden toys to be constructed by the unemployed for charitable organizations. In addition, the programme leader is married to a jewelry designer, a situation that has created a forum for him to question the notion of craft versus mass production.

The second instructor involved in the programme is primarily responsible for design theory and criticism. He is the only one of the three who holds a PhD in design. His background is in painting, fine art and history. He has taught at several different institutions including

one in Hong Kong. He was appointed to do research at this university eight years previous to this study, but has been doing more teaching in the last three years. Since his focus is less practical and more academic, he is involved primarily with teaching students critical and cultural theory in years two and three, and in supervising dissertations in the honours year.

The majority of the students at this design school enter into the first year of study, but some gain direct entry to year two or three. In this study two student-participants gained direct entry into year two of the BSc programme; one of them based on the merits of his portfolio, the other as a transfer student from another institution in the UK. Another significant point is that two participants (different from those who gained direct entry) took a year out from their programme of study. One student took a break after the third year in order to study abroad. The second took a year out after the second year of study for unknown personal reasons. Direct entry and taking time out from the programme are both relevant to this study in so far as these participants have slightly different educational and personal experience levels (sociocultural capital) than the other participants. For example, three out of these four students are considered by the instructor to be top of the class. Their experiences at other institutions, time away and maturity relative to the other students apparently provides valued contributions to the design process. Therefore, it can be said that knowledge gained away from the design school are valued equally, if not above, that which is gained on site. The background of the individual students is summarized in appendix IV.

For the first half of the fourth year the students work on design studio projects such as competitions and their honours dissertations. The second half of the year focuses on a final project that is a physical manifestation of their written dissertation. The UK field study took place during the first half of this particular group's fourth year of study. This was before the onset of their honours project, but along with researching and writing their dissertation. The D&AD design brief was delivered in a module titled 'user-centred design'. The goal of the user-centred module is to place the end-user at the centre of the design and development process. The focus of the module is for the students to develop skills in collecting primary information through empirical studies about the user by using a range of research tools such as interviews, focus groups, and questionnaires. One instructor is responsible for and taught this module; however, the students could obtain advice from the two other instructors responsible for two concurrent modules (*i.e.,* their written dissertation and honours project). Another module the students are engaged with at the time of the study is serviced by the school of engineering and is a module on

materials and manufacture. The students have daily contact with the three core design instructors but not with the engineering instructor.

The D&AD design brief is the second design brief of the year. The first brief is from the *Royal Society for the Arts* (RSA) student awards design competition held in the UK. The RSA brief was titled *Get Washed* and involved re-inventing getting clean by creating an innovative problem solving solution for bathing and showering. This brief emphasizes a function-led project designed for constrained space that is inclusive and safe. The participants had finished the majority of their *Get Washed* project when they began the D&AD brief; however, they were refining the presentation details in order to send their work away for judging. The design brief used in the field study presented in this thesis is called *Design of an Airline Meal Tray*. The design brief and what is entailed with the project is shown in appendix II(a).

A cross-section of what is entailed in the students' programme of study in the UK has been summarized in this subsection providing an overview of part of the inside-local environment. Evidently, what the students learn is relative to these; however, this is also relative to the instructional strategies and educational approaches of their instructor(s).

5.2.3 Participant-instructor and educational approach

This subsection describes the participant-instructor's background and specific examples regarding his instructional strategies. These include his ideas about the Scottish education system, his perception of the students, his definition of user-centred design and some of the specific materials he uses as teaching resources. His instructional strategies are varied and include using personal anecdotes, and using metaphors, and analogies to make specific points. These are detailed through specific examples taken directly from the transcripts and are presented as excerpts here.

The participant-instructor has been teaching for ten years at this university. He began as a technician and part-time instructor of computer aided design (CAD) and life drawing. He describes the earlier years at this university as being a team effort where many boundaries were crossed, which provided him with an ability to create detailed finished models. His background provides him with a range of expertise in design problem solving, detail model-making, materials and manufacture. He takes pride in having built furniture from exotic woods such as teak and mahogany. Along with teaching full-time at this university he is teaching an evening module at another design school in Edinburgh. He has not worked in industry as an industrial designer.

This instructor has taught a number of CAD programmes including *RoboCAD*, *Alias*, *MicroStation*, *Rhino* and *SolidWorks*. Even so, he does not believe that the CAD model is a substitute for a physical model. He stated in an interview:

> *Design students need to know how things go together. Those who fix cars or fit kitchens on the weekend have a fundamental understanding of how things go together and they are better design students. [...] The workshop is equal to the library in a design school. [...] We need to offer a broad range of three-dimensional design — they do not get this now. And they need to do it in the physical sense.*

Excerpt 5.7: importance of physical model making

The participant-instructor feels the students do not experiment with materials and that there is a sensitivity that is missing because of this. In the same interview he says:

> *There is a lack of exploration in materials, which means that they tend not to design with materials in mind because they haven't explored with them.*

Excerpt 5.8: a weakness in the students' approach to design

The participant-instructor stated that he learned his instructional strategies from other instructors at this university and through personal experimentation. He describes his teaching approach:

> *Delivering a set of learning outcomes in different ways. A lot of teaching comes from having to try things. I lose the edge when trying certain things that others suggest. My spirit is lost a bit — watered down. It is a negotiation with the students where projects are pretty flexible. [...] I tend not to tell students 'no' and let them explore. I dislike rigid structures and try to keep things fluid. [...] I try to pull things together as I need them. There is no over-arching approach.*

Excerpt 5.9: UK participant-instructor's teaching approach

This fluid approach is emphasized when the participant-instructor describes that the students need to begin with a "position", but that otherwise things always differ from group to group and year to year. He says that he does what he did the year before, but since it is such a different group with different project resources for every module, it is impossible to plan all things. He prefers to maintain a level of spontaneity. The participant-instructor also explains how he tries to draw out what the students want to do by focusing on their individual interests. He divides their interests into two general groups including those who are *future gazing and more experimental*, and those who are *practical and want to design something for today*. The participant-instructor discusses a particular admiration for the programme leader. He indicates that he learned a considerable amount about teaching and design from him. He says that the programme leader has the ability to *get students to do bizarre things and get the spirit from them by engender enthusiasm.* In general the participant-instructor promotes individuality and a high level of quality in physical and CAD modeling.

Along with being influenced by colleagues at the university, the participant-instructor uses a number of different books to support his teaching. Figure 5.4 shows the primary books

students. The studio space is a combined accumulation of previous projects, current projects, research materials, and objects of interest to the students. On average the students spend between 40 and 60 hours per week in this space. As a result, the studio is used as a workspace, a discussion space, an eating area and a sleeping area. The studio is considered to part of the studio culture and is discussed in detail later in this section.

The Canadian design school boasts an interdisciplinary programme that focuses on *design thinking* while teaching the basic skills to design. International students are attracted to this design school and come great distances to study. Students rarely take time out from their study schedule; however, they have the opportunity to complete one term of study in Barcelona. The majority of the students in this field study were slated to participate in the study abroad component of their programme in the upcoming term. The resources and facilities available to the students are considered to be of superior standard (*e.g.,* housed in a relatively new building with natural lighting and ample space for each student, a number of classroom spaces and lecture halls accessible for a range of instruction styles). As with the UK design school, the design school is one of the major contributing factors in defining the inside-local environment.

5.3.2 MDes industrial design programme

The master's of design programme at this design school takes two to three years to complete depending on past experience. If the student holds an undergraduate degree in industrial design it is possible to complete the programme in two years. Because all of the participants in this field study do not hold degrees in industrial design they are all intend on taking three years to complete the programme (see appendix IV). These students require approximately two years or five sessions of taught modules prior to beginning work on their major project. The project typically takes two to three sessions of work or nine to twelve months[3]. A session at Canadian universities is four months in duration therefore a year is divided into trimesters or three sessions.

At the onset of their programme of study in design the students attend a design camp with all the students from the Faculty of Environmental Design. At design camp the first year industrial design students mix with students in architecture, environmental design, environmental science, planning, and urban design. The design camp was held at Fish Creek Provincial Park. Fish Creek, a small watershed that flows into the Bow River situated on the southwestern edge of Calgary. In previous years design camp was held as an overnight retreat; however, it was a day camp lasting one week for this group. The

intent of design camp is for all the students to join together and get to know each other and support cross-fertilization among the design schools within the faculty. The interdisciplinary teams worked on a design exercise together; however, following design camp the students noted that they did not keep in touch with the students from the other faculties. For example, one participant (CAN6) said:

> *You don't have classes with them for the first year. So there is too much of a gap there to really make bonds with them. If we had classes with them immediately then I could understand.*

Excerpt 5.25: interview about meeting people during design camp

Although the consensus among the students is that design camp is not particularly useful as a design activity, most of them agreed that it is useful socially. The design camp to Fish Creek has the potential to create a strong culture among the students and even if this was not done explicitly, which is examined in greater detail in the section on design culture.

The core modules in this MDes programme include an introduction to industrial design, workshop in industrial design, four levels of design studio, research methods in industrial design, computer applications, drawing skills, ergonomics, and the history and theory of industrial design. In addition to full modules there are block courses, design clinics and charettes that are offered each year. For the purpose of this thesis these three types of modules are considered synonymous and are defined as compressed modules. Compressed modules are delivered by practicing designers or visiting academics and completed over reading week, a week that is typically a university holiday. One of the instructors describes charettes as:

> *We have week long block courses and they are a half credit courses that are really intense and run for a week. A design charette is just a really intense design project. Manzini was for a block course. A charette is a week long project to make a video or something. There are certain block courses [...] that are designated as charettes.*

Excerpt 5.26: defining a charette

The students must take at least two compressed modules over the course of their studies in order to graduate from the programme. These include the following:

1. Participatory design with senior citizens / aging society offered with Liz Sanders from Sonic Rim in this year.
2. Sustainable living offered with Ezio Manzini from Italy.
3. Furniture design offered with Douglas Ball from Herman Miller.
4. Emotion and design with senior citizens / aging society relating to medical design offered with an instructor from the design school.
5. *Cinema 4D* computer explorations offered with an instructor from the design school.

[3] From the 2003/2004 academic calendar.

The compressed modules taken by each participant are detailed in appendix IV, which also identifies the electives taken by the students prior to engaging on the current design brief. This programme is focused on industrial design with the majority of the modules relating directly to industrial design, which is not the case for all master's programmes in Canada.

The first year of study involves a foundation year and consists of studio modules and a number of electives. The primary instructor along with a supporting instructor taught the studio modules to this group of students. The first year is described by one of the student-participants as (CAN5):

> *[It was] a lot of plasticine. [...] Little models that the first years have. Dealing with relationships of dominant and sub-dominant and subordinate. Between planar and rectilinear and organic shapes. That went on forever. Then we did another plasticine we had to go from one item to another item. [...] Then the final project in the first year is a wooden toy that based on simple mechanism.*

Excerpt 5.27: first year of studies described by a student

One of the instructors describes the foundation year and his responsibilities for the group during this time:

> *I had them almost exclusively for the first term. Materials and production, drawing, Solidworks, and design studio. I went to the IDSA conference a few years ago – you can now buy this book – it is called the Elements of Design about Rowena Reed Kostellow and her foundations course at Pratt. It is all 3D projects. I thought this was a weakness and [programme leader] and I were putting together a stronger foundation course. So I took this book and this was the first group we did it with. We got them to do everything out of plasticine because nobody has drawing skills and nobody has shop skills and we needed a medium to have them engage design with.*

Excerpt 5.28: foundation year described by an instructor

Other projects that are completed prior to the onset of this field study include the design of an oil lamp, a chair, a toothbrush, an LED lamp, and a table. The projects are approached in order to teach theory and design, materials and design, social issues and design, and also to provide a breadth of experiences in designing. For example, there are two collaborative projects with groups outside faculty and university. One is with *Light Up the World*, an organization that works toward providing low power lighting for developing countries. The other is with *Noh Bec*, a community in the Yucatan peninsula of Mexico. The community is comprised of 150 families that control the resources of the area including tropical woods. The students were asked to work on wood products and marketing while considering the community. These types of projects unmask this design school as having a high level of social consciousness. The issue of sustainability in design is widely discussed and explored due to the programme leader's involvement with the Dutch group *Eternally Yours*. One of the first projects encountered by these students was to design a lamp in the style of *Droog* a popular design group also from The Netherlands.

The focus on sustainability is also present among instructors beyond the school of industrial design. One of the programme instructors who teaches this group some of their other modules is an architect who is well-known for his work in environmentalism and sustainability in design. These examples of approaching design with a conscious (*e.g., Light Up the World*, *Noh Bec*, sustainability) begin to illustrate an aspect of the design culture, which is elaborated on in more detail later in this chapter.

Five full-time male instructors teach within this industrial design programme. As previously mentioned, part-time instructors are brought in as specialists to teach along side the primary instructors. Together the five instructors represent a range of teaching and industry experience. Although only one full-time instructor was interviewed for this study, the programme leader is known to have a PhD in design research and a background in engineering and was educated in the UK. The three instructors involved with this field study are discussed in detail in the next subsection.

All of the participants in this study entered the programme at the same time and did not take any time off since. Although three students had design related degrees (two have fine art degrees and one has a degree in architecture) all students were anticipating a three-year programme of study. At the start of the field study, the students had completed approximately one and a half years of their studies. The design brief, *The Design of Sports Eyewear* shown in appendix II(b), is the final project in the taught modules before beginning their major design project. For the first half of the semester (approximately two months) the students worked on projects in their design studio that are not related to this design brief. The module these projects are delivered in is called Industrial Design Studio II. It is intended to introduce students to complex design problems where a variety of issues are identified, analysed and resolved through assigned design projects. Issues such as human factors, materials and manufacturing technologies, and design history and theory are some of the areas for exploration. In addition, upon completion of this module the instructors expect students to have achieved a professional standard of competency in the areas of sketching, presentation drawing including CAD, technical drawing, model-making, presentation skills, design management, and human factors. Within this module three projects are assigned including the one observed in this thesis. The first project involved the design of a personal media device. Students worked in pairs and used Futurism or Dada as a theoretical context for the artefact. The second project overlapped with the first and entailed the design of two desktop speakers for computer use. This project was a styling exercise to create the housing for the existing internal components of a speaker set. An

interview with one of the instructors revealed how he felt about the outcome of the first two projects. He says:

> *I think that the projects this term have been quite successful. They had to investigate theory and they had to investigate those principles, reinterpret those as they might apply today and then design a project around that. Then they did the speaker project and that was supposed to be a quick project where they were supposed to take the guts of a speaker and basically generate a piece of eye candy for their portfolios.*

Excerpt 5.29: two earlier projects described by an instructor

One primary instructor is responsible for the module and the students; however, as previously mentioned a second support instructor contributed considerably. A visiting instructor is also present throughout the majority of the project; however, he was involved with the students only informally. Besides from these individuals, students could obtain advice from other instructors on the faculty. One student particularly admired one instructor outside of this module and consulted with him consistently; however, the instructor is not interviewed during the course of this study. In addition to taking this module, students were engaged in two to three concurrent modules: design criticism, multimedia and / or people and products (ergonomics and anthropometrics). This subsection has sketched the industrial design programme as part of the inside-local environment as described by the instructors and students involved. This environment supports the leadership that is provided by, in this case two key participant-instructors, which is outlined in the next subsection.

5.3.3 Participant-instructors and educational approach

Like in the UK field study, the following description of the instructors, their personal educational approaches and instructional strategies is derived from the questionnaire and interview with them along with observations. Each instructor's background is detailed, followed by specific examples of their individual and combined educational approaches. The primary instructor is discussed in greater detail followed by the information about the support instructor. The influences of the primary instructor are tracked by the approaches he takes, which include use of metaphors and analogies, and learning linked to previous or senior students' work. The influences of the support instructor are followed by his approach to teaching design and his interest in and subsequent use of popular culture. While both instructors use varied educational approaches, some things are common between the two. That is, they both use popular culture and personal anecdotes to connect with the students personally and collectively. The instructional strategies that are used with the group conclude this subsection.

The primary instructor has been teaching for seven years at this design school. He began as a part-time instructor but has been full-time for the past three years. Prior to teaching design he was a diving coach for approximately nine years. In an interview, he says that one of his biggest teaching influences is his experiences as a coach and his interactions with other coaches. For example, he says:

> *I was a coach for diving. The biggest influence has come from diving coaches I have worked with. I teach design like I am a coach. It is similar to standing on the pool deck.*

Excerpt 5.30: teaching design is like coaching

Along with a decade and a half of teaching experience, the primary instructor holds two professional degrees in design. His first degree, a bachelor's in architecture, was completed at a university in eastern Canada. His second degree is a master's in design completed at this design school. This instructor also has several years of industry experience, having designed over one hundred commercial consumer products. Some examples of these are baby products, sports and leisure products, electronic products, computers, medical products, and telecom products. He says:

> *I started architecture school when I was 17 and then for awhile I lived and breathed design. I've done mostly commercial consumer products. Lots of electronics. It has all been in Alberta. Computers. Medical products. For people with disabilities. Telecommunications. I did a bomb proof phone once [...].*

Excerpt 5.31: CAN primary instructor discusses his design experience

One of the projects he discusses with the group is called a swing jacket. It is a product that he designed to aid in golf training. In a one-to-one interview he says:

> *It is a golf training aid. It helps people to learn muscle memory. It was a private contract. Launched a few years ago.*

Excerpt 5.32: a product designed by the CAN primary instructor

In week two, when students are trying to define their projects, the primary instructor (PI) uses the swing jacket as an example to motivate the female student (CAN7) to consider gender in her project.

> *PI: [...] Ummm, and you know and another thing to consider is when I worked on that swing jacket. It brought up issues of gender within the sporting world. One of the things that was mentioned in that is that women, if they will get a good golf swing out of it they are more willing to wear it and to use it and they wont feel goofy or whatever. So I am thinking that it might be a good idea to rather to focus on the top male surfer to focus on the top female surfer. Because they might be the ones who are more willing to break with the norm.*
>
> *CAN7: I don't know if it communicates that in surfing. I don't know if there is such a look about it that it doesn't [pause] like golf doesn't have a look about it that is associated with cool.*
>
> *PI: There is a golfing culture. There are baseball hats and golfing shirts and there is a look like right and you can really stand out if you do not have that particular look. I think that there is a feel of I'll tough it out. I don't want to look that goofy on the golfing range. Women might feel that.*

Excerpt 5.33: CAN primary instructor uses the swing jacket as an example

This instructor has an obvious interest in sports design, which is part of his cultural capital and highly relevant to the design brief students are engaged with. It is likely that the design of sports eyewear is chosen as a reflection of this expertise. When asked what his sports interests were, he responded by saying:

> *[...] I was a competitive diver a long time ago. Some people get off on extreme sports but I find standing on a 10 metre tower with the balls of your toes on a board getting ready to throw yourself off to be pretty thrilling. Once you have gone there, there is not a lot that will get me in terms of a thrill seeking venture. I have tried rock climbing once, but nothing seems to hold my interests.*

Excerpt 5.34: CAN primary instructor's interests in sports

When asked which sports he participated in, he said to have tried skydiving, snowboarding once, mountain biking casually, and cross country skiing. While teaching it seemed as if he had been involved in each of the eight sports that students were designing for because of his enthusiasm for their projects, but in fact, he had only participated actively in three (*i.e.,* skydiving, swimming, mountain biking). Other interests he discussed were a desire to travel more extensively and that he enjoys assembling model kits. The primary instructor clearly has a broad background, given his high level of expertise in industrial design. Therefore it is understandable that he is a key instructor in the programme. Although he is a junior instructor compared to some of the other faculty members he teaches a significant amount of the course materials to the first and second year industrial design students. He is responsible for a material and manufacture module, drawing modules, *Solidworks* (CAD), first and second year design studios, and master's degree project supervision.

Besides his cultural capital being highly compatible with industrial design practice, being a teacher, and the design of sports equipment, the primary instructor admits that he admires and has been influenced by the programme leader. He has also been influenced by a number of people in his adult life including lecturers and instructors he had as a student. He references two books as being influential on his design teaching: *Design Drawing* by Francis Ching (1997) and *Elements of Design Rowena Reed Kostellow and the Structure of Visual Relationships* by Gail Greet Hannah (2002). In this interview excerpt the primary instructor talks about the importance of figure-ground relationships, something that is presented in each of the books he refers to. He expands his understanding of figure-ground relationships to involve context. He uses the example of the first project he taught this term, where the students used the philosophical underpinnings of Dada and Futurism to design a personal media device.

When asked what things may be influencing the teaching of this project he says:

> *This particular project [pause] I always talk about the figure ground relationship [...]. It is a lot about formal dominance. The layers and how you frame the vision on that. How the eye wanders and it bounces all over the place. Ching has a good book that references this. Depending on what you focus on in figure ground relationship. Every issue is within a context. So that everything is about figure ground. So this goes back to the ships and boats. A lot of people seem to flatten issues. They see issues two-dimensionally and they equate it with something that is miniscule because they lose sight of what is over here. Figure ground allows you to follow what is dominant and how issues are stacked and which are ships and which are boats. Then we see that we can sus out and which ones get stacked. So there are layers of figure ground and then things are stacked on. [...] The figure ground relationship is key. Designers have to deal with so many different things when designing and they need a way to do that. This is what the Dada and Futurist project was about, it is about how you frame the project with a context and being aware of that.*

Excerpt 5.35: CAN primary instructor talks about perceived influences on the student's project

Metaphor use is quite common throughout the primary instructor's teaching. He uses the metaphor of 'ships and boats' a number of times, for example to describe the kinds of concepts the students are creating. Really big concepts are 'ships' and the concepts that are sub-themes or iterations of these are 'boats'. The primary instructor further explained that it is possible to keep boats on ships, but that ships are too large to be put anywhere but in the ocean. The metaphor of ships and boats is used with the students prior to this project. Therefore, it is part of the language and of the group's common understanding of design. For example when the two instructors (PI, SI) have a desk critique in week three with a female student (CAN2) who is working on motorcycle glasses, the student brings up the idea of ships and boats by saying:

> *CAN2: I think that the feminine is a source of power and a source of empowerment and I think that during the feminist movement they had to go to an extreme to show that they were equals with men. But I don't think that this has to go to that kind of extreme to show that they are gender neutral. So to be feminine is empowered anyways. So from those sorts of ideas I was thinking of five ships.*
>
> *SI: Ships and boats?*
>
> *CAN2: I was trying to think of five main ideas.*

Excerpt 5.36: using the metaphor of ships and boats in a design discussion

The concept of ships and boats comes up a number of times but not with all students. It seems as though it is brought up specifically when a student is developing a 'ship' and the instructors wish him or her to focus on 'boats' in their design.

Another interesting metaphor that the primary instructor uses is the idea of 'upstream-downstream', which he discusses briefly during one of the critiques with the group. The primary instructor (PI) is discussing how to write the assigned 'positioning statement' with a student (CAN8) who intends to design sports eyewear for kayaking.

The instructor begins:

> *PI: [...] When you started talking about the specifics about how people get in and leverage the flow of water to get what they are after, that is when my own excitement starts to rise up. That is what you need to get into with the positioning statement. You know that upstream-downstream diagram. I have drawn before in the drawing class and stuff?*
>
> *CAN8: Yup.*
>
> *PI: This is your real kick at the upstream thing. Part of what you are showing is how well you have listened to the kayakers. What are they looking for is how well you've listened and taking what you know about them and presenting it back in a way that has resonated with you. [...] If you can really spell it out to them in a way that really captures their imagination then they are more likely to be on board to completing the rest of the project with you. So it's a bit of a dog and a leash. Trying to find that angle and that hook.*

Excerpt 5.37: using the upstream-downstream metaphor while in discussion

During the interview, the primary instructor explains what upstream-downstream means and how this links to previous work:

> *One of the things I teach is the role of the industrial design within product design. It came about in thinking what type of CAD package to buy. I present this in the drawing class and the production technology course that I teach. I broke it down into two directions. Upstream is every product that gets developed that has an executive behind it. It can be the designer. It can be the boss. And the role of the designer is that [pause]. They call, the executive signs the cheque, and sustains the process. When you are the designer, then sus out the options. The parameters are identified. Upstream is pitching the ideas to keep writing the cheques. The downstream bit is when you have sold your product to the executives and you have to send it off to someone to make it. The engineers and the shop tech and so on. So it is important because the executive has signed off your design intent and has approved it. I could cover upstream with hand drawn stuff and I needed a powerful CAD package to do the downstream stuff. I kinda made this up.*

Excerpt 5.38: upstream-downstream defined by the CAN primary instructor

When the instructor speaks about ships and boats and upstream-downstream design two things that are happening. First of all, he is speaking in metaphors. He is teaching by providing examples of known things that are linked to understanding the new concept he is describing. In the case of the ships and boats, it is an important concept that tells students how to put limits on their designs. Upstream-downstream is another metaphor that is used to describe a characteristic of design, in this case, different modes of visual communication for different audiences. The use of the phrases 'ships and boats' and 'upstream-downstream' is part of the specific language of this group; when the instructor mentions them, students immediately know what he is talking about. In linked learning, such as this, a known concept is connected to something that is unknown. Connections are made to existing known situations such as previous projects, previous conversations, and previous experiences.

Besides referencing concepts that have previously been taught to the group, there are numerous references to previous projects throughout the field study. Both the instructors

and the students bring up previous projects to present or understand new material. One of the earliest examples is when a student (CAN6) is trying to clarify the idea of the positioning statement with the primary instructor (PI):

> *CAN6: I think it is easier to design for a more succinct positioning statement. It answers questions that come up. I had a hard time designing the toothbrush last year because it was just designing a toothbrush and I couldn't justify why I wanted this one more than another*
>
> *PI: you need to establish a design rationale.*
>
> *CAN6: That was almost harder than design studio last year because this year there are answers. Yeah, they are your own answers but there are answers.*

Excerpt 5.39: using a previous project as an example

There are many examples of references to previous projects, especially to the ones the students just completed (*i.e.,* personal media device, speakers). The instructors, particularly the primary instructor, linked many of the things students are doing to what they had already done. He linked their current ideas, their current drawing skills, and their research to what they had personally done or other group members had done in the past. The links were appropriate in that they were personal when necessary and generic other times. An example of a generic link is when the instructor discusses how far a student's visualization skills had evolved throughout the year.

In another example of linked learning, the primary instructor made reference to work from senior students who were not directly involved with but known to this group. These references are made at several instances and generally to the students' master's degree project (MDP), for example:

> *PI: I just read an architecture MDP that tried to pick up on the skater attitudes. It was really cool because it took a look at the specific student*
>
> *CAN3: [name]?*
>
> *PI: Yah [name]. He took a look at daydreaming as a premise for architecture. Part of that had to do with the use of public spaces. It is interesting because what you are talking about and what the role of skateboarders is and the role of public space. [...]*

Excerpt 5.40: making references to senior students work

Throughout this field study, the primary instructor makes references to several MDP projects for various reasons. One is to encourage students to research their user group through known sources, another is to reinforce and remind students that they will begin their MDP's before too long.

The support instructor, as previously mentioned, teaches part-time along with practicing industrial design. The support instructor holds a bachelor's degree from a different design school in western Canada along with a master's degree from this design school. He has taught for two years at this school and worked in industry for ten years including having

worked in London England. His design practice experience includes working at various design consultancies and working in a corporate design department. He currently leads a design consultancy outside of the university. This instructor has worked on projects such as recreation equipment and electronics including computers and telephones. There are a number of individuals who this instructor feels have influenced his attitude towards design and teaching. Many of these were his instructors throughout his schooling. He comments on the individuals who have impacted him, both positively and negatively. Interestingly, some of the most influential individuals were shop technicians who he felt were very knowledgeable in the area of construction and materials. The support instructor does not feel that any particular books have influenced him. He considers himself more of a hands-on designer than a design thinker. He says:

> *[...] Useful information is technical data that comes from materials and manufacturers that can inspire about use. Design books for design sake are useless. I don't have books. Topics: mathematics and how geometry occurs in nature. Any book that explains how to do perspective drawings, how to illustrate, systems of proportion are useful.*

Excerpt 5.41: CAN support instructor describes the types of books he will reference

The support instructor clearly is very skills-orientated and very practical about design education and design in general. He feels that design is about efficiency (*i.e.,* designing with fewer parts and spending less money). He advocates strong physical skill development (*e.g.,* drawing, CAD) for the students and considers this as one of the programme's weaknesses. He indicates that drawing and CAD are what students will be doing first when entering the work force, and therefore these deserve greater focus in their studies.

Over the course of this field study the support instructor is present for approximately 50% of the classes. Normally he would have been present for all classes; however, other commitments did not allow him to do so this time. When he was present, the group dynamics changed considerably. This is partially due to his personality but also to his practical focus on form, materials, production and design skills whereas the primary instructor is focused on design thinking including content and process. In general the second half of the study, when the support instructor is present, discussions involve more design-specific talk relating to the actual object being designed.

Aside from his practical focus, one particular contribution from the support instructor is his love of popular culture, particularly science fiction films, television, and comic books.

In an interview he says:

> *[...] I encourage people to read and look at science fiction. Novels, movies, comics, toys. My grandmother who was a very austere Italian woman would never watch soap operas because it was a lie. People don't lead those lives, it is fake, it is a lie. And it is apparent to everybody. She would watch Star Trek because it didn't pretend to be something that it was not. It leaves you open to ideas. It could be this, or it could be that. I think that you can find really good ideas from something that is not part of our own belief system, all of the moral ideas. It is thought. It is invention for invention sake. You get ideas of what something that could be. What could this be? Not all science fiction has something new to see. You look at Blade Runner, a pivotal movie. It looks at good, bad, evil and how that should be defined. Right at the beginning there is a little piece of equipment that is not real and doesn't do anything but it could. I always encourage that. It is always good to think about what is not already there.*

Excerpt 5.42: CAN support instructor's love of popular culture

Throughout the field study, the support instructor discusses form making in industrial design as being connected to popular culture. For example, one-to-one desk critiques with students feature numerous film and comic book references initiated by this instructor. In the following discussion, he (SI) encourages a student (CAN5) to look at Japanese animé for inspiration. The primary instructor (PI) supports this line of investigation.

> *SI: The back issues, you can pick them up for a couple of bucks. Tell him [a friend who owns a shop he is recommending] what you are looking for. It is not the story it is the artwork. The story is irrelevant to you. I would say the anime is good. Not so much super hero stuff. [...] Futuristic, war. [...] That kind of thing. Go there. Not so fine art. And movies have a look at some of those [pause] of good quality. Not the cheap ones. Akira.*
>
> *PI: Yah, some of those good quality ones are pretty good. You can rent some of them at blockbusters [a video and DVD shop]. There is a whole Japanese animation section there. You have to be quite judicious about what you are looking for but ask ...*
>
> *SI: Yah, ask [name] at the comic store. Tell him that you wont want to take some of them home...*

Excerpt 5.43: discussion encouraging a student to research Japanese animé for inspiration

Both the primary and support instructors suggest films for the students to watch that might inspire the students work or provide them with information about the user group. For example, the movies *Jaws* and *The Real Cancun* are suggested for the student who is designing beach eyewear. *Jacobs Ladder, Falling Down, The Lawnmower Man, The Cable Guy, Permanent Midnight* and *American Psycho* are suggested for inspiration towards the design of paintball goggles. In general, once films are brought up as a topic of conversation, the discussions evolved into a banter about which films are best and why. It is clear that films are known by the majority of people and a common place to discuss pertinent issues.

Connecting with students on a personal level is a strategy that both instructors use in the Canadian field study. They consistently ask students about individual experiences and

seem to already know quite a bit about them. Evidently experiences with sporting activities (especially those relating to the eight sports chosen by the group) are a topic that brings out many personal narratives. There are numerous exchanges about being involved with particular sporting activities in all discussions, group and one-to-one. For example, the primary instructor swapped stories about skydiving with the student working on this sport, because they had each skydived. The support instructor relayed a recent snorkeling experience while in Mexico with the student designing beach eyewear.

Furthermore, the instructors seemed to be aware of the students' interests from previous discussions and commonly connected with these. For example in week three during a desk critique with one student both instructors began to talk about music to get their point across. They used music as an analogy to how a kayak moves through the water. It was not a coincidence that this analogy was used, since the student they were speaking with is a musician. The two instructors (PI, SI) talk to the student (CAN8):

CAN8: When you come out of the wave you can go right back in again.
SI: But that period out of the wave is a transition when you are going from intense to left or right. You choose then
CAN8: It is a fork in the road.
SI: It is a stop and start, stop and start.
CAN8: Yah, I understand what you are saying.
SI: As opposed to this issue that is staccato.
PI: It is a rhythm.
SI: Yah, it has a rhythm to it.
PI: So even when you are in that wave there is a rhythm to that as well.
CAN8: I think that is for sure.

Excerpt 5.44: music is used as an analogy to connect with a student who is a musician

The instructors attempt to connect with all students in this way; however, it is successful to varying degrees depending on the student and the situation. Some students are more distanced from the instructors and do not want to disclose personal information about themselves. For example, the international students have a different level of respect for their instructors and seemed judgmental of some of the personal banter. In addition, it is clear that the instructors connected better with some students, as evidenced by more casual and relaxed discussions with them. One student pointed this out as being 'favouritism' in an interview with the researcher. This student felt that some of the people in the group were liked above others. Even so, the instructors were consistent with each student. For example, the primary instructor repeated specific examples and cross-references he had mentioned with each student.

Besides connecting to the students' personal interests, the instructors use many personal stories and anecdotes to express and clarify ideas. The anecdotes used are varied and

range from narrations about television programmes, advertisements, and films to personal travel experiences. It is clear that both instructors are not afraid to reveal aspects about themselves by using their cultural capital to make their points. The primary instructor uses more personal anecdotes than the support instructor. In addition, the primary instructor made reference to numerous design related topics such as designers, books, and products. For example, he discusses the notion of reliability by using an example from Martin Heidegger.

In terms of instructional strategies, this study represents one informal lecture (delivered by the primary instructor), numerous group discussions, numerous one-to-one tutorials called desk critiques, two days of one-to-one tutorials for computer modeling, and three group critiques. The instructors spent a considerable amount of time with the students one-to-one. On desk critique days, for instance, the instructor(s) spent on average 30 minutes with each student.

A written handout is provided as documentation of the project expectations. The primary instructor explains the requirements of the project and emphasizes the need for sports eyewear that is independent of a helmet or other devices. At no time does he state that the project involves user-centred principles; however, this is implicitly known. The students are given strict deadlines that mark their progress during the design process. The defined markers are divided into four stages. These stages are shown in detail in the design brief, see appendix II(b), and are summarized as follows:

1. a design brief that identifies the sport, positioning statement, user group, market research and design statement;
2. a design exploration with twenty colour presentation sketches and five sketch models;
3. design development of the chosen design shown in a full-scale model including dimensions, details and colour;
4. and design detailing shown with four presentation boards, technical drawings, a monochromatic study model, and CAD models.

All students perform to the standards that are set by the instructors and produce all the work requested with one exception. Nearing the end of the project the students are attempting to create CAD models of their designs; however, several of them are struggling with this. One student approaches the primary instructor and convinces him to modify the project deliverables. As a result, a CAD model is no longer required. Nevertheless, two of the eight students manage to complete the CAD model despite this being lifted from the schedule. One interesting point about the defined schedule is that the instructors told students to stop when they attempted to move forward in the process before the allotted time. As a result the design process of this group shows a relatively

linear progression (as shown in chapter 6). Along with guiding the design process relatively rigidly, the instructors often give clues on how to enhance their process including tips on how to be creative. For example, when a student (CAN8) was feeling overwhelmed and unable to work on his or her design, the primary instructor (PI) and support instructor (SI) suggested a strategy to overcome the problem:

> *PI: When you hit a wall it is just about channeling it.*
> *CAN8: When I hit a wall I just go and work on papers.*
> *SI: There is nothing wrong with that.*
> *PI: Yah. Keep it in the back of your head. It is almost a gestation or incubation period in your head and you go and peel potatoes or write a paper or something and it works itself out. It was still going on in the back of your head. And then it is like, I can draw that. Why didn't I think of that before.*
> *CAN8: Absolutely.*
> *PI: But it needs a chance to formulate. To steep.*
> *SI: Steeping good.*

Excerpt 5.45: tips on the creative process

Other examples of assisting students though process include advice on how to achieve nicer drawings, how to create standardized drawings in order to compare designs, advice on model-making and CAD drawings, and advice on how to use their intuition.

The instructors in the Canadian field study foster an environment of independence and interdependence. Students are encouraged to challenge themselves personally while being supported by the group. Students are pushed to achieve a high standard by providing a clear list of deliverables and marking the design process at regular intervals with group discussions. Where the primary instructor's knowledge-base of design is broad with a slant towards an academic and thoughtful approach to design; the support instructor is more focused on the practicalities of design and developing the skills necessary to visualize at all stages of designing. The leadership of these instructors especially of the primary instructor and the subsequent behavior of the students is a major defining feature of the inside-local environment.

Through ethnographically oriented research methods information about the inside-local environment of the design school in western Canada has been revealed. This section outlines the contextual environments where references are made. The following section identifies the key cultural characteristics of each field study, which provides further context for understanding the nature of the references. These cultures illustrate some common characteristics but predominantly focus on the distinctive characteristics of each group.

5.4 Cultural characteristics of the two inside-local environments

The inside-local environments of the two field studies has been described as a network of people involved in a group including how those people relate to one another. These are elaborated upon by looking at the specific context, which are the design school, the programme of study and the instructors and educational approaches. It is known that schools are encultured institutions where socialization and focused knowledge acquisition occurs. Design education has a particular kind of enculturation where the physical skills and conceptual tools towards the practical application of design are developed, as detailed in chapter 2. The design studio is typically modeled after those found in industrial practice, which is exemplified by the two field studies in this thesis. Schön (1983:157) describes the educational studio setting as being a *virtual world* for experimenting in design. Within this virtual world the instructor typically provides design problems and the students work towards the solution. Design educators will usually agree that students learn what constitutes a problem, how to solve problems and what constitutes a reasonable solution (Cuff 1991:63) all while being encouraged to be creative and innovative. Furthermore, a good design student is typically perceived as one who produces a prolific quantity of drawings, sketches and models (*ibid:* 122). It is also commonly known that design education includes some one-to-one discussions between instructors and students, and critiques. In addition, design students are generally dedicated and work long hours. The result is a group of individuals who are usually tight knit and relatively cohesive. Enculturation in design includes design education in general but also includes the particular details relating to leadership and the philosophy of the school / programme. These influence the studio culture and define each inside-local environment as distinct. It is a misrepresentation to define any studio culture as homogeneous because of their inherent diversity, complexity and dynamic nature. This section identifies observations that are made about the studio cultures of each group examined in this thesis. The nuances of each group identified here provide a more focused look into the context that references are made.

5.4.1 UK studio culture

In the UK field study the individuals within the group define the characteristics of the studio culture. There are many levels of activities that occur within the studio as a result of leadership from the instructor, the focus of the teaching materials, the way the space is used, the perceived identities of the individuals, and how the individuals relate to one another as a social grouping. The characteristics of the UK studio culture is condensed because of the time that students spent in the physical space, for example, they spent approximately half the time in their studio compared with the Canadian group. In addition,

this group had one instructor whereas the Canadian group had two. These factors affect the amount of data collected (see appendix VII) about this group; even so, particular characteristics define this studio culture. Naturally, leadership defines the student-teacher relationship and sets the tone for how a group interacts with each other. Within the UK group the majority of the students consider the instructor to be an expert in design and have a high level of respect for him. The instructor consistently pushed the students to think for themselves; however, in general they do not have confidence in their own skills to engage in problem solving. The instructor is attentive and consistent with all individuals in the group. However, the lack of maturity in the group (see appendix IV) and a limited connection between the instructor and students (*i.e.,* they have never had him as an instructor before) are factors in how this group responds to the leadership.

One significant characteristic of the UK design culture is that, in general, the students are unmotivated, critical and negative towards the programme and project. For example, in an interview one student (UK8) said:

> *I feel a bit stale here at [the design school]. It is uninspiring. Design should be done in a hot house with a drive. Three years of this place is enough. I feel I shouldn't be designing in this frame of mind. I feel that just now I should go away and do something else. I don't know if it is just me right now.*

Excerpt 5.46: UK student expresses negativity towards the design school

And another student (UK5) said:

> *At the start of the year, I didn't get a buzz at all. At all. This is crap [about previous module]. I thought about the project. I really liked the idea and I would like to develop it but I didn't really think I did that until the presentation. [...] I felt very unsupported at the start of the year. All of us did. Shit, we really felt to be on our own. We expected to be on our own to some extent but [pause] and in fourth year you want to get on with design [pause] do a design project from start to finish. To be honest it's been [silence].*

Excerpt 5:47: UK student feels unsupported in his programme

In addition, several students criticized the design brief saying that it was constrained by *Corus* (*i.e.,* materials and manufacturing) and that their design would not make a difference for airline passengers. One student (UK8) said:

> *I hate this project. This is not a good project for someone like me. I know that they are saying that I could use steel but it is really restricted. I think there is not much that anyone can do with it. [...] You could probably do research that is interesting but then coming back to the brief, you couldn't use it. It is more and more restrictive.*

Excerpt 5.48: UK student expresses the restrictions of the design brief

Another student (UK10) said:

> *In order to make a difference you would need to redesign the whole system not just the food tray. This project is a shortcut to get there.*

Excerpt 5.49: more criticism about the project

This negative attitude towards the programme and the design brief is reflected in poor class attendance, lack of motivation to complete the project, and overall slow progress. Even with this high level of negativity two of the students had a positive outlook. One of these students (UK11) discusses his engagement with user-centred design:

> *The big thing for me is getting into the research process. Doing interviews and focus group stuff. Questionnaires. I think it is really good. I have been able to really focus on the aspects of the design that I want to work on and it hasn't been too wooly. I have been able to set goals and set targets and things to focus on. I have really enjoyed this. It's been one of my favorite things this year.*

Excerpt 5.50: UK student expresses why he likes the module and design brief

The instructor offsets the negativity and lack of motivation in a variety of ways. For example, he provides connections to past projects and information already taught in the programme and he uses personal anecdotes; however, neither is well received by the group. Only one student in the group complies with the instructor's suggestions, for example, this student (UK1) discusses his approach as a result of instruction where he researches designed objects and uses these as points for comparing his own work. He says:

> *Basically I am approaching this by looking at things. I was trying to draw and get an idea. It is particularly good. It is not exactly it [pointing to a page with a sketch and an printed image glued to the corner]. It is the metal and the finish of that thing that I like. I like the two different things together [a set of stainless steel with blue plastic Allessi salt and pepper shakers]. The colour [...] and this Allessi stuff. Plastic stuff. I tend to cut things out and show that it is metal. It is good to have something down beside it. It is next to it. This is not a new approach for me. The images came from the Internet. I found his website [Karim Rashid's] through core77 dot com. I think. All this is Rashid except this which is Allessi.*

Excerpt 5.51: UK student describes how he communicates his ideas with the instructor

Three different students' spaces are highlighted in figure 5.7. The student on the left (UK11) has previous projects, research materials, and a poster from a work project. The student in the middle (UK7) has a picture of his girlfriend, research material for *Virgin*, and a joke leaflet poking fun at George Bush. The student on the right (UK6) has a number of photos from his travels, research materials and a newspaper article.

Figure 5.7: personalizing the studio space

Another characteristic of this design culture is the lack of connection with the physical studio environment. In general it is surprising how little time the students spend in the space, for example, in the UK study the only time the studio is in use is during scheduled class times when the instructor is present. Even though each student has an allotted space with a pin-up board these are not used dynamically during the study. Some of the students have photographs and previous projects pinned up but many have blank walls. Figure 5.8 shows two group items displayed in the room during the course of the project.

Figure 5.8: website list and the Virgin wall

Another defining characteristic of this design culture is that the group is pro-technology. All students are reasonably proficient with computers and have varying skills with different computer programs, for example, with *MicroStation*, *Rhino, Photoshop,* and / or *CorelDraw*. The UK students take creative approaches to modeling and presentation, which results in design projects that reflect the individuality of each student.

Even though the instructor's background and interests lie in the area of physical model making, this group's approaches and abilities to create physical models vary considerably. Only half of the group build physical models, which are carved by hand from high density foam, made from paper stock and made using vacuum forming equipment. Of these, the majority are sketch models (foam and / or paper) with only one mock-up (plastic) created. Figure 5.9 shows three sketch models created by three different students (left to right UK1, UK11, UK6).

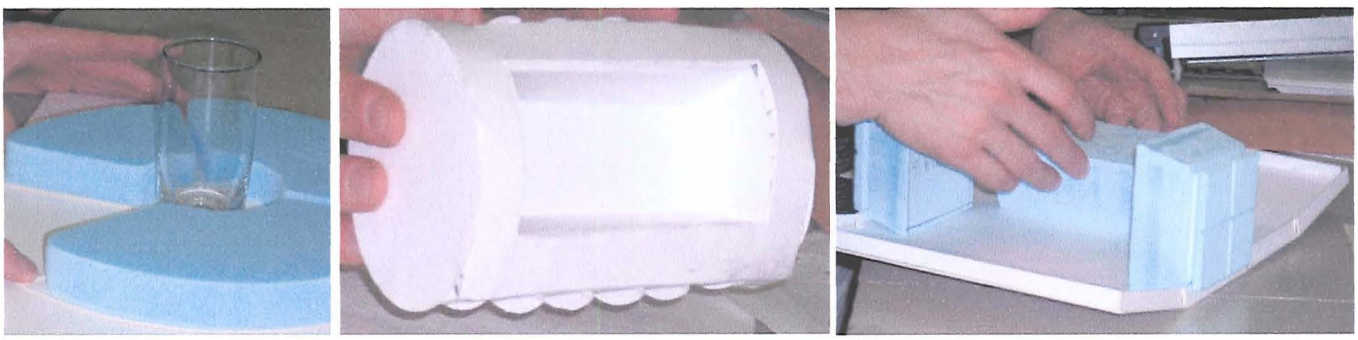


Figure 5.9: three sketch models

Yet another characteristic of the design studio within this group is an individualistic approach towards all aspects of the design process. This approach is a reflection of the

individual identities and the programme of study. For example, the individuals consistently work independently unless they are told to do otherwise. They do not consult with one another or engage with each other's work in any way. The instructor (likely unknowingly) encourages an individualistic approach, for example, the students rarely present their work as group but instead work one-to-one with the instructor the majority of the time. As a consequence, the UK group is not particularly cohesive in their design studies.

Although there is little cohesion while designing this all-male group is bonded by many common interests, which involve enacting a 'boys club' attitude on a daily basis. This occurs through casual discussions that generally revolve around sports or girls. For example, these students connect with one another as participating or not in sports activities and in contrasting a positive self-image with a negative image of others. They often speak positively about the sports / sporting teams they support while degrading all others. Discussions around girls involve those focused on 'real' girlfriends and / or fantasies about females in media.

For example, more than half of the group participated in creating a life-sized painting of the popular singer Kylie Minogue shown in figure 5.10.

Figure 5.10: life-sized painting of Kylie Minogue

Other gendered objects found in the UK design studio include images of scantly-clad girls, a pair of underwear pinned to the wall and photographs of girlfriends.

Hierarchy is a characteristic that is commonplace to group situations and involve distinctions made between differences in culture, family background, ethnicity, physical appearances, racial categories, and age. Hierarchical behavior is demonstrated frequently in this studio culture including, for example, elevating the newest group member's status because he had taken a year away from school traveling and studying. Other examples are another student is alienated because he did not attend class regularly and one is picked on for his accent (he is from the Orkney Islands). Yet another student comes from

a lower economic group and is treated as less intelligent by the rest of the group. Finally, another student is consistently picked on for being short in stature and quiet spoken. Hierarchy is taken to another level with the UK group, where the students take the usual jibes about differences further by modifying each other's names. In this way *markers* are attached to people that create further distinctions between them (Robbins 2001:170). For example, the small and quiet student has the term 'wee' as a prefix to his name and another student who has strong work habits and practices Christianity has the term 'Christian' added as a prefix to his name. The nuances that make each person an individual are judged by this group, which includes having no dedication, too much dedication, less financial status and greater financial status, having a girlfriend or not having one, and so on.

The final characteristic of the UK design studio involves typical Scottish behavior called 'taking-the-piss' out of someone. Taking-the-piss is a playful form of teasing that is common in this design studio. For example, one student (UK11) pins up a Chinese banner given to him by international students and as a joke another student (UK1) makes copy of the banner and put it up in his workspace. Figure 5.11 shows the two banners.

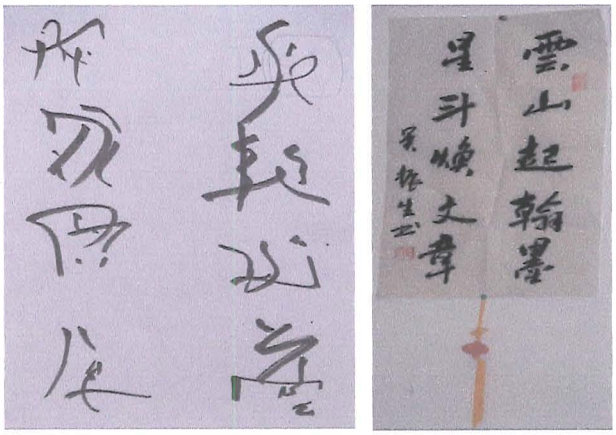


Figure 5.11: original banner (right) and the forgery (left)

Another example of this teasing was when a prank was played on the researcher when she went away on a short break. The students 'mooned' the video camera, complete with sticky note descriptors of who was who stuck on the bare buttocks of each student. The entire group was amused by the teasing and pranks played on each other.

The characteristics of the UK studio culture includes general attitudes (negativity, lack of motivation, pro-technology, 'boys club'); connections or lack thereof (with the instructor, physical environment); approaches (individualistic); and behaviors (hierarchical, playful). The complexity and ambiguity of any given studio culture is made apparent through the description of this one in the UK. Studio culture cannot be easily generalized due to the

range of factors and circumstances that affect the individuals and the group therefore the references that are made during designing reflect the characteristics of the studio culture.

5.4.2 Canadian studio culture

This section describes some of the characteristics of the Canadian studio culture by detailing student responses to the leadership, the focus of the teaching materials, the way the space is used, the perceived identities of the individuals and how they relate and interact as a group. Noticeably more data was collected about the Canadian studio culture (see appendix VII); this is because along with there being two instructors the weekly activities and the time the students spent in the studio is considerably greater when compared with the UK group. As a consequence the studio culture of this group is defined with a slightly broader range of characteristics. The students' responses to their leadership are complicated and multi-layered. In general the students show a high regard for both the primary instructor and the support instructor. They are respected by the group but not elevated. There is an understanding that the instructors' knowledge-base was not infinite and the students' own ideas were highly valued. The student-instructor relationship is that of familiarity and collegiality, this is because they have already spent considerable time together in first year of the programme. The majority of the students are independent and confident. They demonstrate confidence to do their own problem-solving in design and are able to defend these decisions. Of the group, the two international students demonstrate the least confidence in the group, which is likely due to a different cultural notion of the student-teacher relationship. For example, the Mexican student spoke of a high esteem for the student-teacher relationship where in the Spanish language there is a prefix used to address instructors.

The first characteristic of this studio culture is that the instructors and students make many personal connections between design work through personal stories and anecdotes. This personal talk is exemplified during the first critique in week two, when the group discusses the principle of branding and the notion of 'cool' as being functional. One female student (CAN7), who has done professional downhill skiing, says:

> *Just from coming from being sponsored and stuff in skiing you have to wear their logo from here on in. You had to represent them in a way that they wanted. There were certain things that you had to do while they were sponsoring you. You weren't allowed to eat at McDonalds, you [pause] there were certain things you had to follow. You have to be choosey on how you want to be sponsored and how they will represent you. Do you want your name attached to that?*

Excerpt 5.52: CAN student contributing her personal experience to the group

The majority of personal anecdotes are closely aligned with the project and related to the sports being investigated. For example, there are discussions about skydiving and the

feelings attached to freefalling from an airplane, about swimming and wearing goggles, about the perceptions of skateboarders, and about competitiveness in general, to name but a few.

Another characteristic of this studio culture is that there are many references to previous projects. The primary instructor consistently refers to work previously accomplished and the result is the students do the same. For example, a student designing eyewear for mountain biking decided to use the concept of 'intimidation'. It is unknown whether this topic is directly covered; however, psychology and emotion are explored in another module. There are numerous examples where there are references to other modules and in addition to this there are references to summer work experiences at the design school (a collaboration between the school of engineering and the healthcare industry). A reference to this summer project is made during a group discussion about what type of designer the students wanted to become. The primary instructor (PI) leads the discussion with two students (CAN5, CAN6):

> *PI: This raises a question for you as designers. What thing do you want to put your good name to? What things do you want to be associated with? And which exercises to you want to be known as? [...] What kinds of products do you want to design? Work on? Be associated with? The need for products and the need for a material world does not go away if we do not want to design them.*
>
> *CAN5: This sounds like the whole utilitarian thing with [name]. Do you not [pause] my position is just avoid it. Go into a field that you don't have to think about that. But if you do go into a field that [is focused on] utilitarianism. What you should do is do it in a more responsible way. You can do it in a more sustainable way.*
>
> *CAN6: The health care industry is not immune to that. Looking at the health care product that we were working on this summer there are companies that are undercutting the product and companies that are styling their health care product to make them more appealing ...*
>
> *CAN5: The ultimate is if you could make that product disposable you can sell one every time you have surgery.*

Excerpt 5.53: two CAN students discuss their summer job relative to design beliefs

Overall, there are many examples where the instructors and students link much of what they had gained through their involvement in the design school to their current work. These include previous projects, topics previously discussed, key phrases (*i.e.,* ship and boats, upstream-downstream), previous modules, in-house exhibitions, and field trips.

The teaching material and resulting design discussion in the Canadian study are focused, particularly on the design process, which is another characteristic of this design studio. In addition the material is well-rounded because of the two instructors who value design thinking (primary instructor) and skills acquisition (support instructor). In general the students embrace design thinking while struggling with skills acquisition. They often complain about the quantity and quality of visualization that is required. Along the way, the instructors provided numerous tips on how to draw more accurately, how to use

consistent sketching techniques to illustrate variations of the same idea, and many positive remarks about students' drawings. In general, the group was relatively anti-technology and did not embrace computer-use, even though both instructors are well versed in computer programmes. Students are given one week of tutorials in the computer lab to work on their CAD models and a great deal of one-to-one time. They are much more comfortable creating physical models than CAD models.

Figure 5.12: the design process shown through sketches, models and CAD modeling

Each student produced a remarkably large volume of material that represented the design process. Figure 5.12 shows some of the sketches and physical models completed by CAN6 and a CAD model being created in Rhino by CAN8.

Along with designing, students conducted a considerable amount of research on this project. They look at a variety of magazines, books, films, and use the Internet for sources. Several students created inspiration boards in the first week, which inspire the whole class to also create these. Examples of product precedent and abstract sources used by CAN6 are shown in figure 5.13.

Figure 5.13: sources of inspiration

Another characteristic of this design studio culture is the students' connection with the physical space. They use the space intensively over the course of field study including spending the night in the studio before all major deliverables (approximately every two weeks).

Pulling all-nighters was also common with the first year students who also slept in the studio frequently as shown in figure 5.14.

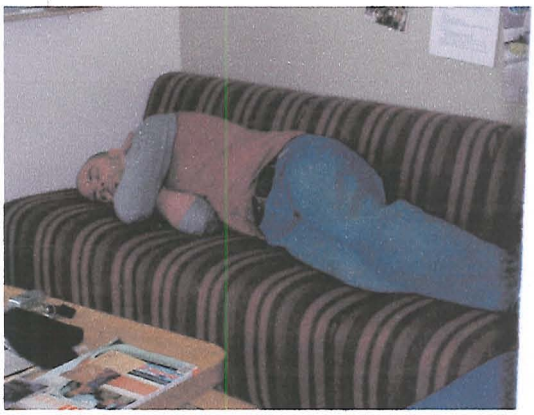


Figure 5.14: CAN student sleeping in the studio

Along with staying all night, the group also ordered pizza, picked up take-away food, and heated pre-made food in the studio. All the students, even those with partners or spouses took part in the extended all-night work parties. When it came to working all night, working hard, and accomplishing all the assigned tasks, there was a great deal of group cohesion. Like with the UK study, the Canadian students have an allotted space in the studio with a desk area, a large locker to contain projects and books, and a pin up area. These spaces are highly personalized and dynamic. Typical things found within the spaces are research for this and past projects, photographs, previous projects and more. Figure 5.15 shows several examples of the students' personalized spaces (top CAN6, CAN1; bottom CAN8, CAN7):

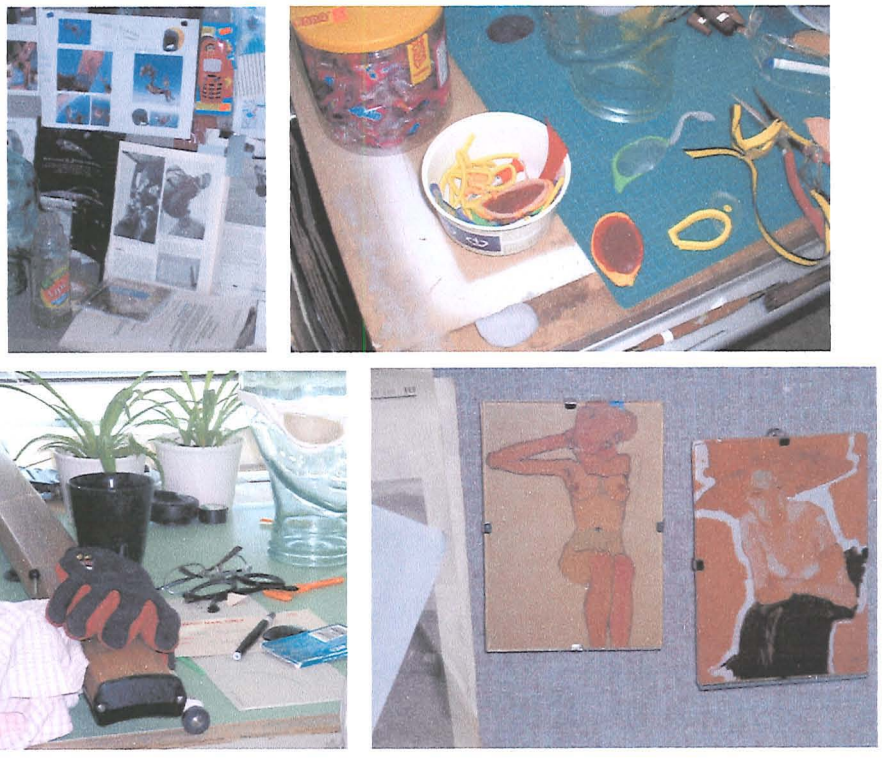


Figure 5.15: personalizing the studio space

used during this module. The books that he told the students to buy for this year's work are Bryan Lawson's *How Designers Think* (1998) and Donald Norman's *The Design of Everyday Things* (2002). He used several other books for this module including Neville Stanton's *Human Factors in Consumer Products* (1997) and Mike Baxter's *Product Design* (1995). The majority of the students purchased Norman's book. Two students purchased Lawson's book and one student purchased Baxter's book. The participant-instructor explains that he uses these and a few other books to create lectures as a starting point for group discussion in the studio. The concepts covered and discussed are later applied to the design project.

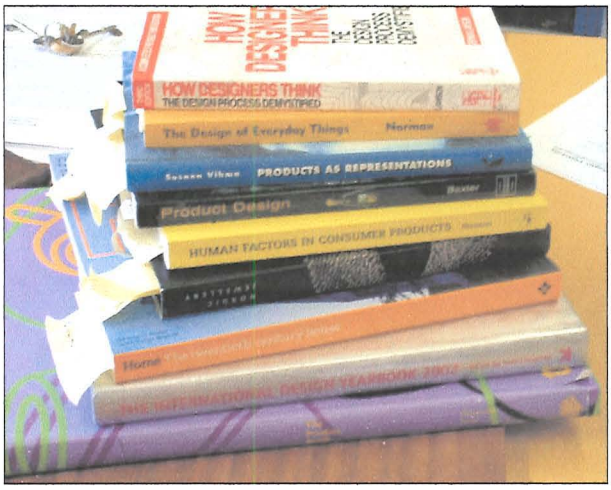


Figure 5.4: books used by the instructor to teach the module

The participant-instructor also indicates that he takes a variety of books in and shows them to the students as an instructional strategy. For example, he showed the group Stanton's representations of matrices to demonstrate how to quantify information about the user. In addition to showing books to the students, the participant-instructor indicated that he sometimes referenced objects and things from the media. For example, during the interview with the participant-instructor he describes how he talked about the 1968 film *Barbarella* directed by Roger Vadim. He used this film to get the students to explore the notion of the future for their RSA design brief to create a futuristic bath. He said that he used this in an attempt to engage the students because in general they have a lack of willingness to engage with work from history. He felt that the film would motivate them to investigate a range of work throughout history. Two other books the instructor spoke of using for this module are Ross Lovegrove's (editor) *The International Design Yearbook 17* (2002) and a book on Nordic Jewellery called *Nordisk Smykkekunst* (1995). The participant-instructor discussed the importance of materials and felt that these two books illustrate excellent examples that demonstrate material combinations. This tied back to the his notion of making physical objects and models.

Along with teaching in a particular way the participant-instructor has specific views on the type of students he is teaching. These perceptions begin with his general idea of Scottish education. He feels that in Scotland the students get a formal education that shows them to do things in a certain way. He describes this as being very limiting, especially when dealing with design where students must use problem-solving skills. His experience is that students need to be exposed to a broader range of things in higher education because they tend to have a localized and limited range of experience. For example he says:

> *The students are reluctant to look at things themselves so you have to take things in and say "look at this". They won't explore it further.*

Excerpt 5.10: UK instructor's view of his students

The participant-instructor also has a particular view about the user-centred topic that is the focus of this module. He says:

> *User-centred design requires a fairly structured approach to doing research and analysing data. It is completely different from other modules such as design alchemy, which is about exploration. [...] I don't think user-centred design should be a specific module. It should just be there in all the design of products. [...] We tend to leave out that students are going out in industry and may never speak to the user. The manager will have the say and they will just get told what to do. Maybe we view consumers as being hypersensitive when they are actually very adaptive. I think we want the students to design something that people have to adapt as little as possible to.*

Excerpt 5.11: UK instructor's definition of user-centred design

He feels that user-centred design should not be taught in a specific module and that it is not as relevant to industrial design as other principles in design.

The instructional strategies used by this participant-instructor include two field trips, three informal lectures, one group discussion, three one-to-one tutorials and one formal critique. Therefore, he spends considerably more time one-to-one with each individual than he does instructing the group as a collective. A written handout about the module and project is provided, which is supported with the D&AD design brief and the handout on *Corus* metals. The participant-instructor explains the requirements of the project as laid out by the competition. In addition, he emphasizes a need for user-centred design techniques such as interviewing, focus groups, and questionnaires in order to gain information about the user through empirical research. He elaborates on the importance of being objective and not simply designing for oneself. At the onset of the project the instructor took a small group of students on a field trip to the airport to look at how the food and dishes are handled on an airline. Four students in the group attended this field trip. In addition, two students attended an information session hosted by *Virgin* and *Corus* in London part way through the module. There is no formal discussion following the field trip but a sample meal tray was brought back to the classroom and used as a reference

throughout the project. The *Virgin* and *Corus* session was videotaped and shared with the group.

Instruction on user-centred design included how to conduct primary research through questionnaires, interviews and focus groups, which is completed in the first week of the field study and the students are required to formally present what they discover. Aside from primary research the participant-instructor does not formally guide the students through the design process. For example, the students are not told to reach a specific point in designing; however, the participant-instructor does *suggest* when they should be working on something new such as models or presentations boards. The three defined markers in the design process are:

1. report on information gained about the potential users,
2. present three concepts,
3. and provide four presentation boards for the final group critique.

The participant-instructor puts the onus on the student to bring the appropriate media to communicate their designs throughout the design process. He reminds the students on occasion when to make models and that they need to move forward with their work; however, he is consistently frustrated by the students' lack of responsibility. In general they provide minimal representations of their design thinking. Therefore, he approaches teaching design with a focus on the skills and final outcomes rather than on processes of design that relate to thought, intuition and reflection. There is a distinct focus on defining the design brief, on primary research, communication through design (drawing, model making), the elements of design (colour, form, composition) and the function and features of the artefact. The following is just one example of the practical angle that the conversations take.

> *I: [...] The sketches show many more forms that this could take, if you like committing yourself at this point, open spaces, but it could take many more forms. [...] What is it that lead you to the Scandinavian design?*
>
> *UK2: Basically I wanted to find something that was a simple form. Shapes. And incorporate those into my design. I have a tendency to do things complex.*
>
> *UK5: I think those kind of shapes are good. You don't want something sterile because of the stainless steel. That leads to organic shapes.*
>
> *UK11: Fit in together organic shapes and Virgin seem to go together more. Virgin is quite a fun company.*

Excerpt 5.12: discussion about form and materials

The participant-instructor spends the majority of his time speaking with the students about 'design specific' aspects such as illustrated in excerpt 5.12. These discussions are typically centred on a sketch or model and include the elements of design (*e.g.,* form, space, size, colour), materials and / or manufacture. Other design specific references are to designed objects and designers. These references to precedents are far less frequent

than expected. In fact, the participant-instructor makes only three references to designed artefacts or designers.

All three are referenced during individual tutorials with the students.

> *I: Have you seen the Vitra organizer? The vertical office organizer. You know the Vitra furniture group. You don't know them? You should do. They make and manufacture most of the design classic items. They hold the license to manufacture many like Charles and Ray Eames' stuff. Quite a lot of very well known stuff.*
>
> *UK11: Is it V-I-T...*
>
> *I: ... R-A. They also do some ... I don't know why they license these things ... the Vitra organizer. It ties in a bit with what you've got here. I'm not too concerned with this stage how you look at the vertical shelf. It can be disposable.*

Excerpt 5.13: UK instructor references well-known design artefacts

Other references are to the work of Marc Newson and to the German Bauhaus. All the references are made at separate occasions with three different students.

In general, it is witnessed that the participant-instructor's primary role with this group is to motivate and focus the students towards completing their work. He is constantly prodding them along by encouraging them or telling them to draw, build models and do research. In contrast, the participant-instructor did joke with the students, but not very often. He made three jokes over the period of the study and one was done with the aim to assist in moving the students forward with their work. The participant-instructor (I) is in a tutorial with a student (UK1) and calls out the group:

> *I: [student's name - S1] is breaking new ground here by drawing an airline seat in his sketchbook.*
>
> *UK6: yah, I saw that.*
>
> *I: Have you seen that?*
>
> *UK1: [smiling]*
>
> *UK9: I had a seat last week.*
>
> *I: Really? I didn't see it.*

Excerpt 5.14: UK instructor uses a joke to try to motivate the students to sketch their design in context

Another joke is made with the group as a collective while summarizing primary research findings. The intention of this joke was more playful. One student (UK3) is speaking about his group's research findings:

> *UK3: This is [his] point [pointing to a drawing], he has a fear of flying, so we gathered from him that any distraction was good. He wanted kebabs and fast food and never ending gin and tonic. His negative aspect was flying and his positive point was...*
>
> *I: When it lands?*

Excerpt 5.15: UK instructor jokes with the students

The rapport between the participant-instructor and students is kept professional and somewhat distanced. Even so, he uses aspects of his personal sociocultural capital to

express ideas and to make specific points. There are total of seven personal anecdotes used by the participant-instructor.

For example, in a tutorial with a student (UK11) the participant-instructor (I) says:

> *UK11: I feel these ones are ... much more purpose and the others are experience [concepts]. I think that they have value because they save space. They make it a lot easier. They move. This is the one that fits most with Virgin [a sushi concept].*
>
> *I: Where do you think this might go then?*
>
> *UK11: I am not sure. Just talking about it now. Is one thing that puts me off is that these compartments are quite small. If it is going to be small bits of food then I might try to link these two things together.*
>
> *I: when you go to a Chinese or Japanese restaurant and you get your steamed dumplings you get them in a rack like this [gesturing to the concept sketch]. Four or five steamers high like this. Each one is a little surprise. Something that takes that concept idea through. That experience of eating is taken through. Is what you want. That is a different approach. It is not an object-based approach. Ultimately you know that you need to design something but you need to get the user point across.*

Excerpt 5.16: UK instructor uses a personal anecdote to get across a point

Other personal anecdotes used by the participant-instructor include references particularly to traveling, which relate to the meal tray design. Metaphors describing the visual aspects of a design are used more frequently than personal anecdotes. The use of metaphor is defined here as generalized unspecific references to things. The participant-instructor provides a stimulating description of artefacts by using examples from the everyday world and from the design realm. The participant-instructor (I) is in a tutorial with a student (UK9) who is showing his idea through a sketch.

> *UK9: I was trying to get it to a section to show ... [muttered] ...*
>
> *I: That look here is a soft pillow look. Is that something that you can get? A soft undulating surface ...*
>
> *UK9: Yah.*

Excerpt 5.17: UK instructor uses metaphors to make visual descriptions

Along with using visual metaphors to stimulate ideas and to describe aspects of the design work, analogies are used with other like-objects. For example during a tutorial the participant-instructor (I) discusses a children's story with a student (UK3) and provides an analogy between a handkerchief in a story and the design the student is working on. Although the tutorial was one-to-one, the student group overheard the analogy and became excited by its use.

> *UK3: It would be disposable according to the user. It would just get chucked in the basket and taken away. But it really depends on how it is done. Perhaps it can be hinged and it would collapse or something. Re-usable.*
>
> *I: There are analogies for something like that. Think back to children's literature. [pause] go back to children's stories. Like handkerchiefs. They carry handkerchiefs and they take it all out then put it back together and like Puss and Boots or something they hang it back on the wall. You have these kinds of fold out ...*

[excited and overlapped speaking among the group] *I: Well you have this kind of visual reference. It's kinda a one person picnic. It is the kind of thing that you are talking about.* *UK3: It is.*

Excerpt 5.18: UK instructor uses an analogy with a known object

Using metaphors and analogies is done in a variety of ways including linking learning to common situations such as previous projects, other instructors and previous conversations.

In this studio environment the participant-instructor's role is that of an individual who is guiding the work of the students, teaching design and motivating them while trying to foster independence. There seems to be the assumption that because these students are in their final year of study and senior to the programme, they are capable of a great deal of responsibility. As previously noted, not many markers are provided for hand-ins but the students are continually reminded of the project expectations. The participant-instructor is consistent with the students in the group and repeats things in tutorials for the individuals but when the information is relevant to their work. For example, the idea of ritual in eating is explored with each student through queries about other cultures such as Chinese and Japanese. The participant-instructor and the educational approach, as described in this subsection, provide a context for understanding the leadership of this group. The leadership and subsequent behavior of the students is one of the major contributing factors in defining the inside-local environment.

Through the interviews with the students and three instructors, questionnaires responses of eleven students, and six weeks of observation, this section has provided insights into the inside-local environment of the field study that took place in Edinburgh Scotland in the UK.

5.3 Inside the Canadian field study

This section provides the context for the field study that took place in Calgary, western Canada. When someone thinks of studying industrial design, they likely do not think of Canada as their first choice. Industrial design education in a country so large with relatively few manufacturing plants and being situated so closely to the USA does not make Canadian design education particularly appealing. However, the Canadian context of design has always focused on the knowledge of design rather than the skills of manufacturing (Giard 1990:24), which has given Canadian designers the profile of being versatile and having a breadth of skills and knowledge. Like in Scotland, design schools are typically associated with universities and colleges. They are divided into two general types that typically act in competition with one another. One type is housed in colleges

and generally more skills orientated. The second is housed in universities and more academically focused. The school highlighted in this study is situated in a university. There are a number of design schools in Alberta with several of these being in Calgary. Because of the geographical distance between cities there is little collaboration between the schools. In addition, it is rare to intermix instructors among the schools. A graduate from a design programme in one city is rarely employed at a design school in another city. The design schools typically hire former students who have worked in industry. Design education in western Canada is likely more similar to the UK and European educational systems than to the American system because of the strong history between Canada and Britain. In addition, the majority of the instructors at the Canadian university highlighted here are British, European, and Canadian.

The following subsections mirror those of the UK section. These are derived from the questionnaires done with students and two participant-instructors (*i.e.,* primary and support instructors), private interviews with three instructors from the programme, interviews with students and observations over the course of the seven-week field study. Descriptions of the design school, the programme and the educational approaches of the two participant-instructors follow.

5.3.1 Design school in western Canada

The design school in western Canada in Calgary Alberta is a university that teaches industrial design at the master's level only. The school attracts a high number of international students because of the location and relatively low cost of Canadian postsecondary education in the global marketplace. There is a cross-section of student abilities in general, students at the higher end of socio-economic level and a great deal of cultural diversity. For example, including all the industrial design students enrolled in this academic year there is one or more from Mexico, Hong Kong, Japan, and India. Because this design school does not offer an undergraduate degree in industrial design it is clear that the students have chosen the programme as a career choice towards a design related profession.

The design school is within the faculty of environmental design. Environmental design encompasses the built, natural and human environments and focuses on the interactions between human behavior and environmental processes[2]. A number of different professional degrees are offered within this faculty including environmental science, industrial design, planning, and urban design. All the degrees offered are at the master's degree level. Typically a master's degree in Canada takes from 24 to 36 consecutive

months of full-time study and involves at least a year of in-class / taught work. The master's of environmental design specializing in industrial design is offered to students with no previous industrial design education. Skills such as drawing and computer visualization are not required prior to the onset of the degree programme. The industrial design programme at this school stresses an understanding of the conceptual and philosophical issues pertinent to design, development and manufacture of artefacts or components of the built environment. A considerable amount of the work in the programme involves interdisciplinary studies and the students are encouraged to work closely with their classmates and colleagues from other faculty programmes.

Industrial design in Canada is commonly taught within fine arts or engineering faculties at the university level. This programme is situated in an unusual faculty and the material is delivered in a unique way, which is elaborated upon by the primary instructor:

> *The programme doesn't sit on the normal convention of design schools. Normally it would sit on an engineering or fine art department and sometimes as a sub-set of an architecture programme.*

Excerpt 5.19: description of how the programme is situated

He continues to discuss some of the strengths of the programme by stating that:

> *It does teach good grad level teaching. A lot of the graduates become teachers or managerial types. They don't become the typical designers. The skill level is secondary to the other stuff. It has generated students that are good paper writers and not necessarily good at design skills. They are good in terms of nuancing form.*

Excerpt 5.20: description of one of the programme strengths

This is echoed by the supporting instructor who says the strength of the programme is:

> *[...] building thought based skills. How to think through a problem and find a solution to the problem. It is not skills such as drawing, model making and CAD. Although I am trying to push that more because that is what gets you the first job. [...] They [students in the programme] move up quickly because they have the ability to solve the problems. How to look for and solve problems. The education is design specific. Accounting is a technical skill not a creative one. Hard core engineering is not creative. I think that the graduates here can sit down with an engineer and push it. This place is not about skills.*

Excerpt 5.21: further description of the programme strengths

The programme strengths are considered to be the academic approach to industrial design. However, this is also described as a weakness because, in the case where there is a high level of design thinking it is possible for there to be a shortfall in the area of skills development. The supporting instructor says:

> *There is a lack of good solid development in skill. [...] Nobody has the time in a job to do skill stuff.*

Excerpt 5.22: description of a programme weakness

[2] The details about the programme are taken from the 2003/2004 academic calendar published annually by the school.

Other strengths of the programme are the delivery of the course materials, the low number of students, and the high instructor-to-student ratio. Each year eight students are accepted into the programme and there is an attempt to balance the gender of the group each year. Two instructors, one full-time and one part-time (sessional), typically deliver each module. Part-time instructors act to support the full-time instructors and are engaged in design practice. For example, in an interview an instructors says:

> *Sessional's roles are industry experience. They are graduates of the programme who have experience. [...] [instructor's name] is actually an architect but she worked at [design firm] as a marketer. She brought a lot to the table and pointed out a lot of things.*

Excerpt 5.23: roles of the different instructors from an interview

Thus far, the interviews used are from the two participant-instructors. It is important to note that each of these individuals are graduates from this industrial design programme. A visiting instructor from Mexico provides a more objective viewpoint by commenting on what he perceives as the strengths and weaknesses of the programme. He says:

> *One thing that struck me when I got here [...] this is going to be interesting working with designers. But to my surprise I am the only designer here. The rest come from fine arts, from political sciences [...] at the beginning it struck me as rough. This will not work. I don't know what will happen. It turned out to be really interesting. [...] It is much more complicated, it is not easy. I have learned that in a five year bachelor's in industrial design you cant substitute five years for two. Just cant compress it. [...] Even though we work in this interdisciplinary programme there is still a strong division between the architecture and planning. [...] I think that the diversity of teaching styles is interesting. It gives a full feeling for the complexity of designing. [...] Just one final strength is that we have a nice library and resources in Mexico but it drives me crazy that people complain about it here, this library, all his stuff here. [...] Everybody would like to have more but this is great. [...] I think the weakness of this is the structure of the industrial design programme is too defined. There are too many courses that are required. You have to have some basic skills but I would like to see it more flexible. Another weakness is that we have the programme with the university [name] in Barcelona and it is geared to architecture students.*

Excerpt 5.24: programme strengths and weaknesses from a more objective point of view

The interdisciplinarity of the programme is identified as a strength and weakness of the programme. In addition, resources within the design school are considered the main strength. This visiting instructor considers the defined structure, including numerous necessary modules (courses) to obtain the degree as weaknesses in the programme.

The resources and facilities for this industrial design programme are considered fairly typical to most design schools and are comparable with those in the UK. There are two smaller computer labs, a printing lab, a workshop for model making and a design studio. Unique to this school are an in-house exhibit space and an internal library with design publications and dissertations from previous years.

Figure 5.5 shows the in-house exhibit space, one of the computer labs, and the internal library.

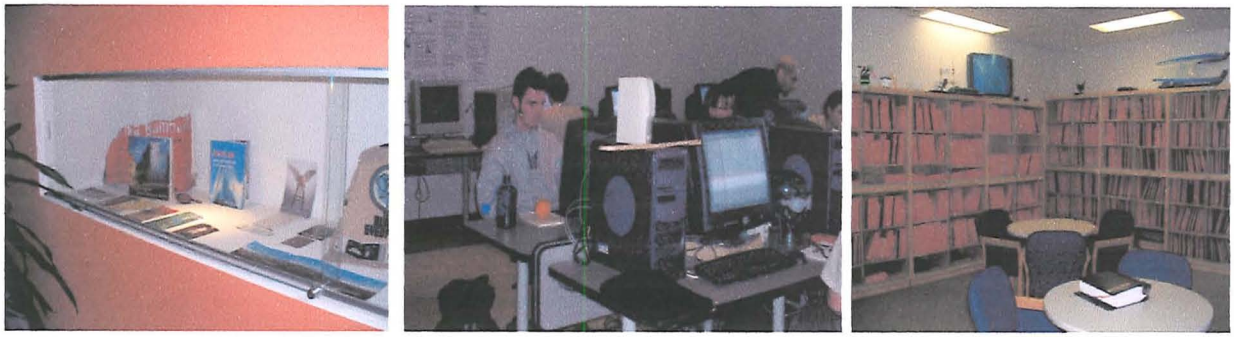


Figure 5.5: some of the onsite resources

The students have 24-hour access to the computer labs and studio. The workshop for fabricating mock-ups and prototypes is equipped with woodworking, plastic working, and metal working equipment. The studio is set-up like a design firm with separate cubicles consisting of a drawing table, shelving, pin-up boards, and a locking cabinet for personal materials. These individual spaces are used by first, second and third year industrial design students who are mixed throughout one room. Figure 5.6 shows the industrial design studio and the workshop.

Figure 5.6: open studio space and part of the metalworking shop

The studio is used as the primary workspace; however, there are several other spaces used for instruction. There are two main classrooms, one smaller one used primarily for lecturing and the other used primarily for critiques. Some instruction also takes place in the computer lab and in the workshop. The critique room and the studio are the two most dynamic spaces because these change according to the given activities. The materials (in various forms of visualization) handed in by the students drove the changes in the critique room. For example, combinations of visual materials are displayed in the critique room (*e.g.,* constructed objects, drawings, research). In addition, the students use presentation techniques with computer equipment including sound and multi-media. The studio space at this university is much more dynamic than the critique room and is purely driven by the

The studio space is a non-judgmental environment where students represent themselves and their personal tastes. For example, three students have religious iconography displayed, while others have items from popular culture.

One of the strongest characteristics of this studio culture is joking around by playing pranks on each other. The pranks are played between the first and second year groups and bonds the two groups. That is, each group is strengthened while the two groups are bonding with each other. Over the course of the field study four separate pranks are played between the senior and junior groups (two each). The first prank occurred when a junior left his locker unlocked by accident one evening. The senior group removed all locker contents and placed everything identically in a different locker across the studio. When the junior returned the following day he found all his belongings exactly as they were the night before but not where he left them. The second prank is when the junior group retaliated by choosing several personal items (including a flying cardboard Pee-wee Herman and a neck tie) from two senior students desk areas and suspended them over a 40-meter stairwell in the faculty building. The suspended items were dwarfed in the large stairwell space, but both groups were in appropriate awe as they tried to determine how the juniors had placed the items in the space without getting injured.

Figure 5.16: three pranks that get increasingly more elaborate

The third prank is more elaborate than the previous ones. With CAN$100 worth of *Saran Wrap* (cling film) the senior group carefully moved all juniors' desks together and created an enormous cocoon (4 X 5 metres) enveloping the desks. What is most remarkable

about the cocoon is that the senior students managed to enclose all desks without dislodging one item on them. The juniors do the final prank, which involves surrounding numerous lockers with chicken wire filled with colourful balls. Figure 5.16 shows the Pee-wee prank (top), the cling film prank (bottom right), and the ball prank (bottom left). All the pranks are accomplished as two collective groups. A high level of work (and cost) went into creating these pranks and, despite their inconvenience they acted to provide amusement and group cohesion among and between both groups.

Another characteristic of the Canadian studio culture is that there is a focus on sociocentric behavior. This is supported by the instructors but is also independently perpetuated by the students. That is, the instructors often ask the students to discuss their projects with one another, for instance, the supporting instructor (SI) notes that the work that one student (CAN5) is doing is similar to another student's work (CAN5) and he tells him to consult with his colleague:

> *SI: It might be worth your while going over some things with [CAN4]. Go through the material he is going through and see how you can connect.*
>
> *CAN5: Yah.*
>
> *SI: What he is looking for is quite different from what you are looking for. What he is looking for is gladiator helmets for their aggressive stance. What he is also looking at is that they were built for protection. You can pool your efforts here — your research time because you are gonna go through the material just like he is.*

Excerpt 5.54: CAN instructor asking the students to support one another

In addition to this students often mention each other, each other's projects and each other's opinions. For instance during a desk critique one of the students (CAN8) talks about his conversation with the other student:

> *[...] I was talking to [name] about hers and I think there might be one other element. There is water and then there is the adrenaline. Like there is the power of the river flowing and the power of the energy from the river and self from being excited and playing and having fun. I was talking to her and she has the concept of an amphibian. And maybe there is one other element in there. We were talking about the aspect of showing the erosion of the water on the rocks. Like how they meander and carve away [gesturing] different shapes of rocks. [...]*

Excerpt 5.55: CAN student references a conversation with a fellow student

The students initiated a range of sociocentric behavior including involvement in what they called "mini-crits", which is a critique that is done to evaluate each other's design work *without* an instructor present. During a mini-crit the students do not compare work, but instead they provide a critique similar what their instructors would do by evaluating potential concepts and reassuring each other. Over the course of the Canadian study the researcher witnessed the students engaging in different six mini-crits.

Much like with the UK group, this studio culture involves hierarchy among the students; however, it is much more subtle here. Within this group there is a male leader, followed by

a female leader. The male is Caucasian, slightly older than the majority of the group members, and has participated in a number of sports. The female is also Caucasian, has a strong art and design background, is very outspoken, and has also participated in a number of sports. Some group members admire these individuals while others feel they are over-confident. One participant noted that one of the instructors "favoured" these individuals. Even so, group cohesion seemed to override any feelings of negativity towards these individuals or towards the instructors.

Gender is a characteristic specific to this design studio compared with the UK group. This is because there is an even split between male and female students whereas the UK group is all male. In general, the males are more competitive where design skills are involved (*e.g.,* drawings, CAD and physical models) while the females are the first to notice when a group member is struggling and are more supportive. Interestingly, both males and females encourage group cohesion. Another area of difference between the males and females it that references and conversation types differ. Females are more likely to speak about friends and family members, that is, all the females in this group referred to their boyfriends numerous times during the field study. For example, one student brought up her friends numerous times who she often used to validate her ideas. While in a one-to-one critique with the two instructors the student (CAN7) says:

> *Like my friend [name] she has to wear goggles. She is practically blind without them. And she has tried to surf with contacts or they just come out or float in the back of the eye.*

Excerpt 5.56: CAN female student mentions her friend

Another gender difference is that females are more likely to use abstract and personal examples. For example, one student tells a personal narrative of when she visited an art exhibition that involves art done by medical students. The narrative is very lengthy and quite abstract, and more interestingly the two male instructors fail to derive its relevance and do not query it. There are numerous examples of abstract narration by female students and no examples by the male students.

Multiculturalism is a characteristic that defines this design school therefore it is not surprising that it is found specifically within the group. It is another characteristic specific this studio culture. There are two international students in the group, one is from Mexico and the other from China. It is clear that sometimes these students felt more frustrated with the social situation than other students and that at times they did not understand the intent of the discussions. Within a multicultural group this is called a cultural disconnect or schism and is when the value systems of the two individuals involved do not connect. For example, the primary instructor (PI) and the Chinese student (CAN4) discuss the notion of

paintball goggles (the students sport and design) being given as gift from a company to an employee when they sponsor a game. During a formal critique gift giving is discussed:

> *PI: [...]I could see how corporate events do this once a year or twice a year. Are you intending for the user to buy this or rent this or what?*
>
> *CAN4: The company is going to pay for it. Because it is a team building thing.*
>
> *PI: And why would they do that? Why would the company hang onto it for years?*
>
> *CAN4: For personal hygiene reasons. Nowadays they probably would not want to wear someone else's goggles.*
>
> *CAN6: Can they be disposable?*
>
> *CAN4: The reason why they [pause] I have one more point [pause] that they have eyewear that should not be perceived as a disposable unit. They could be brought home for a souvenir of the day.*

Excerpt 5.57: discussion about making a product 'free'

The Mexican student (CAN1) also examines notion of designing a product (swimming eyewear in this case) as a gift independent of the other international student.

The primary instructor (PI) discusses her concept during the same group critique:

> *PI: Are you saying that the eyewear will be distributed at a resort or something?*
>
> *CAN1: Yah, the idea is that the hotel you arrive to the beach they will give it you because you are very important and this product is getting meaning and it is a souvenir and when you try it on you go "Wow"! This is comfortable and you like it. It is not just the look of it, it is also what comes behind it. Through all this I try to how you make feel comfortable for the average Joe. If you are beautiful you look beautiful [pause] but the average person may not even want to try it. It is not eyewear to just make you feel safe and comfortable it is the meaning behind. You will remember your holiday. When I was looking at how to increase self esteem it is one of the keys is to go back and remember a phase. So I thought "Ahhhh" a souvenir for your holidays [pause] then you say "Hmmmm, I am good enough".*
>
> *PI: I was slow on the uptake there. I didn't realize that you were distributing this as a gift from a resort or hotel chain. As a gift ...*
>
> *CAN1: Yes, as a gift. The customer is a at the chain hotel.*
>
> *PI: I am a little nervous about this again for the same reasons that we talked about with [name]. In terms of the nature of distribution. It is one thing to sell something through the hotel chain and another to give it to people. [...]*

Excerpt 5.58: a 'free' product has meaning for some

The notion of giving a gift added value and meaning to the product for the international students but cheapened the product for the westernized students and instructors.

The Canadian studio culture, like the UK one, is defined as complex and ambiguous and relate to the approaches, attitudes and behaviors of the individuals involved in the group. The general attitudes involve a group that is independent and confident, inspire each other to work and they are relatively anti-technology. These are affected by the approaches that are generally well-rounded with a focus on physical and conceptual skills; design process and research; and are generally altruistic and sociocentric. The resulting behaviors involve discussing things by using stories and anecdotes; referring to past projects, a hard working environment that includes hierarchy and play. The Canadian

studio culture involves deep connection to the instructors and their physical environment, which they engage with in a dynamic manner. This studio culture is more diverse than the UK one in that it includes a balance in gender and the added characteristic of multiculturalism. In addition the Canadian programme and school promotes the notion of culture through activities such as design camp where they support and uphold an overall vision of altruism that supports group cohesion.

5.5 Conclusion

This chapter is the result of observations that are undertaken as an exploratory investigation into references made while designing and provides the cultural contexts for the UK field study in Scotland and the Canadian study in western Canada. It is known that sociocultural research includes both inductive and deductive approaches in order to do more holistic investigations. This chapter is the result of an open-ended (inductive) approach where the outcomes are in the form of rich descriptions, in this case of the inside-local environments of two studies. These are important in understanding the detailed and fleeting references because the two (inside-local environment and references) are paralleled. As indicated earlier, it is the placement of the individual references in these contexts where meaning emerges.

This chapter provides details about the design schools in Scotland and western Canada, the two degree programmes and the educational approaches taken by the instructors of each group. Along with this, characteristics of the two studio cultures are identified. This chapter has also illustrated that although design education is generalized there are extreme variations in the approaches, attitudes and behaviors within individual design studios. Each studio culture is as unique as an individual due to many factors including, for instance, the resources of the specific design school, the instructional strategies employed, and the general maturity of the group. For example, the level of maturity of the UK group is consistently young and therefore limited in their overall cultural capital, while the Canadian group is more diverse in age and their subsequent exposure to sociocultural situations is greater. Another interesting difference between the two groups is that one is egocentric and the other is sociocentric. The students of each group achieve different skill-bases because of these differences. That is, in general the UK individuals have stronger abilities when working independently, whereas the Canadian individuals are more able to negotiate and collaborate because of their sociocentric attitude. In contrast to the UK students the Canadians have a greater sense of group cohesion where there is a specific internal design language used and advanced group bonding. In general the UK group focuses on independence where they master a range of

skills necessary to be industrial designers, whereby the Canadian group focuses on design thinking where they become generalists who create things with a conscience. Although the similarities of the two groups are few, two significant ones exist. These are playful behavior (teasing, pranks) and hierarchical behavior. Play is considered one the key characteristics of design culture (Kelley & Littman 2001) and hierarchical relationships are not uncommon in social situations (Bourdieu 1987). The tension between the notions of what is perceived as global design (design culture) and the local identity may be the most challenging part of the design education culture today.

Studio culture is part of the inside-local environment and is defined through characteristics that are influenced and relate to the leadership; the focus of the teaching materials and the subsequent attitude towards these; how the physical space is used by the group; the perceived identities of the individuals in the group; and how the individuals relate as a social grouping. Chapter 6 further elaborates on the findings of this research by describing the individual references. This is done in a variety of ways including through the generic design process model and the design process milieu model developed for evaluating what is happening inside and outside design. The references are mapped, as shown in chapter 3, to the different environments and then determined to be either tangible or intangible.

6 References in the Design Process Milieu

6.1 Introduction

The biggest challenge to exploring references is that the sociocultural, tangible and intangible are not easily separable. In order to do this there must be a considerable understanding of the contextual situation, as elaborated upon in chapter 5. Sociocultural references are those that come from outside of the design environment and intangible references are extremely fleeting because these are less connectable to designing and the project. Chapter 3 has identified how to map the references by first defining the content morphemes and then by using the design process milieu model. Naturally, the references are intimately connected to discussions about topics (design brief, broader design principles) *in situ* (inside-local environment) as these occur between individuals (students, instructors). In addition to the macro issues enveloping and affecting the participants, the students also bring their own focus to the design situation. These are best described as their sociocultural capital, which is comprised of the individuals' experiences and memories. The data from four participants make up the majority of the information presented in this chapter. Two students from each field study are highlighted in order to complete a microscopic presentation of the design process milieu that allows for examination into the exact nature of the references. On occasion the UK and Canadian groups are presented holistically to illustrate characteristics, such as the progression of the design process and a complete list of the intangible references used by all participants.

The aim of this chapter is to understand the meaning of the references within their rich context. The first section provides details beyond the contextual environment by highlighting information about the four participants discussed here. This section provides another added layer of contextualization for the references by identifying the sociocultural capital of the participants. The second section deconstructs the reference-types of the two design environments and four participants by summarizing the themes that emerge

over the course of each study. The third section presents some of the specific references made by the four participants. In addition, this section illustrates the intangible references of each group as a means to exploring and understanding the sociocultural forces. The fourth section examines the quantitative relationship of references paralleling inside-to-outside, local-to-universal, and tangible-to-intangible. The final section illustrates the relationship between the references and the generic design process model.

6.2 Identifying the sociocultural capital of four participants

The sociocultural context of each individual is presented here based on responses to the questionnaires (appendix III and summarized in appendix IV), interviews (appendix V) and observations. The four participants highlighted in this chapter have been chosen randomly *after* the field studies have been completed; they are first and last in alphabetical order in each field study. The highlighted participants include three males and one female. Two UK participants (UK1 and UK11) are presented first, followed by two Canadian participants (CAN1 and CAN8). The two UK participants are both male and British one born in Scotland and other in England; and the two Canadian participants are a female international student from Mexico and a western Canadian male. This section identifies the sociocultural capital of each individual by summarizing the following: where they are from, their interests and beliefs, the role they take and their position in the group, their use of the physical space, their approaches towards classmates and instructors, their approach to design and how they engage with the design brief. It is based on this information and the overall context that the references are categorized through the design process milieu model.

6.2.1 Scottish male (UK1)

UK1 is a 21-year old male who is born in Scotland and has lived there his entire life. He is from a major city in Scotland and is a typical urban citizen. He has traveled throughout Europe on a number of family vacations prior to coming to university. He started higher education at the age of 17, which is common in the UK, and he has never taken any breaks away from the programme. He has some experience in design including having worked as a graphic designer during his work placement. UK1 indicates that his primary interests are sports and socializing. For example, he plays football (North American soccer) and a range of other sports. He also indicated that he is Christian and attends church regularly; however, this point was never brought into the discussions during the study. UK1 is one of two people in the UK group who indicated religion as being significant in his life.

UK1 is not particularly loud spoken; however he holds his own in the group. There is no clear leader in this group but this individual clearly has the potential to be a positive leader if he wished to be so or if he were encouraged in that direction. UK1 takes an active role in playing jokes on fellow classmates. For example, he created the forgery of the Chinese banner and put it up in his own workspace to poke fun at his colleague. This participant has chosen a desk area in the centre of the group, which puts him in a good position to engage with other students. Even so, he is not a disruptive personality and keeps to himself on the most part. He is hard working especially compared with some of his group counterparts. UK1 has a positive attitude towards the instructors at the design school, the design brief, and the programme of study. He does not allow the overall group attitude of negativity to affect his progress. His attendance is good since he rarely misses a class, is typically on time and consistently brings the requested materials to class. In an interview he indicates that he likes to get the majority of his work done during the class hours (9 am to 5 pm) so that he can play sports and socialize with friends in the evenings. He says that he sometimes works into the evening, but typically does this away from the design studio. Clearly, UK1 is in this programme to learn about design and to make the most of his studies. He complies with the requests of the participant-instructor and does not complain at any time.

UK1 is one of few individuals in the group who consistently references 'high' design through designers and objects. Unlike any others in the group, he uses a technique where he pastes these influences in his sketchbook, making a type of scrapbook for himself shown in figure 6.1.

Figure 6.1: UK1's references to 'high' design

Although this technique is a powerful way of communicating design process and design intention, UK1 does not use it to the extent that he could (*i.e.,* he only references a few designers and objects). Even so, he reflects on his own process explaining that he feels

strongly about pushing his process and learning *how to design well* when he is at school. For example, he states:

> *I tend to cut things out and show that it is metal. It is good to have something down beside it. It is next to it. This is not a new approach for me. [...] This has worked for me. It is work that I am thinking about. I feel that it can communicate exactly what I am thinking about. I can see it and then everyone else can see it also. The he [instructor] can see what I am seeing. I have done this. I can hear him say to others in the class that he isn't sure what they are talking about. But in this case it is communicating with him and that means I am communicating with him.*

Excerpt 6.1: UK1 reflecting on his design process

The one thing that UK1 states that he regrets in this project is that he has not often been on an airplane and never on a transatlantic flight (the focus of the project). Aside from this he seems to take a genuine interest in the design brief, especially in the materials and manufacture component. The design outcome that this student pursues is a concept that was a theme in the group: a turntable styled meal tray.

Figure 6.2: an iteration of UK1's meal tray concept

Despite this student's focus on process, his design does not evolve significantly beyond his early concept.

6.2.2 English male (UK11)

UK11 is a 21-year old male born in England. He has lived in Edinburgh since he was 18 when he first left home. This participant began his design studies at a university in his home city in England where he did his foundation year in art and design studies. He received direct entry into this programme and joined his fellow classmates in the second year of studies. His design experience includes doing his practicum with a company that designs music products, and having done graphic design for several university clubs. He has only traveled a few times to Europe with his family and stated that this is due to his mother and brother having serious fears of flying. UK11 chooses to use the idea of fear of flying for his project and spends considerable time researching how to calm people who do not enjoy flying. One of his goals is to incorporate a calming effect or distraction factor into his design. This participant's interests are atypical to the group since he is the only

one who is not sports orientated. This is not due to being unfit, but is connected to strong interests in other areas. UK11 does not hide his deep religious beliefs, an attitude that has given him the prefix 'Christian' in front of his forename in this group. He is involved with a number of clubs at the university that promote Christianity and Christian values. UK11 emphasizes that his personal life is separate from his university life; however, his beliefs cross over into his design work. He says:

> *I keep uni [university] separate from everything else. I keep my mind off work. [...] I guess there are Christian ethics there and I try to keep that in the things I am designing. Is there any benefit to what I am designing? Are there moral connections? The way I approached the feasibility study I wanted to do something that would benefit people. So I chose communication because I wanted to look at how people communicate.*

Excerpt 6.2: UK11 describes how his Christian beliefs connect with design

In addition to being involved with a Christian group, UK11 also participates in the international club that helps foreign students integrate into life in Edinburgh and university. He comments on having a newly found interest in Chinese, Korean and Japanese cultures because of exposure to the international students. He states that this interest does not affect (inspire) his design work, yet he references Japanese sushi, bento boxes, and eating rituals from oriental cultures numerous times throughout the study. In addition to being labeled as being religious, this student is looked upon as being eager to learn and hard working, these are sometimes criticized by the rest of the group. This is because he appears to work harder than any others in the group and is amiable at all times, even when other students openly state that expectations are unreasonable. In addition to being hard working and having high standards for himself, UK11 is relatively soft spoken and gentle. He has a positive attitude and clearly enjoys designing. He states that he wishes to make a career as a product designer. This student stands out in the group because of his 'squeaky clean' values and his enthusiastic outlook. He has a desk on the edge of the group, which is mirrored with another student who is also considered a bit odd by the others. Even so, his position in the group, where he often takes the brunt of the jokes does not seem to affect his ability to perform. He is the only student who is consistently on time and stays until everyone else has long left the studio. He works only during the daytime hours to keep his evenings completely free for clubs and church attendance and is the only student who says he never works on weekends.

UK11 is confident of his design work and likes to push the envelope. He goes against the norm by trying concepts that are often described by the rest of the group as unrealistic or "out-there". His design concept is expressed by the instructor as resembling a "birdfeeder" and is one of two highly creative solutions in the group. Figure 6.3 displays

an early version of his concept showing numerous compartments in a tubular format that is intended to stand vertically on the airline table.

Figure 6.3: 'bird-feeder' concept developed by UK11

Although this student created a number of different sketch models, UK11 did not get beyond the concept phase. This is discussed in greater detail later in this chapter. UK11 engages with the design brief by producing a high volume of sketches, researching fear of flying and different food types, and researching ways to brand the food. He is the only student to develop a graphic component for his design proposal. This resembles sushi shown in Figure 6.4.

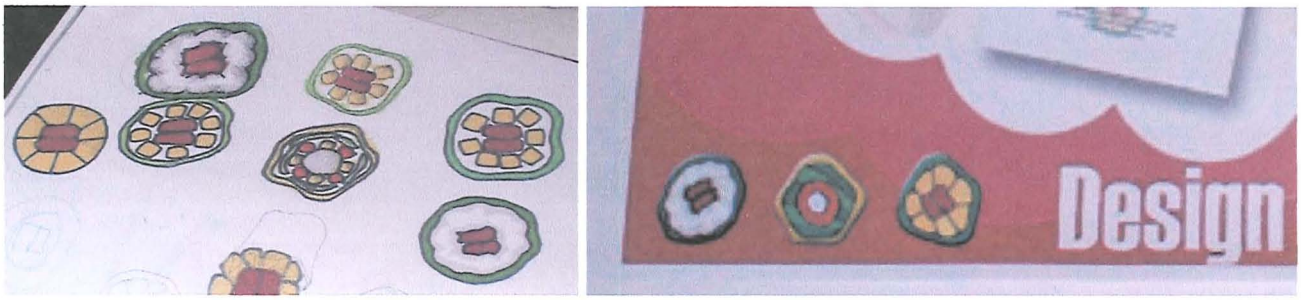


Figure 6.4: UK11's food graphic

6.2.3 Mexican female (CAN1)

CAN1 is a 27-year old female born in Mexico who has lived in Canada only for the duration of this programme of study (approximately 1.5 years). She holds an engineering diploma in materials technology from a university in Mexico. She comes from a well-established Mexican family of Spanish origin. Her father is a respected medical doctor in Mexico and she is close with her immediate and extended family. CAN1 met her Canadian boyfriend in Mexico. He encouraged her to come to Canada and they currently live together with his parents. She has a relatively low global experience-base, having only traveled with her family in Mexico and with her boyfriend's family in Canada. CAN1 enjoys dancing and music, is family orientated, is sociocentric, and has strong religious faith linked to Catholicism.

Figure 6.5 shows this participant's saint along with a Mexican flag, both prominently displayed in her work area in the design studio.

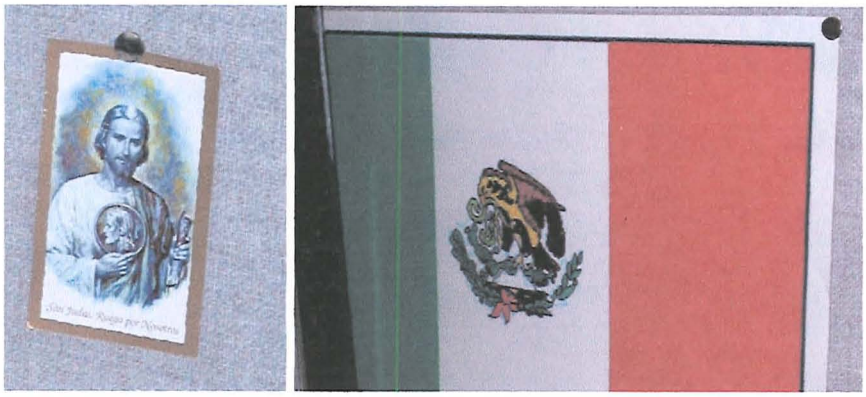


Figure 6.5: CAN1's Saint Judas and the Mexican flag

CAN1 is one of three people in the Canadian group who are guided by religious faith; however, each individual follows a different line of Christianity (*i.e.,* Catholic, Evangelical, Mormon). CAN1's desk area is located in the centre of the studio next to the visiting instructor (who is also Mexican as described in Chapter 5). She feels deeply connected to the visiting instructor and is collaborating with him on an ergonomic project (for a different module) during the field study. In an interview the visiting instructor laughs about his relationship with CAN1 because she shows him the respect that a student in Mexico would show him even though from his point of view they are both students. The visiting instructor says:

> *My role is as a colleague and not a prof [professor]. My experience, age does make a difference. My experience is not that they look up to me, and that they see I have a different way of looking at things. One student [CAN1] is the only one. I can work with her very well. She will not call me by my name. Instead of calling me [first name] she would call me Mr. [surname]. I asked her to call me by my name. She will defend me with the group. She feels that some lack respect. It is a cultural thing. I love that. I like that, there is a different [thing] between me and the other students.*

Excerpt 6.3: CAN visiting instructor explains his relationship with CAN1

Although CAN1 has an excellent command of the English language, she is conscious that it is her second language and that she may be missing some things during discussions. In her daily conversations including casual talk, one-to-one, and group discussions, she is very expressive compared with the other students. She gestures continuously and uses dramatic facial expressions and body language to aid in her verbal expressions. At times CAN1 appears less confident than the majority of the group; however, it is clear that it does not have to do with confidence. She listens intently to all discussions and to the instructors, and clearly has a higher level of respect for the student-teacher relationship. In an interview she expresses a disconnect with one of the instructors but she still remains respectful and attentive because he is her teacher. CAN1's aura of a lower level of confidence provides her with additional support from the group that she might not

receive otherwise. She is attended upon by the more sensitive socially-orientated individuals in the group. There are several instances when other participants stand up for her and interrupt the discussion to give her more time to complete her point. Particularly interesting during the course of the project was CAN1's discovery of her absolute desire to design for the 'local' Mexican market. She said that the fact that she knew she would return home to Mexico had not defined her role as a designer prior to this project.

CAN1's final design combined the idea of designing a product for a Mexican marketplace that emphasized good design and some western aesthetics. This is based on her research that indicates the Mexican market desires Americanized products. Figure 6.6 shows some magazine images she uses as resources that were perceived to reflect an American interpretation of Mexicans.

Figure 6.6: an American interpretation of Mexican culture

CAN1's design proposal reflects a hybrid of the Mexican and American cultures. It is colourful, transforms into a necklace when not in use, and is designed for Mexican female teenagers. Along with the project deliverables this participant completed two inspiration boards, dozens of pages of sketches, and many sketch models from plasticine.

6.2.4 Canadian male (CAN8)

CAN8 is a 31-year old male born in Calgary who has lived there his whole life, but has traveled extensively. He holds a degree in Political Sciences from the same university he is currently studying at. He has prior design experience including graphic design and leather bookbinding. He has worked as a practicing musician and feels strongly that his musical background is an asset to design. He explains:

> *We do crits all the time. Hard to remember who said what. Some of my process is external thought process. I'm a musician. Someone made a comment once. When you play guitar you can't sing what you're playing. You can't play it. Because you haven't internalized that music. There's the technical side [pause] press the string [pause] make the note [pause] but you cant sing what you want to have come out of the guitar. You have to internalize it. You have to externalize. In my head I go [pause] I know what it looks like but cant draw it, but it's blurred. Until you draw it [pause] talking to people helps. [inaudible] if it's in your head [pause] I just do a lot of thinking out loud. [inaudible] I've been a musician for five years. Music is design. It's got different rules but it's still an aesthetic thing.*

Beautiful. Whatever that means to you. It can be loud and crunching or heavy metal but within the bounds of that type of music. It can be aesthetically good quality versus crap. You have to put together notes like you put together a drawing. There's composition. I've always done my best work in music when I'm collaborating. We get into rhythms. Play the same chords. It's natural to go from this chord to whatever. You do this all the time. The other person will say, "what about this" and give you a nudge. And take you in a different direction. It opens you up to new ideas. I see the same thing in design. It's creative.

Excerpt 6.4: CAN8 explains how he feels music is analogous with design

CAN8 is observed as a strong personality in the group and is considered the primary student leader. He has a positive attitude towards the design brief, the two key instructors, the design school, and the programme. Along with his positive attitude and designerly demeanor CAN8 sets high standards for the group, works late into the night and often leads the pranks done in the studio. Many of the students go the CAN8 for advice and look to him for guidance in projects. He is enthusiastic and takes the opportunity to participate in as many design-related and in-programme extracurricular activities as possible. He is involved with a number of advisory boards and groups within the programme, and has spearheaded a student publication that will be published for the first time in the autumn of 2004. The other students and instructors clearly have a high regard for CAN8. Within the Canadian group, CAN8 is the only student who has a family member currently involved in design. In his design project, CAN8 chooses kayaking, a sport he has been highly involved with in the past. In doing so, he relies heavily on his personal understanding of the sport and considers himself a typical user of sports eyewear. The majority of his statements about the sport revolve around his personal experiences in rivers nearby. This student finds creative ways of problem solving through sketching and modeling. He is one of the first to purchase a glass head where he can create full-scale plasticine models. Figure 6.7 shows a glass head with a model attached.

Figure 6.7: CAN8 introduces using a glass head for sketch modeling

This participant carefully photographs all the models he creates and begins the detailing phase earlier than most other students in this group. CAN8 is one of two students who complete the creation of an intricate CAD model within the schedule provided. His final design is a pair of sunglasses that are secured while kayaking that is asymmetrical and

resembles the dynamic motion of water, rocks eroded by water and the skeletal form of branches on a tree.

The four individuals summarized in these subsections enable the deconstruction of the references made while designing. The varying backgrounds of the individuals identified in this section are four examples of different sociocultural capital unique to each individual and subsequent group. For example, within the UK group there is a narrow range of maturity, which results in a lower exposure to sociocultural materials. In addition, the UK group is all male and is monocultural (British). Whereas the Canadian group consists of individuals who have a broader age range and are older resulting in broader sociocultural capital among the members. In addition, the Canadian group is made up of four males and four females and is multicultural. Moreover, the overall focus of each group is one factor that encouraging the use of sociocultural capital individuals. The UK group is designing an airline meal tray where there is little latitude for connecting individually to the project, whereas the Canadian group is designing sports eyewear where they can choose a sport that each individual relates with. For example, CAN1 chooses to design beach eyewear for Mexican teenage girls when she has a teenage sister and has spent time at Mexican beaches, and CAN8 chooses to design kayaking goggles when he has kayaked extensively.

6.3 Reference-types of two design environments and four participants

Having described the sociocultural capital of the four participants in the previous section, this section acts to define the different reference-types. The three key reference-types highlighted in this chapter are the tangible, the intangible and the sociocultural. The tangible references refer to the inside of design and are familiar and routine. These relate to the inside-local, which are the design studio, the design school, the instructor, the design brief and everything taught explicitly. The tangible references are also part of the inside-universal including those things that involve design content, generic design culture, and are part of the common understanding of design. Some of the tangible references may lie in the outside if these connect both to the design project (brief) *and* to the individual's experiences and memories. The intangible references, on the other hand, always lie outside the design environment but are also part of the outside-local or outside-universal depending on how idiosyncratic and subjective the references are. As previously discussed, sociocultural references are all the references that are associated with things outside of the design environment.

This section focuses on the different types of references made by each group while designing. The first two subsections relate to the UK group and the second two to the Canadian. These involve deconstructing the references and situating them in the appropriate quadrants of the design process milieu model to identify the references made in the two different design environments, which is followed by an overview of all the material discussed by the two highlighted participants within that context. The primary focus of this section is to understand all the references made over the course of a project by mapping these to the design process milieu model.

6.3.1 References within the UK design environment

As indicated, the references are first deconstructed and placed into the general categories for each study. Figure 6.8 shows the references made by the two highlighted UK participants.

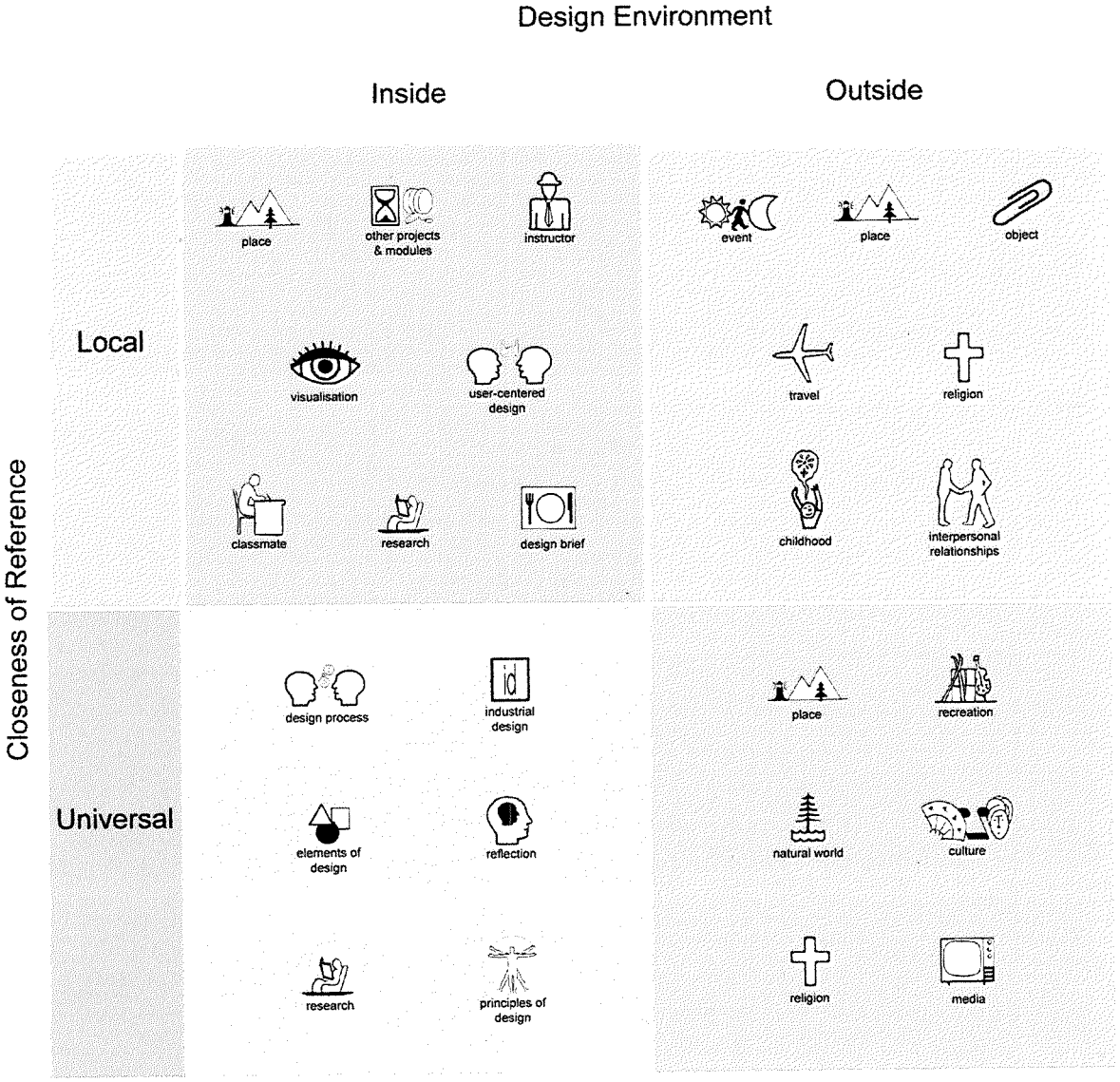


Figure 6.8: categories of references identified in the UK study

These references also represent those made by the participant-instructor and any other individuals present during the discussions. This is due to the natural flow of a conversation that involves two or more people are speaking to one another typically talking about the same topic. Moreover, since the participant-instructor went to great measures to repeat themselves with each student, the majority of the patterns and themes are identified through the two participants.

The most basic themes found inside the environment relate to the design brief, the expectations of the instructor(s), visualizing design ideas, and significant people and places. The UK study revealed inside-local references to the instructor, classmates, the design school (place), other projects and modules, and issues that relate to the module and project (*i.e.,* user-centred design, research, design brief). The inside-universal references include issues that are pertinent to designing yet are not taught directly by the instructor. For example, at no time does the instructor tell the students to discuss the elements of design, nor are there any required deliverables around these issues. The issues referenced by the UK group are the design process, industrial design, the elements and principles of design, research not relating directly to the requirements of the module (those that are above and beyond the instructors expectations), and reflection. Reflection is defined as a student observing and recollecting things about him or herself (self reflection). The tangible outside-local references include those that relate to the design brief (*i.e.,* travel, place, events). However, as will be discussed later in this chapter, some of the references to places, events, objects, family and friends (interpersonal relationships), childhood and personal religion. are generally unrelated to the design project (intangible). The outside-universal includes references to places, recreation, natural world, culture, religious organizations, and media.

The general categories discussed by the UK group are typically focused on the design brief, design in general and are overall a reflection of the instructions given by the participant-instructor. Even so, there are examples where these students draw upon their sociocultural capital to assist them in designing, which is illustrated by the thirteen different categories that are part of the outside environment.

6.3.2 Deconstructing reference-types of the UK participants

The references made by the two UK participants over the course of study are identified week-by-week and shown in figures 6.9 A-F.

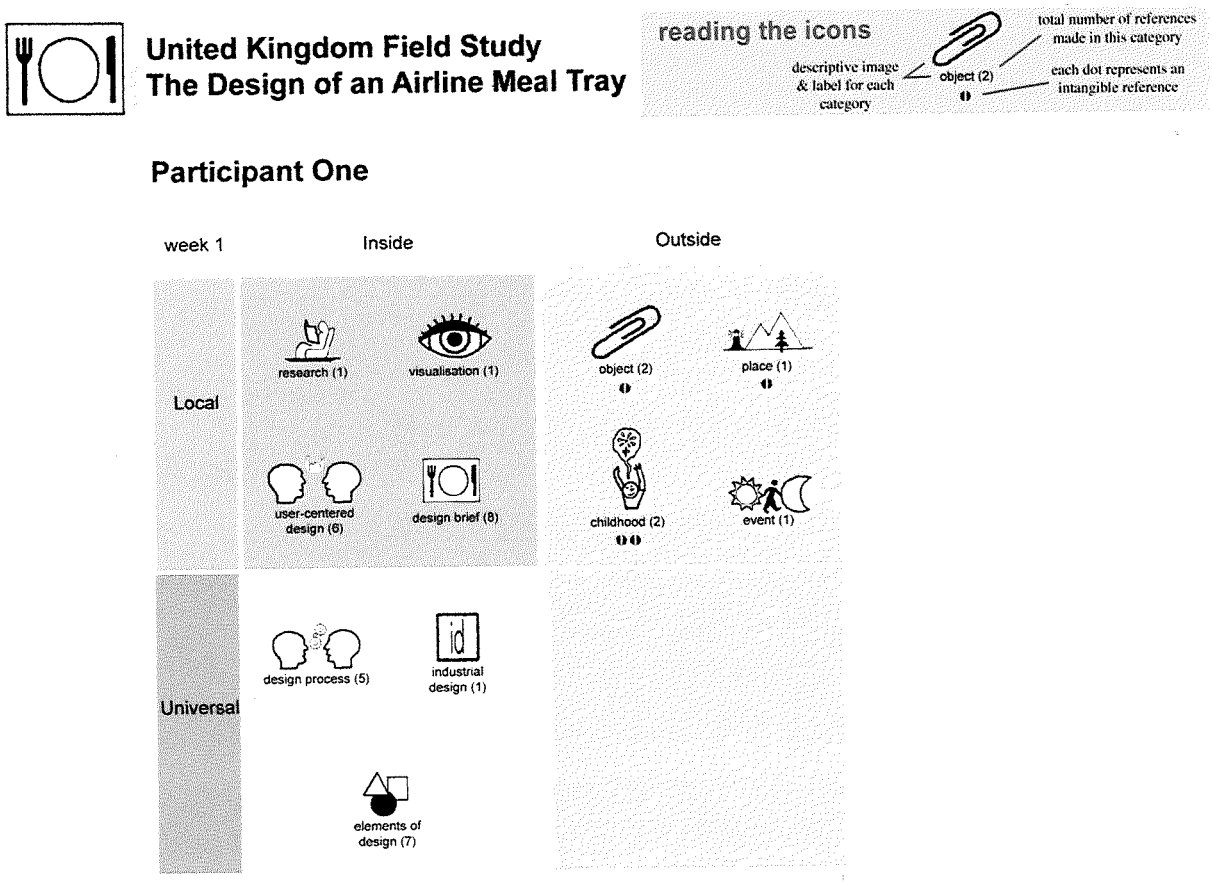
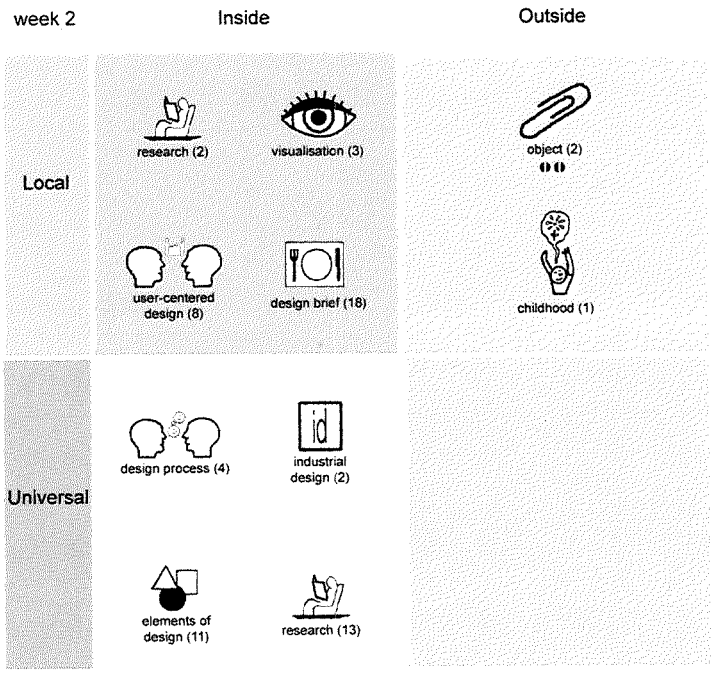


Figure 6.9A: UK1 and UK11 week one

Participant One



Participant Eleven

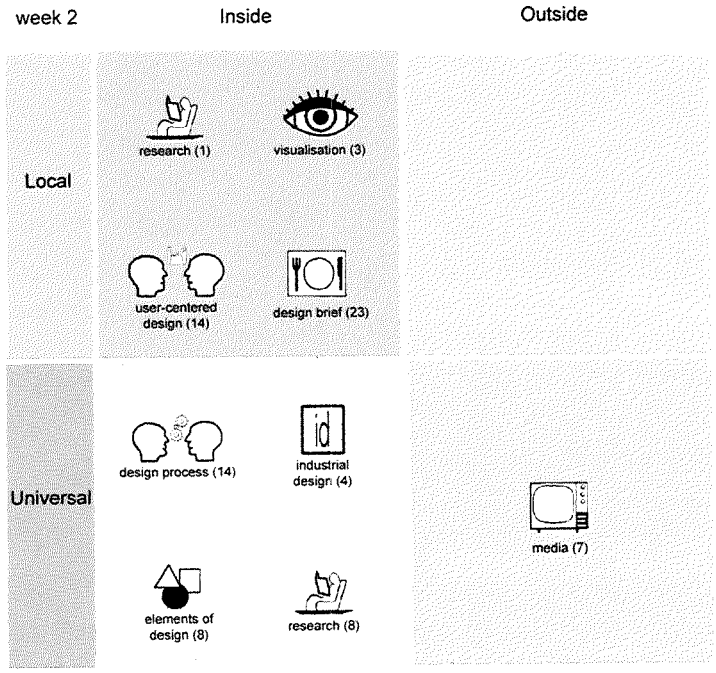
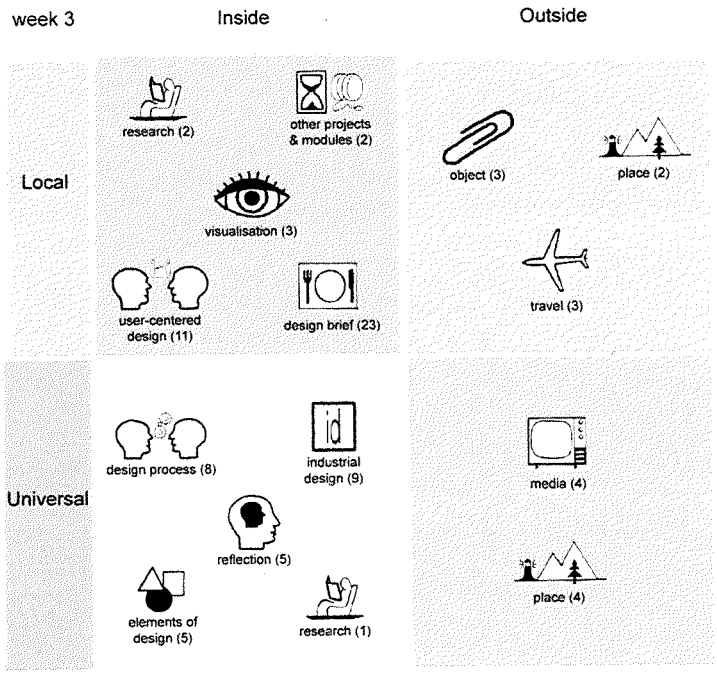


Figure 6.9B: UK1 and UK11 week two

Participant One



Participant Eleven

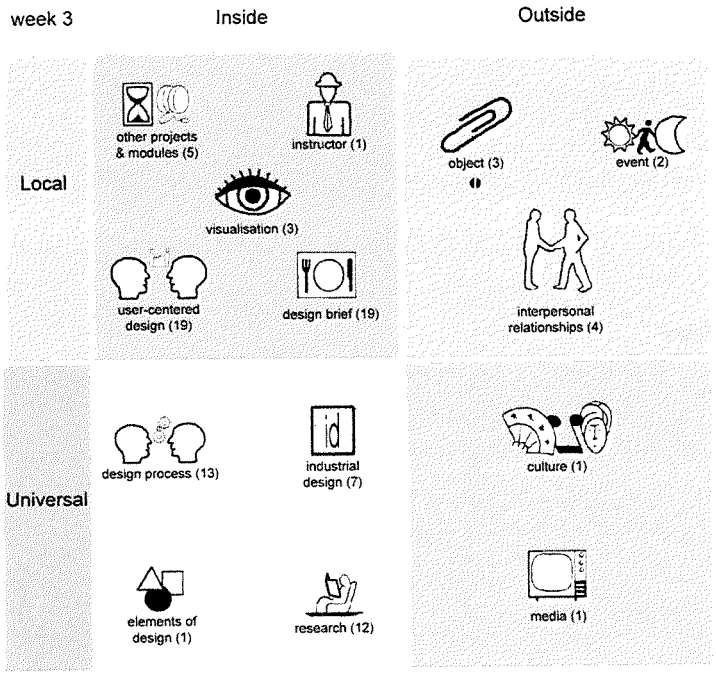
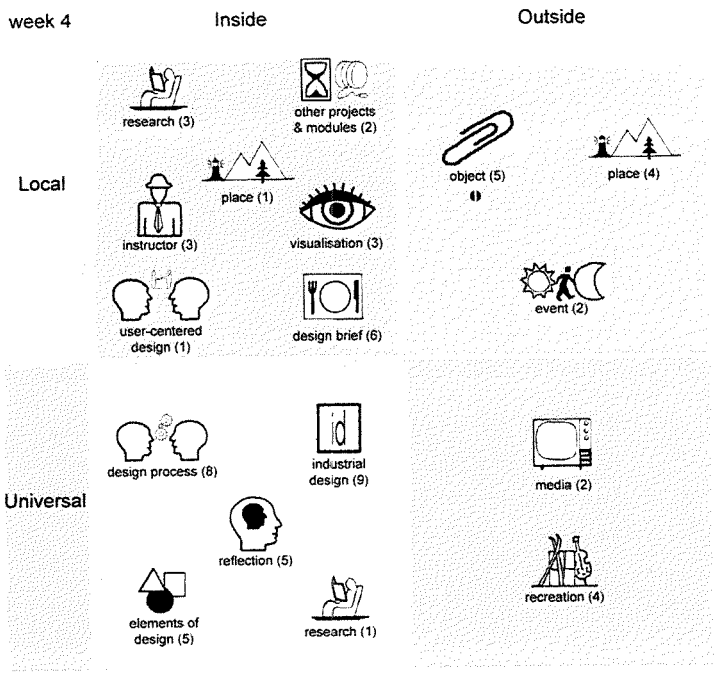


Figure 6.9C: UK1 and UK11 week three

Participant One



Participant Eleven

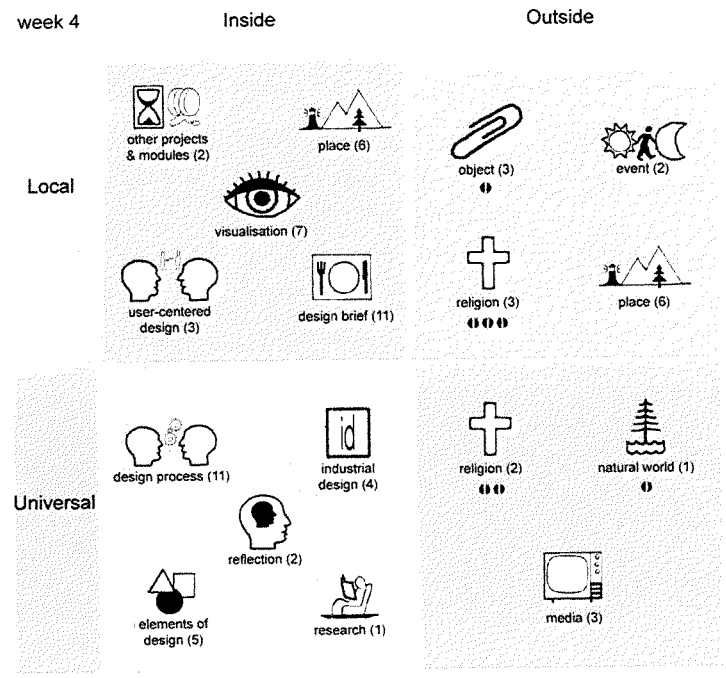
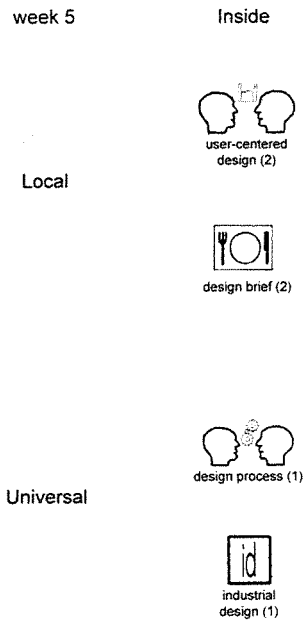


Figure 6.9D: UK1 and UK11 week four

Participant One



Participant Eleven

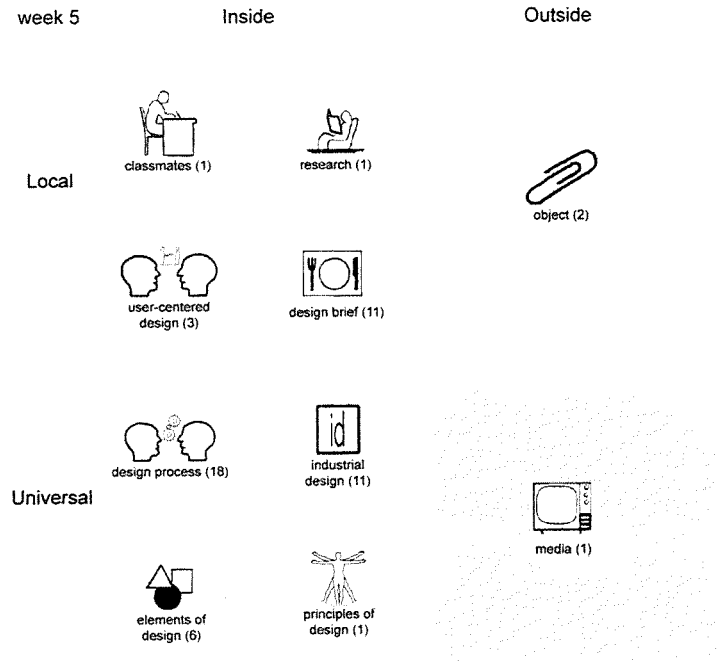
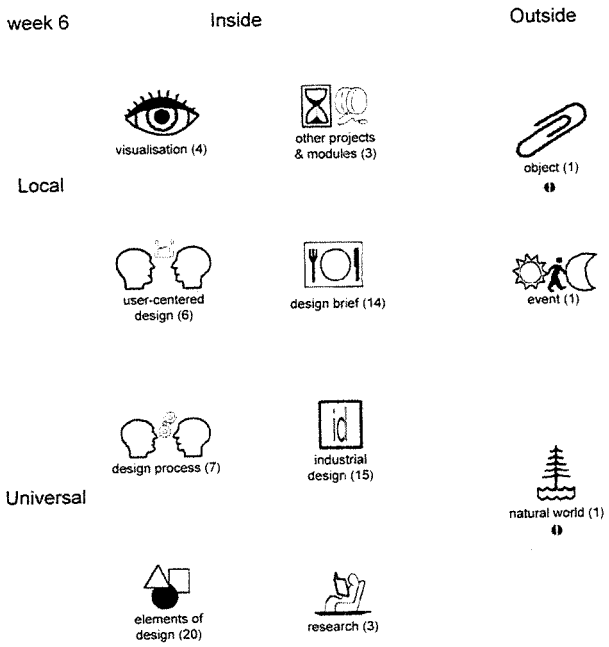


Figure 6.9E: UK1 and UK11 week five

Participant One



Participant Eleven

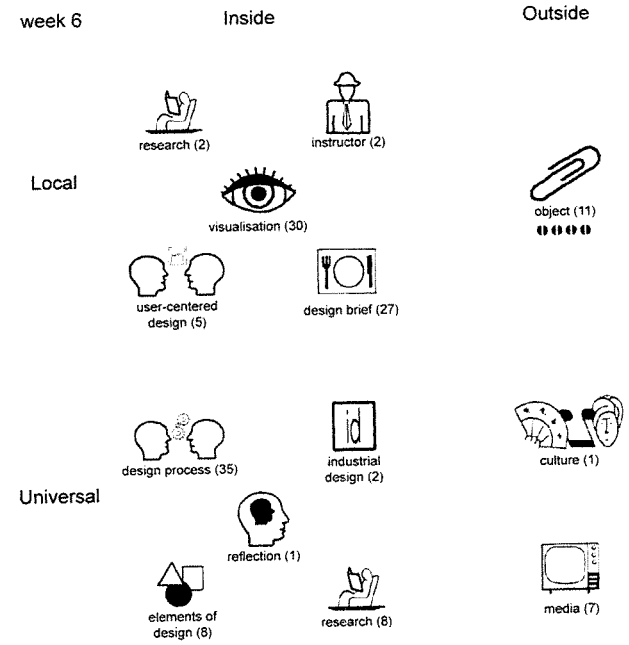


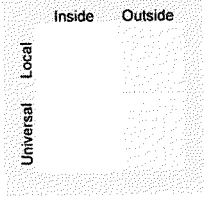
Figure 6.9F: UK1 and UK11 week six

The references in figure 6.9 A-F represent all the references made during the design of an airline meal tray. These are further summarised by category and quantified week-by-week in figure 6.10.

t = tangible reference
i = intangible reference

Summary by Week within the Design Process Milieu

Each week of the field study is represented by a square divided into quadrants.



Participant One

16t	2t 4i	31t	1t 2i	41t	8t	19t	10t 2i	4t	0	27t	1t 1i
13t	0	30t	0	28t	8t	28t	6t	2t	0	45t	1i

Participant Eleven

4t	0	41t	0	47t	8t 1i	29t	10t 4i	16t	2t	66t	7t 4i
3t	0	34t	7t	33t	2t	23t	3t 3i	36t	1t	54t	8t

Summary of References by Category

object
(13t+6i = 0+0+(2t+1i)+(2t+1i)+2t+(7t+4i))

total references within this category over 6 weeks — week 1 — week 2 — week 3 — week 4 — week 5 — week 6

Participant One

childhood
(**1t+2i** = 2i+1t+0+0+0+0)

design brief
(**71t** = 8t+18t+23t+6t+2t+14t)
design process
(**33t** = 5t+4t+8t+8t+1t+7t)
elements of design
(**48t** = 7t+11t+5t+5t+0+20t)
event
(**4t** = 1t+0+0+2t+0+1t)
industrial design
(**37t** = 1t+2t+9t+9t+1t+15t)

instructor
(**3t** = 0+0+0+3t+0+0)
media
(**6t** = 0+0+4t+2t+0+0)
natural world
(**1i** = 0+0+0+0+0+1i)
object
(**8t+5i** = (1t+1i)+2i+3t+(4t+1i)+0+1i)
other projects & modules
(**7t** = 0+0+2t+2t+0+3t)
place
(**11t+1i** = 1i+0+6t+5t+0+0)

recreation
(**4t** = 0+0+0+4t+0+0)
reflection
(**10t** = 0+0+5t+5t+0+0)

research
(**26t** = 1t+15t+3t+4t+0+3t)
travel
(**3t** = 0+0+3t+0+0+0)
user-centered design
(**34t** = 6t+8t+11t+1t+2t+6t)
visualisation
(**14t** = 1t+3t+3t+3t+0+4t)

total references
(320t + 10i)

Participant Eleven

classmates
(**1t** = 0+0+0+0+1t+0)
culture
(**2t** = 0+0+1t+0+0+1t)
design brief
(**91t** = 0+23t+19t+11t+11t+27t)
design process
(**94t** = 3t+14t+13t+11t+18t+35t)
elements of design
(**28t** = 0+8t+1t+5t+6t+8t)
event
(**4t** = 0+0+2t+2t+0+0)
industrial design
(**28t** = 0+4t+7t+4t+11t+2t)
interpersonal relationships
(**4t** = 0+0+4t+0+0+0)
instructor
(**3t** = 0+0+1t+0+0+2t)
media
(**19t** = 0+7t+1t+3t+1t+7t)
natural world
(**1i** = 0+0+0+1i+0+0)
object
(**13t+6i** = 0+0+(2t+1i)+(2t+1i)+2t+(7t+4i))
other projects & modules
(**7t** = 0+0+5t+2t+0+0)
place
(**12t** = 0+0+0+12t+0+0)
principles of design
(**1t** = 0+0+0+0+1t+0)

reflection
(**3t** = 0+0+0+2t+0+1t)
religion
(**5i** = 0+0+0+5i+0+0)
research
(**34t** = 1t+9t+12t+1t+1t+10t)

user-centered design
(**47t** = 3t+14t+19t+3t+3t+5t)
visualisation
(**43t** = 0+3t+3t+7t+0+30t)

total references
(434t + 12i)

Figure 6.10: summary of references within the design process milieu

Figures 6.9 and 6.10 illustrate the complexity and sophistication of a design environment and although the references vary from participant to participant a vast range of discussion takes place that relates to the inside and outside of design. For example, UK1 references 18 different categories and UK11 references 20. These figures show that designing is an incredible juggling act where designers are negotiating between the expectations laid out for them (inside-local), how design is defined and understood by them (inside-universal), their own individual personal identity and outlook on the world (outside-local), and the sociocultural realm they are shaped by (outside-universal).

A further summary in table 6.1 shows the top seven categories referenced by the two highlighted UK participants.

Number of References	UK1	Number of References	UK11
71	Design brief	94	Design process
48	Elements of design	91	Design brief
37	Industrial design	47	User-centred design
34	User-centred design	43	Visualization
33	Design process	34	Research
26	Research	28	Elements of design & industrial design
14	Object	19	Media & object

Table 6.1: top categories referenced by the UK group

Again, it is not surprising that the top referenced categories relate to the topics of the design brief, the module and the expectations of the instructor. This shows that students are responding to their instruction on the design assignments (*e.g.,* user-centred design, visualization, research) and the studio culture (*e.g.,* instructional strategies and design school expectations). More interesting, however, is that UK1 uses a surprising low number of references to travel (the central topic of the design brief), to other projects and modules (potential sources of precedent and analogies), and to visualization (the key way to communicate in design). In addition, UK1 makes no mention of gender or the principles of design (pertinent issues indicated in the design brief such as sustainability). UK11 has similar shortfalls in the same categories, making few references to other projects and modules or to the principles of design, and no references to travel and gender.

6.3.3 References within the Canadian design environment

Like with the UK study, the Canadian study identifies the reference themes that are made within the context of this design environment. Figure 6.11 shows the references made by the two highlighted participants from the Canadian study. Much like in the UK study the

most obvious references are to the design brief and to visualization of concepts. In the Canadian study the inside-local references are to the instructor, classmates, other projects and modules, and to the design work done while employed by the university over the summer (workplace).

The inside-universal covers issues pertinent to designing that were also referenced by the UK group; however, user-centred design is not explicitly taught by the Canadian instructors therefore it falls under inside-universal.

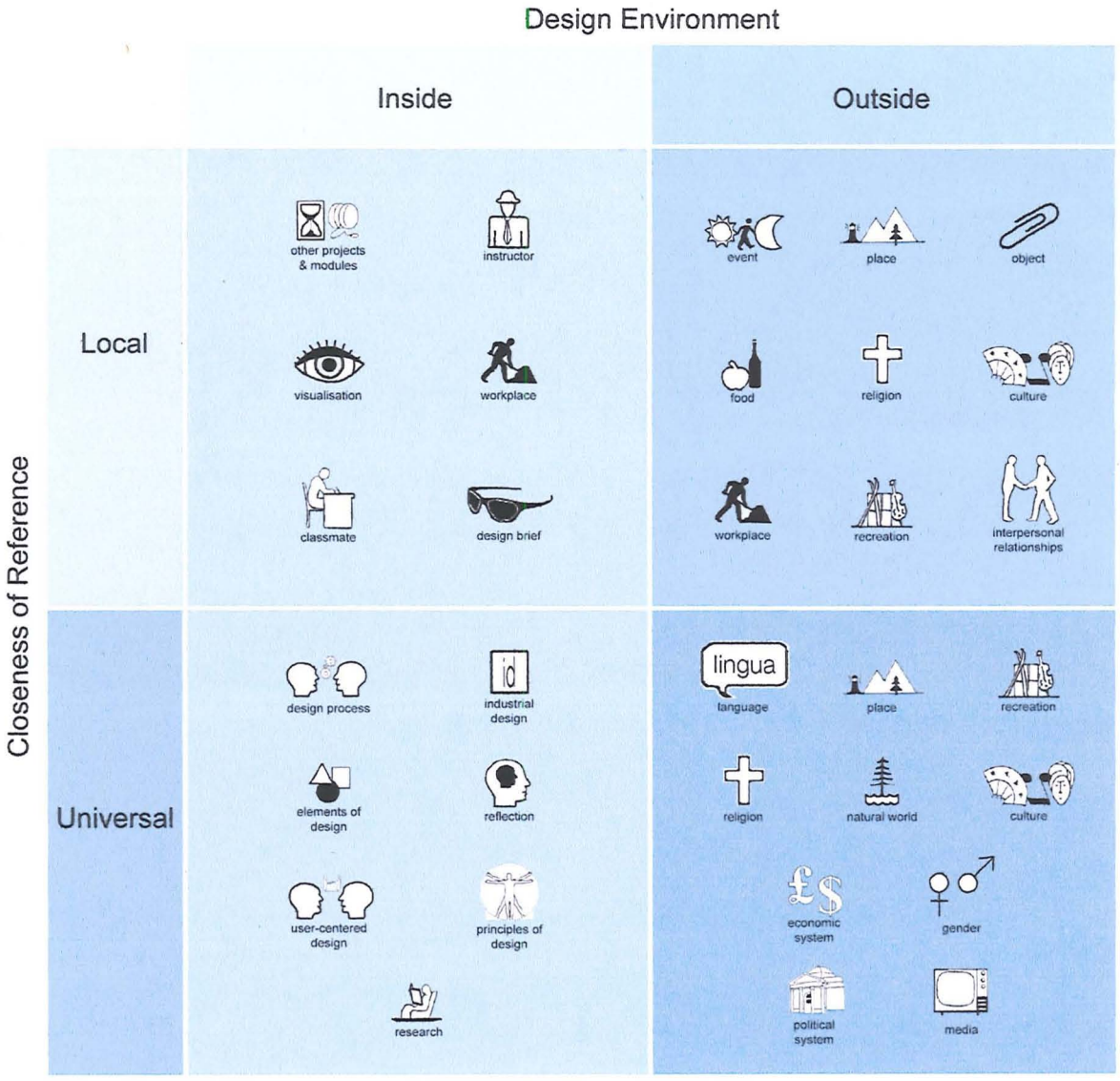


Figure 6.11: categories of references identified in the Canadian study

Like the UK group, the Canadians make some of the same references in the outside-local quadrant, which include those relating to the design brief (*i.e.,* recreation, place, events). Again, some of the references to places and events do not relate directly to the design brief. There are also references to unrelated objects, family and friends (interpersonal relationships), food, culture, workplace, and personal religion. Furthermore the outside-

universal includes places, recreation, natural world, culture, and media, many of which are tangible because they relate to the design brief. The references unique to the Canadian group include language, economic system, gender, and political system.

The general categories discussed by the Canadian group have a greater breadth than those referenced by the UK group. Along with the design focused references in the inside environment, there are nineteen categories referenced that relate to the outside environment. Therefore, it can be stated that the Canadian students draw upon their sociocultural capital more readily while designing than the UK group.

6.3.4 Deconstructing reference-types of the Canadian participants

Mirroring the UK subsection, figure 6.12 A-G on the following seven pages show the references represented within the Canadian design environment week-by-week by two participants over the course of the study. Figure 6.13 provides a summary of the references within the design process milieu and table 6.2 is a summary of the top categories discussed by the Canadian group. The Canadians are, naturally, within a very different design environment than the UK group, which results in vastly different references. Again, discussion is taking place that relates to the inside and outside of design. For example, CAN1 references 26 different categories and CAN8 references 23.

The top categories discussed by the Canadian group are summarised in table 6.2.

Number of references	CAN1	Number of references	CAN8
172	Industrial design	355	Design brief
132	Design brief	245	Design process
127	Design process	192	Visualization
109	Place	148	Industrial design
93	User-centred design	139	Natural world
87	Visualization	125	Elements of design
86	Elements of design	99	Object
53	Culture	96	User-centred design
32	Interpersonal relationships	93	Recreation
31	Natural world & Other projects and modules	44	Principles of design
		42	Research
28	Research & principles of design	40	Media
18	Reflection	28	Other projects and modules
14	Classmates		

Table 6.2: top categories referenced by the Canadian group

For this study the top thirteen categories are shown because these represent the majority of the references. The top referenced categories for the Canadian group are relatively

predictable; however, note the high number of references to interpersonal relationships made by CAN1.

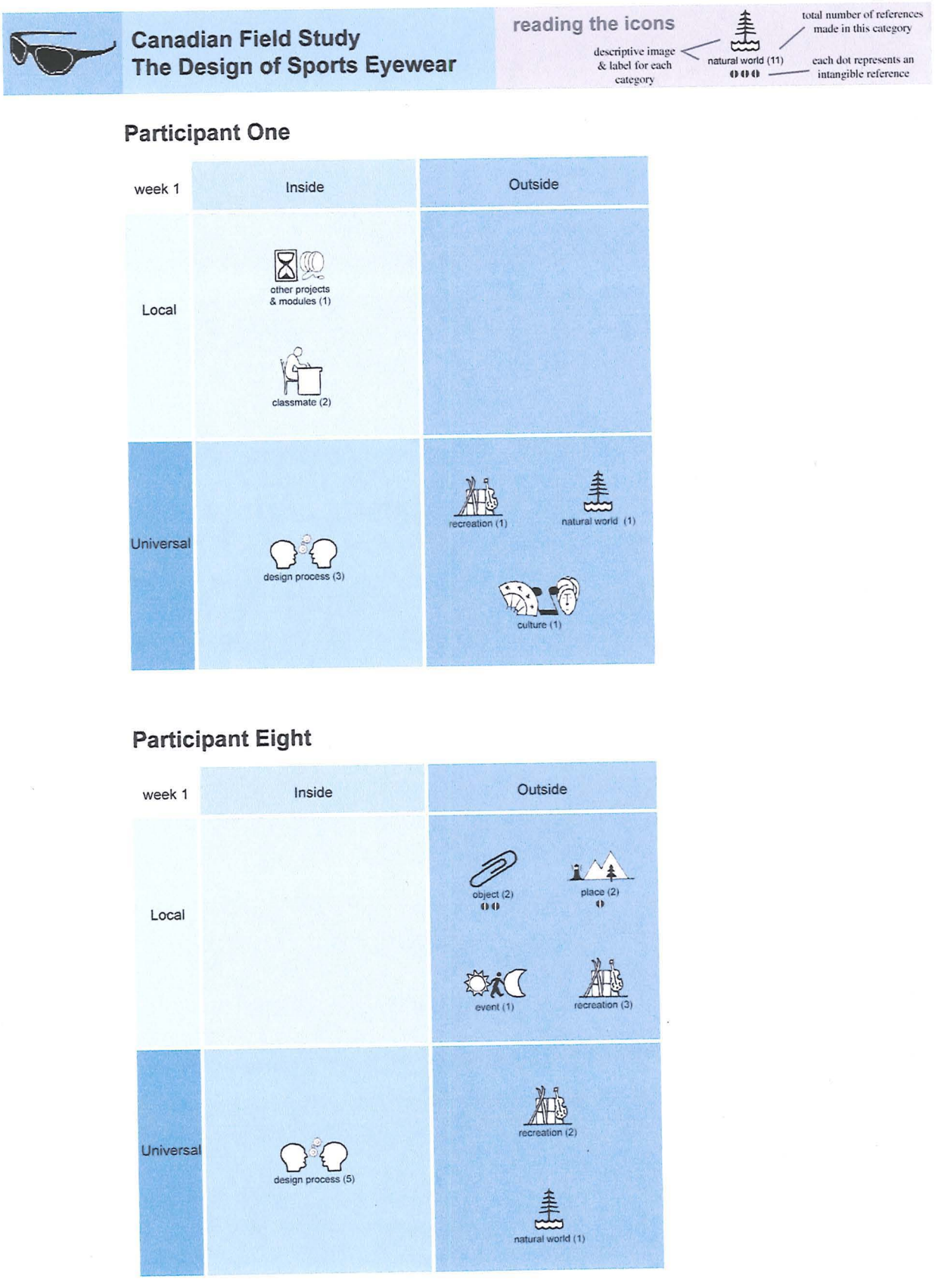
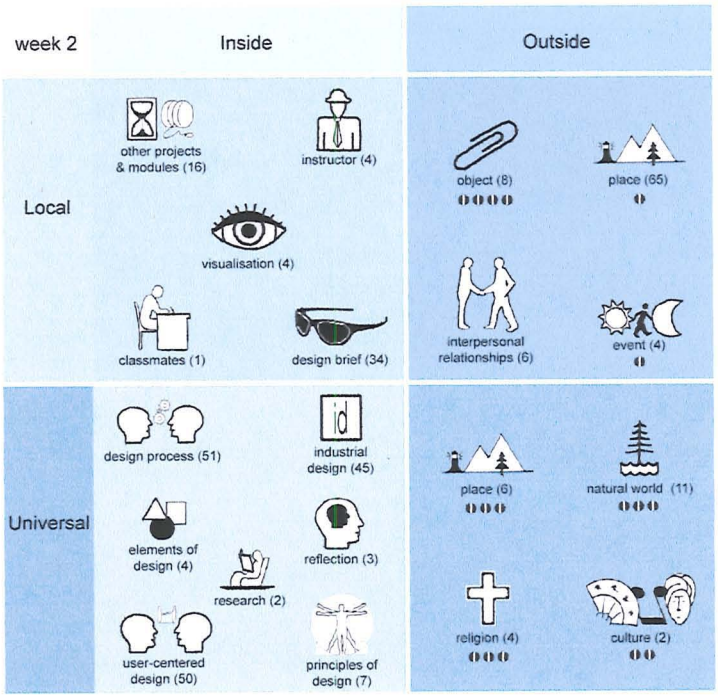


Figure 6.12A: CAN1 and CAN8 week one

Participant One



Participant Eight

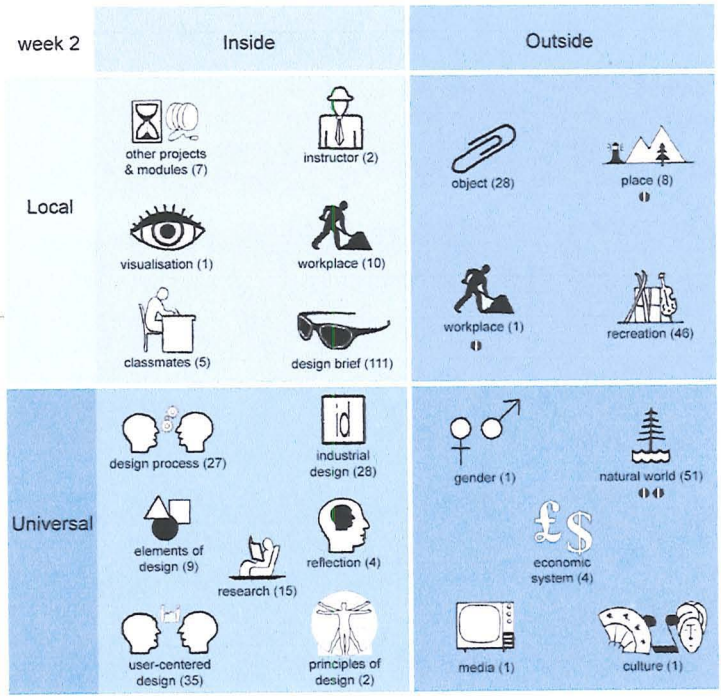
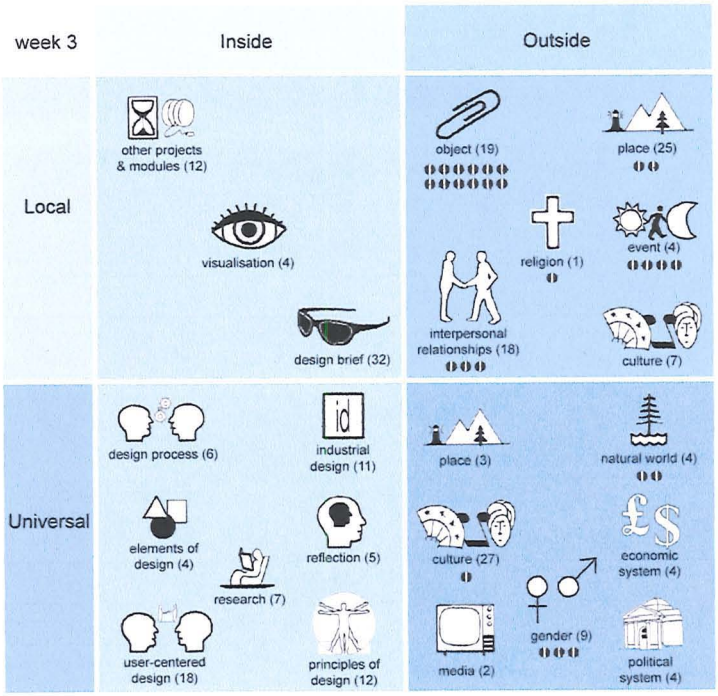


Figure 6.12B: CAN1 and CAN8 week two

Participant One



Participant Eight

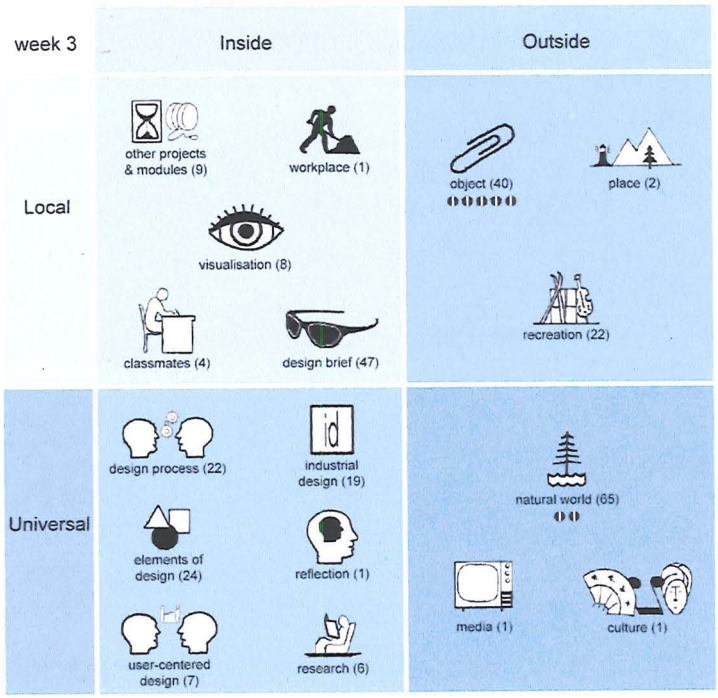
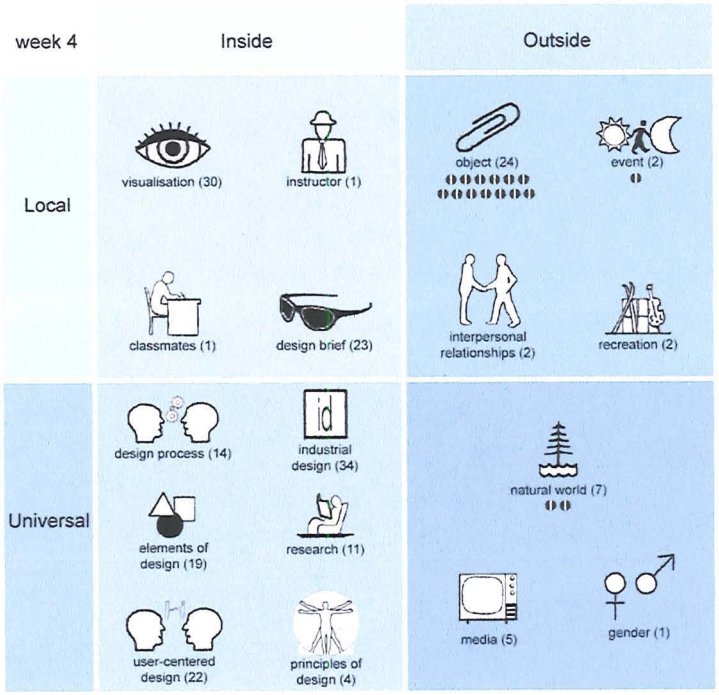


Figure 6.12C: CAN1 and CAN8 week three

Participant One



Participant Eight

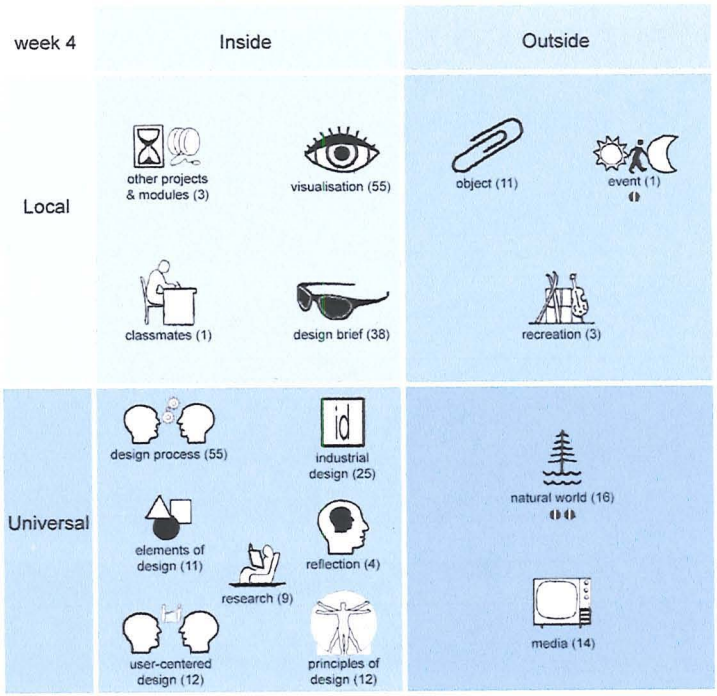
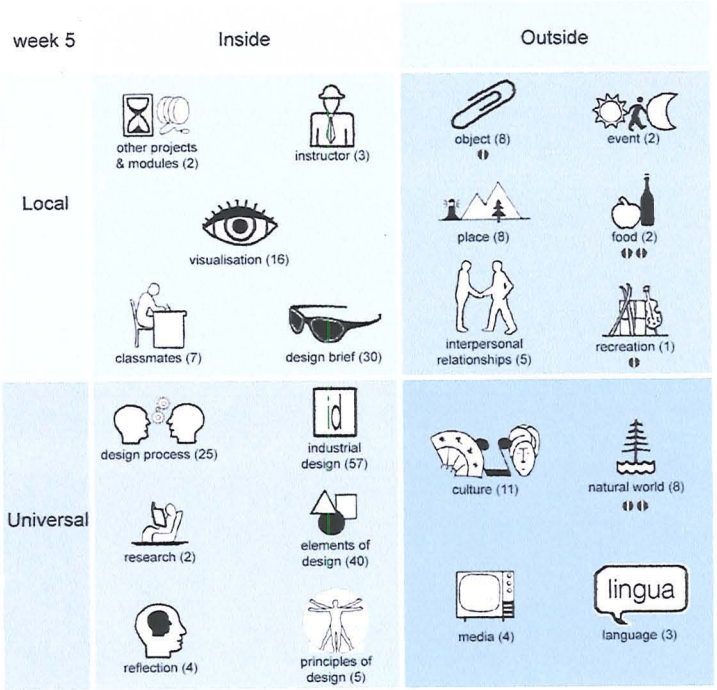


Figure 6.12D: CAN1 and CAN8 week four

Participant One



Participant Eight

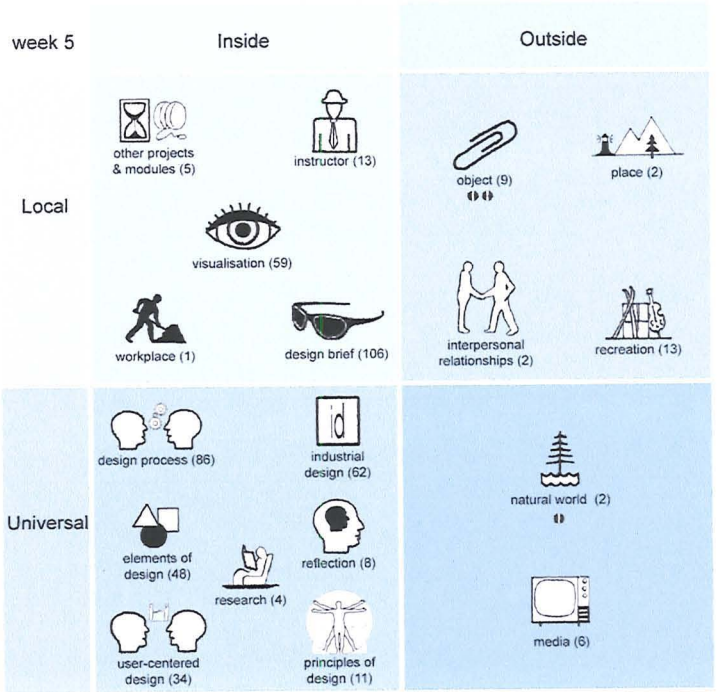
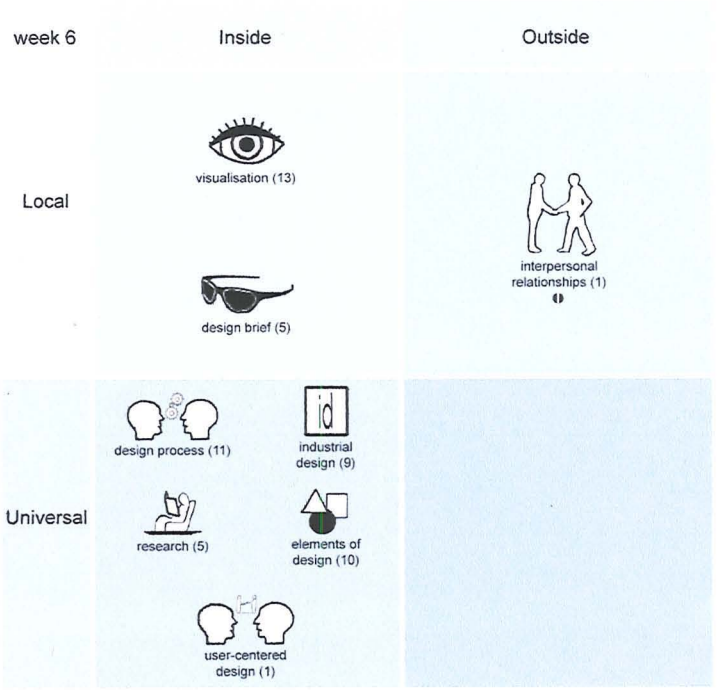


Figure 6.12E: CAN1 and CAN8 week five

Participant One



Participant Eight

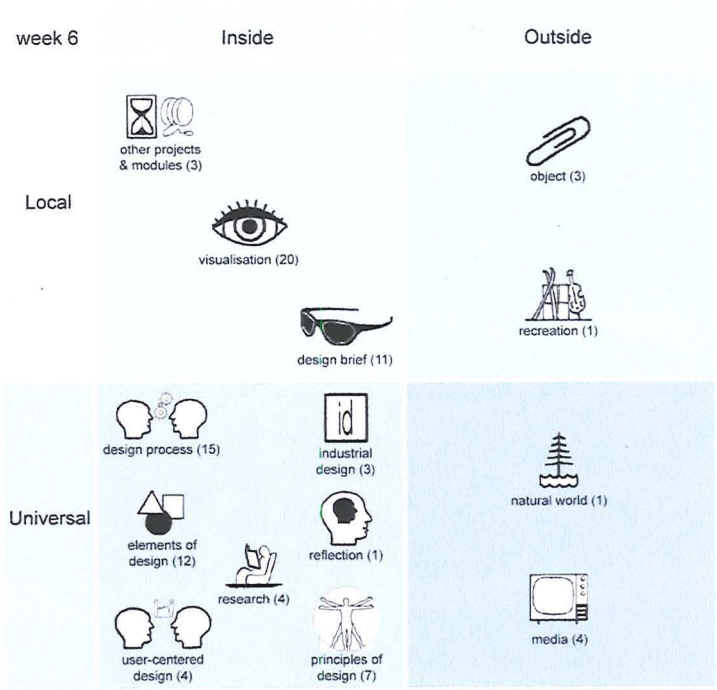
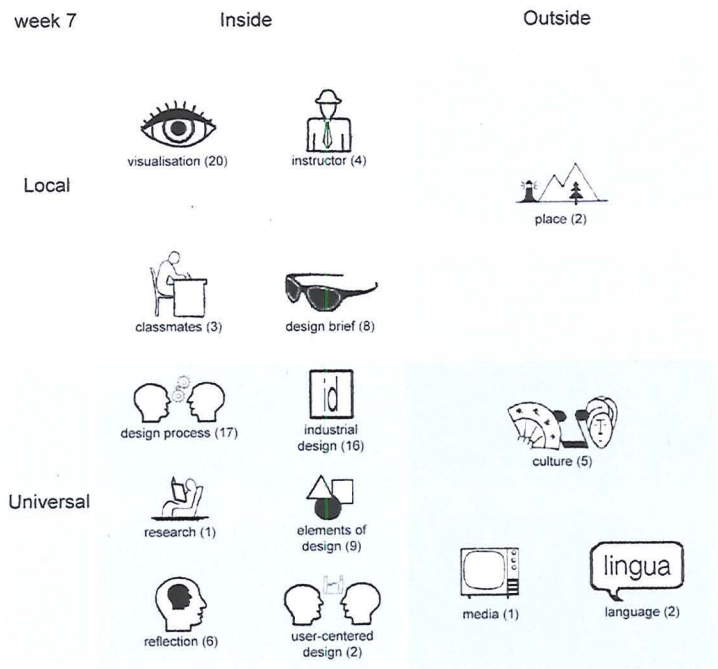


Figure 6.12F: CAN1 and CAN8 week six

Participant One



Participant Eight

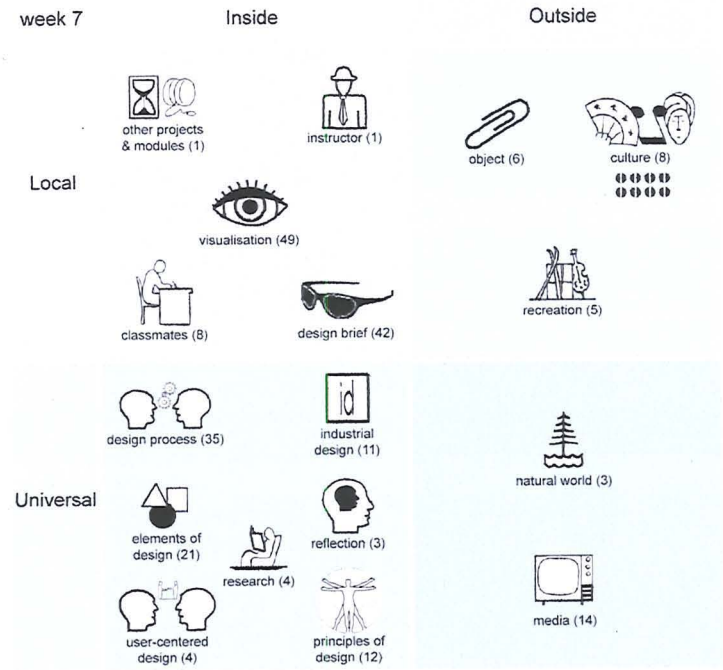


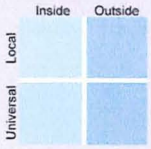
Figure 6.12G: CAN1 and CAN8 week seven

The references in figure 6.12 A-G represent all the references made during the design of sports eyewear. These are further summarised by category and quantified week-by-week in figure 6.13.

t = tangible reference
i = intangible reference

Summary by Week within the Design Process Milieu

Each week of the field study is represented by a square divided into quadrants.



Participant One

3t	0	59t	77t 6i	48t	52t 22i	55t	16t 14i	58t	22t 4i	18t	1t	35t	2t
3t	3t	162t	12t 11i	63t	47t 6i	104t	11t 2i	133t	24t 2i	36t	0	51t	8t

Participant Eight

0	5t 3i	136t	81t 2i	69t	59t 5i	97t	14t 1i	184t	24t 2i	34t	4t	101t	11t 8i
5t	3t	120t	56t 2i	79t	65t 2i	128t	28t 2i	253t	7t 1i	46t	5t	90t	17t

Summary of References by Category

natural world
(132t+7i = 1t+(49t+2i)+(63t+2i)+(14t+2i)+(1t+1i)+1t+3t)

total references within this category over 7 weeks — week 1 — week 2 — week 3 — week 4 — week 5 — week 6 — week 7

Participant One

classmates
(14t = 2t+1t+0+1t+7t+0+3t)
culture
(50t+3i = 1t+2i+(33t+1i)+0+0+11t+5t)
design brief
(132t = 0+34t+32t+23t+30t+5t+8t)
design process
(127t = 3t+51t+6t+14t+25t+11t+17t)
economic system
(4t = 0+0+4t+0+0+0+0)
elements of design
(86t = 0+4t+4t+19t+40t+10t+9t)
event
(6t+6i = 0+(3t+1i)+4i+(1t+1i)+2t+0+0)
food
(2i = 0+0+0+0+2i+0+0)
gender
(7t+3i = 0+0+(6t+3i)+1t+0+0+0)
industrial design
(172t = 0+45t+11t+34t+57t+9t+16t)
interpersonal relationships
(28t+4i = 0+6t+(15t+3i)+2t+5t+1i+0)
instructor
(12t = 0+4t+0+1t+3t+0+4t)
language
(5t = 0+0+0+0+3t+0+2t)
media
(12t = 0+0+2t+5t+4t+0+1t)
natural world
(22t+9i = 1t+(8t+3i)+(2t+2i)+(5t+2i)+(6t+2i)+0+0)
object
(29t+30i = 0+(4t+4i)+(7t+12i)+(11t+13i)+(7t+1i)+0+0)
other projects & modules
(31t = 1t+16t+12t+0+2t+0+0)
place
(103t+6i = 0+(67t+4i)+(26t+2i)+0+8t+0+2t)
political systems
(4t = 0+0+4t+0+0+0+0)
principles of design
(28t = 0+7t+12t+4t+5t+0+0)
recreation
(3t+1i = 1t+0+0+2t+1i+0+0)
reflection
(18t = 0+3t+5t+0+4t+0+6t)
religion
(1t+4i = 0+(1t+3i)+1i+0+0+0+0)
research
(28t = 0+2t+7t+11t+2t+5t+1t)
user-centered design
(93t = 0+50t+18t+22t+0+1t+2t)
visualisation
(87t = 0+4t+4t+30t+16t+13t+20t)

total references
(1102t + 68i)

Participant Eight

classmates
(18t = 0+5t+4t+1t+0+0+8t)
culture
(2t+8i = 0+1t+1t+0+0+0+8i)
design brief
(355t = 0+111t+47t+38t+106t+11t+42t)
design process
(245t = 5t+27t+22t+55t+86t+15t+35t)
economic system
(4t = 0+4t+0+0+0+0+0)
elements of design
(125t = 0+9t+24t+11t+48t+12t+21t)
event
(1t+1i = 1t+0+0+1i+0+0+0)

gender
(1t = 0+1t+0+0+0+0+0)
industrial design
(148t = 0+28t+19t+25t+62t+3t+11t)
interpersonal relationships
(2t = 0+0+0+0+2t+0+0)
instructor
(16t = 0+2t+0+0+13t+0+1t)

media
(40t = 0+1t+1t+14t+6t+4t+14t)
natural world
(132t+7i = 1t+(49t+2i)+(63t+2i)+(14t+2i)+(1t+1i)+1t+3t)
object
(90t+9i = 2i+28t+(35t+5i)+11t+(7t+2i)+3t+6t)
other projects & modules
(28t = 0+7t+9t+3t+5t+3t+1t)
place
(12t+2i = (1t+1i)+(7t+1i)+2t+0+2t+0+0)

principles of design
(44t = 0+2t+0+12t+11t+7t+12t)
recreation
(93t = 3t+46t+22t+3t+13t+1t+5t)
reflection
(21t = 0+4t+1t+4t+8t+1t+3t)

research
(42t = 0+15t+6t+9t+4t+4t+4t)
user-centered design
(96t = 0+35t+7t+12t+34t+4t+4t)
visualisation
(192t = 0+1t+8t+55t+59t+20t+49t)
workplace
(12t+1i = 0+(10t+1i)+1t+0+1t+0+0)

total references
(1719t + 28i)

Figure 6.13: summary of references within the design process milieu

When comparing and contrasting the reference types and the number of references made overall by each participant it interesting to note that the total number of references made by CAN8 is considerably higher (49.3%) than CAN1's. In contrast the total number of reference categories is higher with CAN1 than CAN8. CAN1 makes references to language (relevant to her) and a surprising (and more abstract) reference to food (discussed later when addressing the intangibles in detail). CAN8 neglects to make references within the categories of interpersonal relationships, gender and culture.

Although the number of references and the number of top categories are higher in the Canadian group than in the UK group this does not signify that the Canadian group is better. The volume of references is relative to the data that were gathered, which are naturally relative to the resources of the group (*e.g.,* scheduled class time, student-instructor ratio) and the instructional strategies and maturity of the group.

This section has provided details regarding the general reference categories that occur within each group studied. In addition to this, the specific categories of two pairs of student-participants are illustrated and summarised here. The next section continues along this line by elaborating on the references with specific examples.

6.4 Specific references within the design environment

Although the references are idiosyncratic and relative to the individual and the context of their discussion, it is possible to identify specific types of references made within the identified categories. This section continues by detailing some the references that are consistent across both studies (among the two pairs of participants). Following this, the more ambiguous and idiosyncratic references of all the participants in each study are presented separately then in parallel. In so doing, a cross-section of tangible and intangible references is identified, which aids to better understand the sociocultural context.

6.4.1 References of the four participants

Although the categories illustrated here are derived from the studies herein, these will be familiar to design educators and designers alike. This is naturally because of a deep understanding of the encultured design education scenario. For example, it is known that there are special qualities of graphic dialogue meaning that visual images are used to support the ideas discussed in design. In addition to this, some of these categories are well known as common currency in design (inside-universal) such as the 'design process', 'elements of design', 'principles of design' and 'user-centred design'. Even so, within some of the categories there is a vast range of different references that are highly

idiosyncratic yet still directly relate to the task at hand. These categories include the 'design brief', 'media', and 'object' where, for instance, the category of 'object' contains over 190 diverse references among the four participants. The top nine categories across the two studies are identified and examples of specific references in these categories are detailed in table 6.3.

Design Brief	Design Process	Industrial Design
Food, drinks, dishes, cups, cutlery, trays, trolley, napkins, containers, menus, table, Virgin, music, branding, *etc.* Eyewear, goggles, sunglasses, glasses, mask, contact lenses, head, face, hair, jewelry, sporting equipment, subculture, positioning statement, *etc.*	Project definition Concept Task analysis Detail Evaluation Skill acquisition	Aesthetics Materials Manufacture Function Technology Cost Production Stakeholders Marketing Market Problem solving
Elements of Design	**Principles of Design**	**Research**
Form, shape, line, colour, proportion, size, volume, weight, surface, angle, rhythm, organic, square, circle, structure, balance, space, organic, symmetry, asymmetry, *etc.*	Branding (CAN only) Safety Graphics Anthropometrics Geometry Durability	References to doing research about, for example: Designers Artists Objects And to acquiring information from, for example: Books Websites Internet *etc.*
Media	**User-centred Design**	**Objects**
Referencing various: Films Magazines Books Music Videos	User experiences Use scenarios The user Primary research	Eggs, hand blower, window, turn stile, phone, spring, mirror, bridge, hologram, gift, boat, skirt, desk, purse, wire, beach ball, security blanket, bed, bandana, bobby pins, walkman, car, boxes, chord, hook, telescope, sandals, jacket, paddle, ball, running shoe, head band, *etc.*

Table 6.3: specific references in the top categories

The context of the design process milieu is rich with a wide range of references within categories relating to all quadrants of the design process milieu model. This subsection has focused on the inside-local and the inside-universal, whereas the next subsection focuses on references less identifiable to the particular design projects and environments.

6.4.2 Intangible references of the UK group

Although it is possible to find many common references that relate to the inside environment there is a wider spectrum of references that come from the outside. This section provides a breakdown of the exact references made by the UK participants involved in the design of an airline meal tray. These references are itemized by week to

enable paralleling these with the design process later in this chapter. The UK students' intangibles are detailed in table 6.4. All references come from the outside-local environment unless followed by ⌘, which denotes that they stem from the outside-universal environment.

Within the UK group, participants make a relatively conservative range of intangible references. For example, the majority of the participants refer to 'objects' including everyday things (*e.g.,* key, toolbox, door hinge) and things from childhood (*e.g.,* games). As previously noted, these relate to the sociocultural capital of the students, which is narrow due to their youth and the limited range of life experience as described by them during interviews. In addition, the UK groups' instructor does not readily use examples from his own sociocultural capital therefore it can be expected that the students follow his example. Along with this, the UK group is more cautious about remaining focused on design, therefore there are fewer abstract connections made.

6.4.3 Intangible references of the Canadian group

Intangible references made by the Canadian group are itemized in table 6.5. These reference types are similar to those of the UK students where there are a number of references to everyday 'objects' including clothing items, and numerous references to everyday 'events' (*e.g.,* shopping, socializing). In addition there are references to local and childhood 'places'. The 'natural world' is also popular reference among these students, which may be because the design brief focuses on sporting activities within the context of a sporting environment (the outdoors). Even so, the intangible references in this category do not relate to the design brief.

Overall, the intangible references used among the Canadian group are more ambiguous and individualistic than those used by the UK group. This incident is explained by the maturity of the Canadian group, the focus of the leadership and teaching style, the level of education and the general latitude of the design brief. For example, the participant-instructors use their own sociocultural capital to articulate design concepts and the design brief has a component that allows the students to choose their sport of choice. Of the eight Canadian participants only one student (CAN4) expressed a lack of connection to sports activities and interestingly, this student struggled through the project and is one of the participants with the fewest intangible references.

Week

	1	2	3	4	5	6
 UK1	Jigsaw Game Egg tray Restaurant "Crayons for kids to draw on table cloths"	Hand blowers Window		Squeegee		Telescope Flowers⌘
 UK2						
 UK3		Heating-element Drafts Buckaroo Key Micosoft keyboard	Kagools Toolbox Bobbins Door hinge Ikea bluebag Whiteboard Train journey Black dog ⌘	Mother	Space Swivel Wall hanging Tracks	
 UK4						
 UK5	Girlfriend	Laptop Rail Toolbox	Clinical uniform			Oyster shell ⌘
 UK6	Doctors white suit	Cardboard boxes Bucket Spaceship ⌘ Cornish box ⌘	Girlfriend Dad Port cases Whisky tins ⌘ Bible ⌘			Clouds Steel box
 UK7	Train		Box Laptop			
 UK8		Swimmers Wet socks Army ⌘ American school desks ⌘ Football ⌘ Army ⌘	Whiteboard Doctors note Sterile	Mom		
 UK9		Puzzle Abstracted map			3d map Hologram	Wallet
 UK10		Mirror	Dash Dial Levers Instruments on plane	Pixie	Fins Dashboard Cars	
 UK11			Springs	Work ethics (3) Drawer Christian ethics ⌘ Bible ⌘ Spiral ⌘		Zips Zipper Clips Bags

Table 6.4: intangible references made by the UK students

	1	2	3	4	5	6	7
 **CAN1**		Calculator, Stamp, Gift Bridge, Pro-swimming High school Fly ⌘, Coral reef ⌘, Eagle, Blonde ⌘ Dutch ⌘ Canada (3) ⌘ Catholic (3) ⌘	Hacky sack Tanning lotion (2), Top (2), Skirt (2) Poncho (3) Food (2), Sister, Family Boyfriend Drinking (3) Shopping St. Jude House (2) Culture ⌘ Cougar ⌘ Flower ⌘ Gender (3) ⌘	Purse , Wire Bed, Bandana (3) Clips Safety blanket Pendant Bobby pins Beads Smarties Necklace Knitting, Rock ⌘, Cocoon ⌘	Sombrero Tea bag Spaghetti Tennis Shell ⌘ Eye ⌘	Boyfriend	
 **CAN2**		Birma Travel Videogames Writing essay Sheep ⌘	Power suit Costume Funnel Rhine-stones Safeway Elbow drive Punk rocker ⌘ Pricilla Queen of the Desert (film) ⌘ Feather ⌘ British people ⌘	Friend Librarian	Table Computer Light table Scorpion ⌘ Dog ⌘		
 **CAN3**		Punk	Safety pin Army barracks Bandana Belaclava Graffiti ⌘	Tom cat Devils horns ⌘, Cartoon characters ⌘ Jackie O' ⌘	Piano, Guitar CD cover Cigarette Bus	Music	
 **CAN4**		Mentally ill Countries at war ⌘	Sandpaper	Car sunshades Fire ⌘, River ⌘, Rocks ⌘	Wife Claw Bird	Muscle ⌘	
 **CAN5**	Codliver oil	Face paint	Dragonball-Z ⌘, Sailormoon ⌘, Gladiator (film) ⌘	Transformer toys	Kids, Family Church,Board games, Chalkboard PlayStation ⌘	Socks Elementary school	Wasp ⌘ Lizard ⌘ Caymen ⌘
 **CAN6**		Storm	Car accident C-train, Friend Med-school Art show, Doctor, Bed Sexual dysfunction Feet, Fish bowl		Billboards Engineers Bridges (3) Construction Boots, Steel-toed boots Razor, Raccoon ⌘ God ⌘		Boyfriend Brother Water ⌘
 **CAN7**		Sponsors ⌘	Friend		Boyfriend Nickel, Brother, Travel ⌘		Boyfriend
 **CAN8**	Contact lenses (2) Kananaskis	Store Workplace Horse ⌘ Snake ⌘	Ball, Seat belt buckle, Motorbike helmet Cheesy 70s headband Running shoes Rocks ⌘,Ocean ⌘	Belly flop Bug ⌘ Branch ⌘	Telephone Walkman Frog ⌘		Musician (2) Guitar (2) Music (4)

Table 6.5: intangible references made by the Canadian students

6.4.4 Paralleling the UK and Canadian intangible references

When comparing the two groups it is interesting that references to everyday objects are the most frequent and common theme. It is probable that because students are learning how to design everyday objects therefore looking to such objects as sources is the natural choice. The intangible references made by the Canadian students are more consistent, which indicates that in general the Canadian group is more comfortable with random intangible referencing, while the UK group maintains considerably more focus on the task at hand. Perhaps this is because the intangibles are considered more desirable by the Canadian instructors and are not suppressed, while the UK instructor may considered these undesirable. For example, there are two UK participants who never make intangible references whereas all Canadian students do so at some time.

Typically, both groups made fewer intangible references during the formal critiques (see appendix VII for weekly activities). For example, the UK group has a formal critique on week five, where the majority of the students did not make intangible references. Those who did (UK3, UK9, UK10) are still at relatively early stages of concept development and evaluation. The Canadian group has their formal critique during week seven, which also shows a decrease in the use of intangibles. In the UK critique, for instance, the instructor is very focused on determining materials, manufacture and design details and all the questions he asks are related to these topics. In the Canadian study, a number of intermediate critiques allowed students to freely explore and evaluate their concepts. By the time of the final critique, the focus is therefore mainly on presenting a thorough resolution to the design problem and, like in the UK study, on material selection, manufacturing processes, and design detailing. However, the UK group is *exploring* during their critique while the Canadian group is *describing*.

This section itemizes the specific details of the categories found among the four participants highlighted in this chapter. Particular references are identified as similar across the two studies, while others are identified as being idiosyncratic and relative to the individual's sociocultural capital. In this way, the sociocultural context, both near (inside) and far (outside) is explored.

6.5 Quantifying the references

Examining the individual references, as shown in the previous section, is one way to look at the data collected. Another way to look at the references is quantitatively. This is done in this section by looking at ratios and relationships of the inside-to-outside, the local-to-universal, and the tangible-to-intangible references. Figures 6.14 (UK1) and 6.15 (CAN1) display a visual breakdown of all the references made by one participant from each study.

Visual Breakdown of All References During the Design Process Milieu

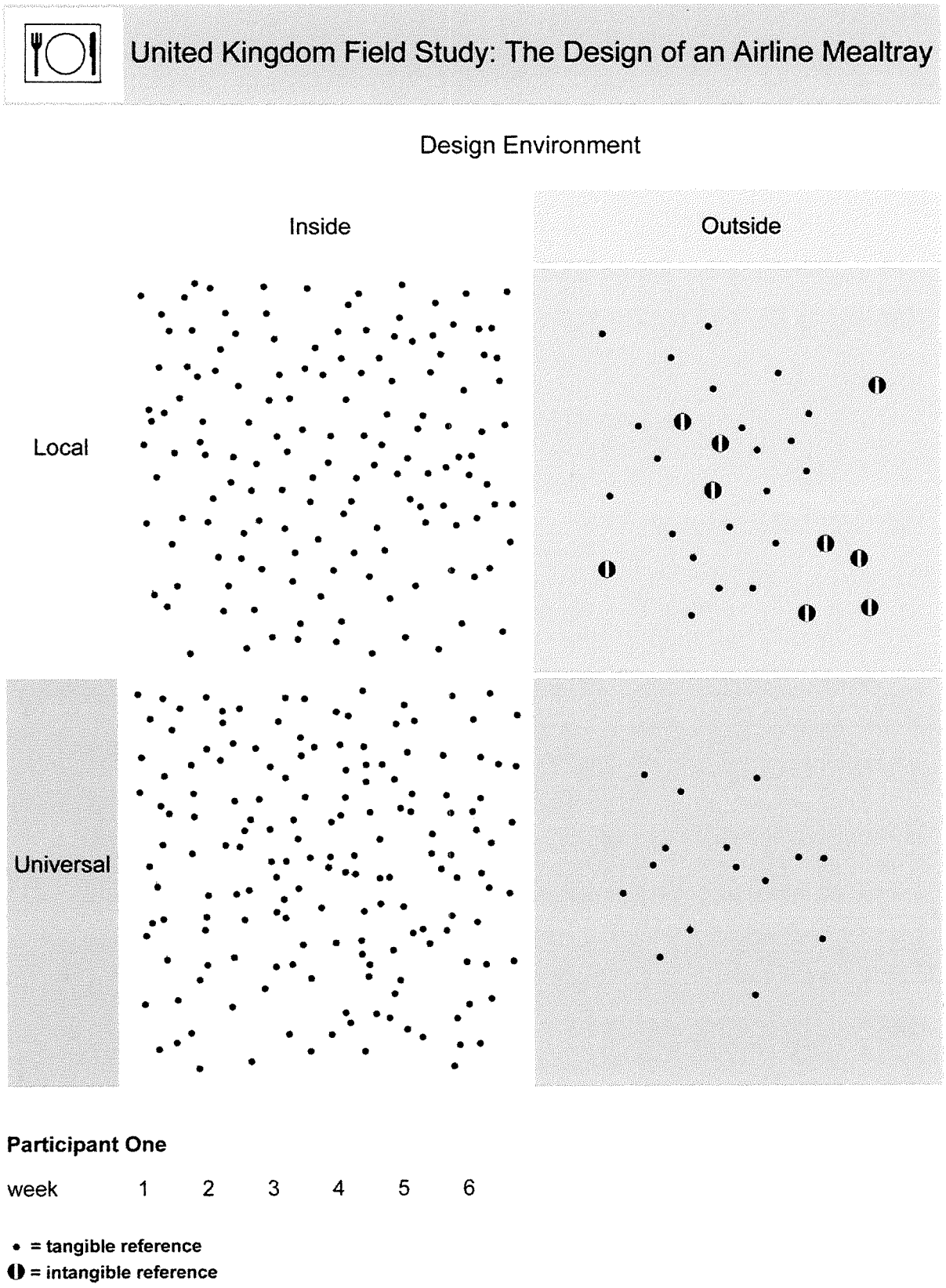


Figure 6.14: visual representation of all references made by UK1

Visual Breakdown of All References During the Design Process Milieu

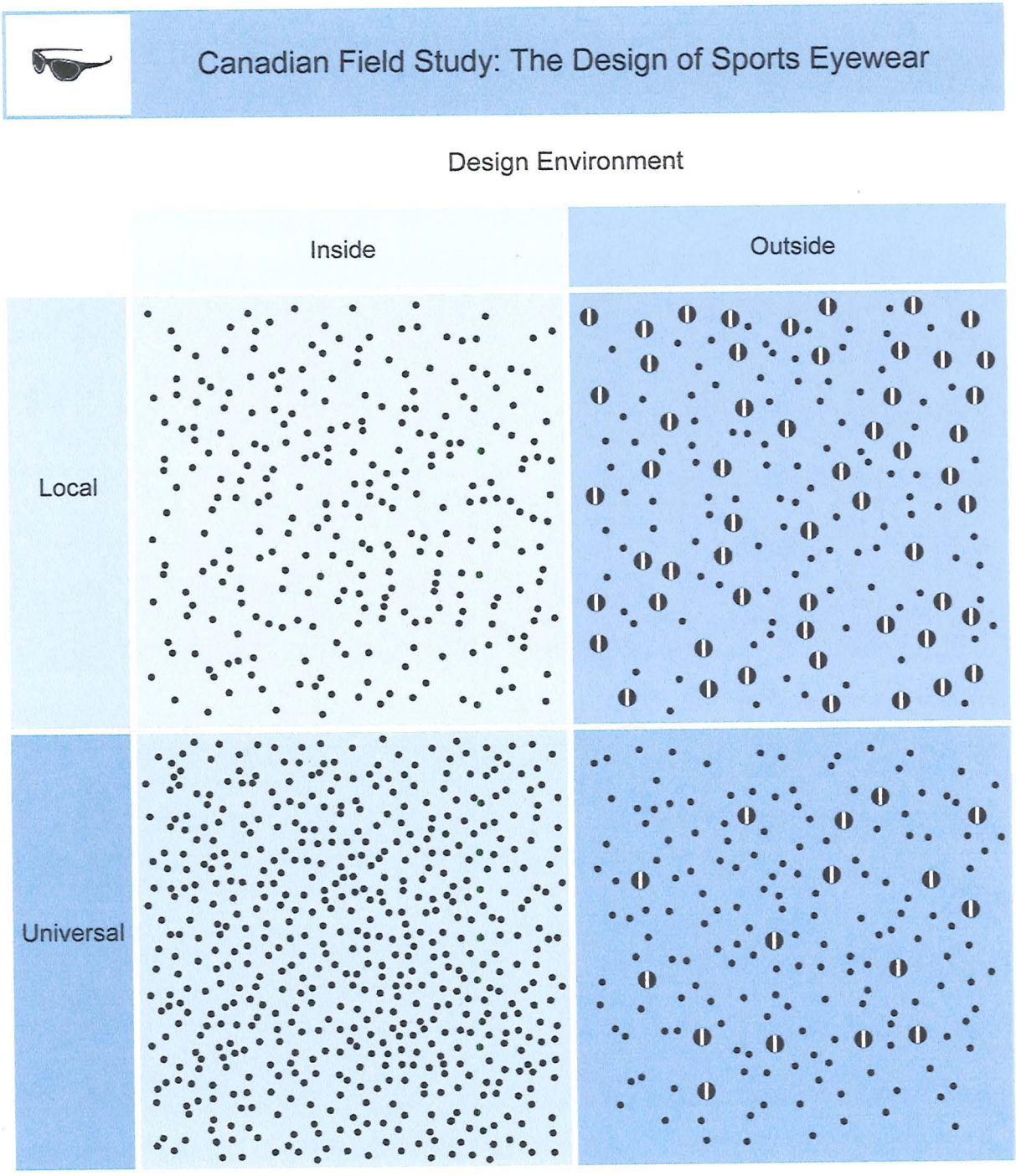


Figure 6.15: visual representation of all references made by CAN1

Within each quadrant the individual dots represents a single reference. A tangible reference is represented by a solid circular dot and the intangible by a larger circular dot with a vertical line through the centre. Figure 6.14 shows the total references of UK1 who predominantly discusses things that relate to the inside environment. Figure 6.15 shows the total references of CAN1 who has a more balanced representation of references from the inside and outside environments. Table 6.6 displays the ratios from inside-to-outside and local-to-universal for the four participants.

	UK1	UK11	CAN1	CAN8
Inside	86%	86%	71%	77%
Outside	14%	14%	29%	23%
Local	51%	54%	42%	48%
Universal	49%	46%	58%	52%

Table 6.6: breakdown of the references made relating to the design process milieu

The quantification of the references in table 6.6, not unlike the visual representations in figures 6.14 and 6.15, indicate that the majority relate to the inside design environment. This is not surprising because typically focused discussion is desired over random discussion. In fact, most instructors would agree that the more focused the design discussion the better.

Table 6.7 shows the ratio of tangible-to-intangible references. This, again, is not surprising because instructors do not, as yet, teach explicitly to use the intangibles. As indicated previously, it may even be possible that intangible references are considered a favourable way of communicating for some groups and not for others.

	UK1	UK11	CAN1	CAN8
Tangible references	97%	97%	94%	98%
Intangible references	3%	3%	6%	2%

Table 6.7: ratio of tangible-to-intangible references

This section has quantified the references by providing a visual breakdown of all the references of one participant from each study and the ratio of inside-to-outside, local-to-universal and tangible-to-intangible references for the two pairs of highlighted participants. The variety in data display, including qualitative descriptions and quantitative ratios, provide different viewpoints that establish a more holistic look at the design process that includes the sociocultural context.

6.6 Progression through the generic design process

The aim of this section is to provide some insight into what students are doing as they reference the outside of the design environment. The generic design process model, as established in chapter 3, is used here as a guide for this investigation.

United Kingdom Field Study: The Design of an Airline Mealtray

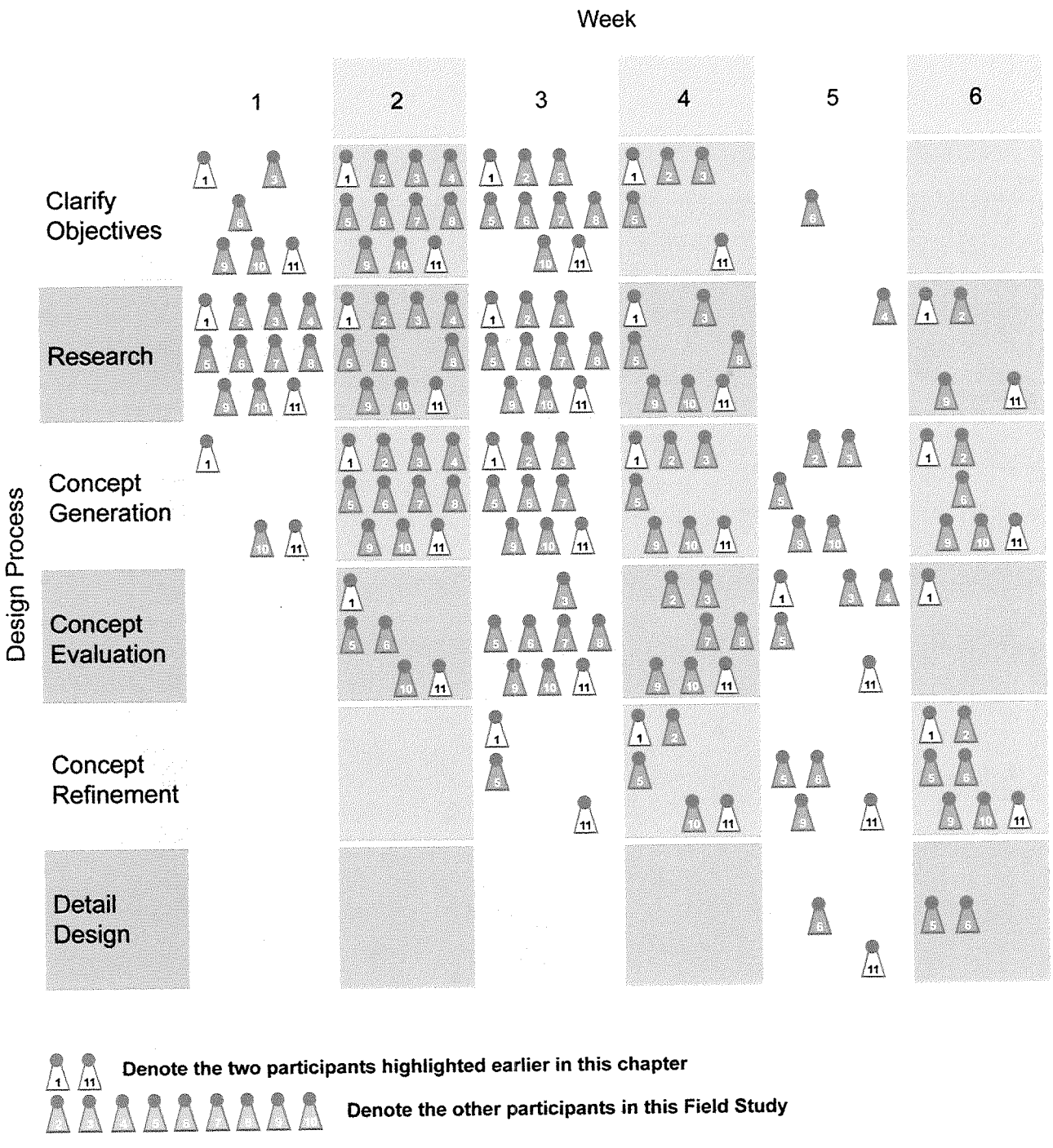


Figure 6.16: the UK student's progress in the design process

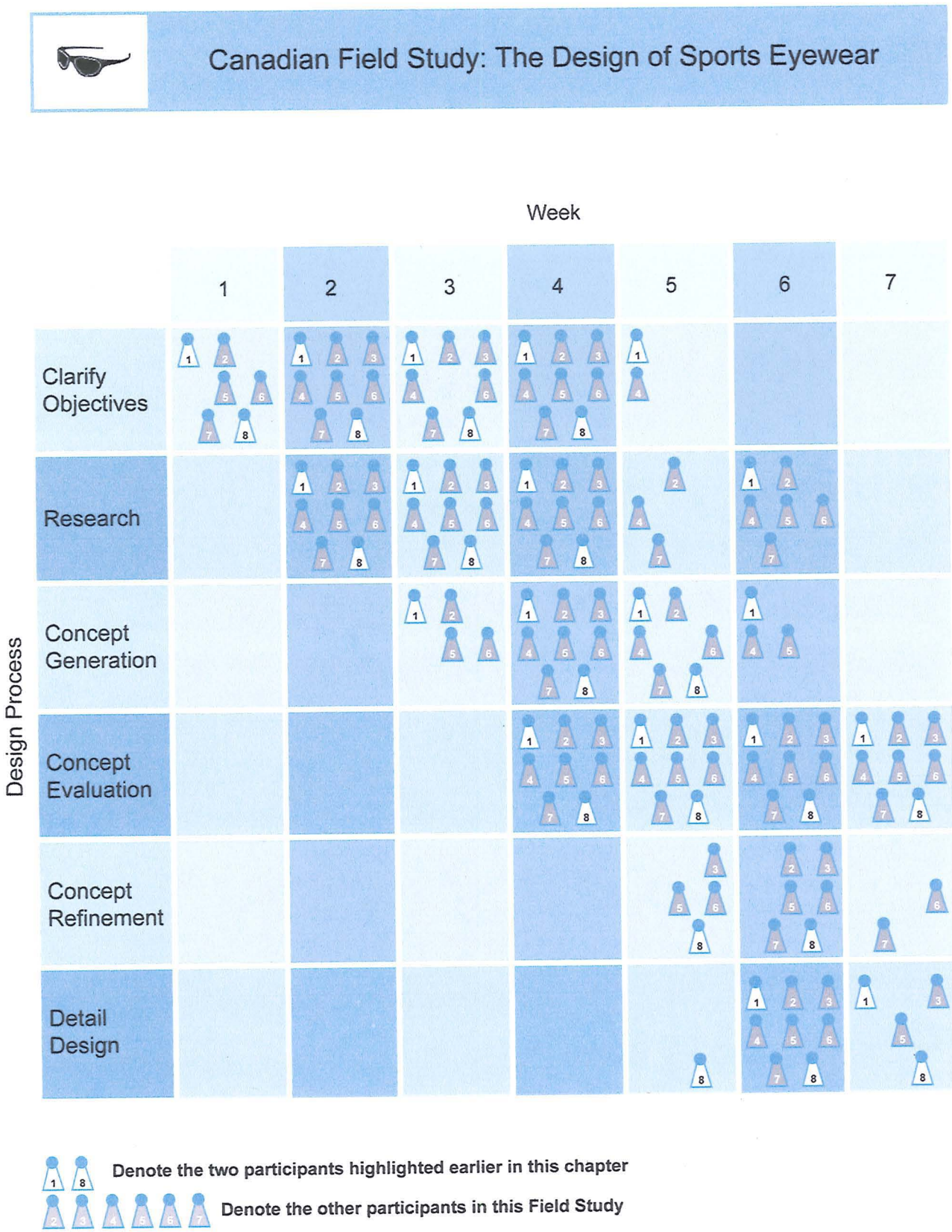


Figure 6.17: the Canadian students' progress in the design process

United Kingdom Field Study: The Design of an Airline Mealtray

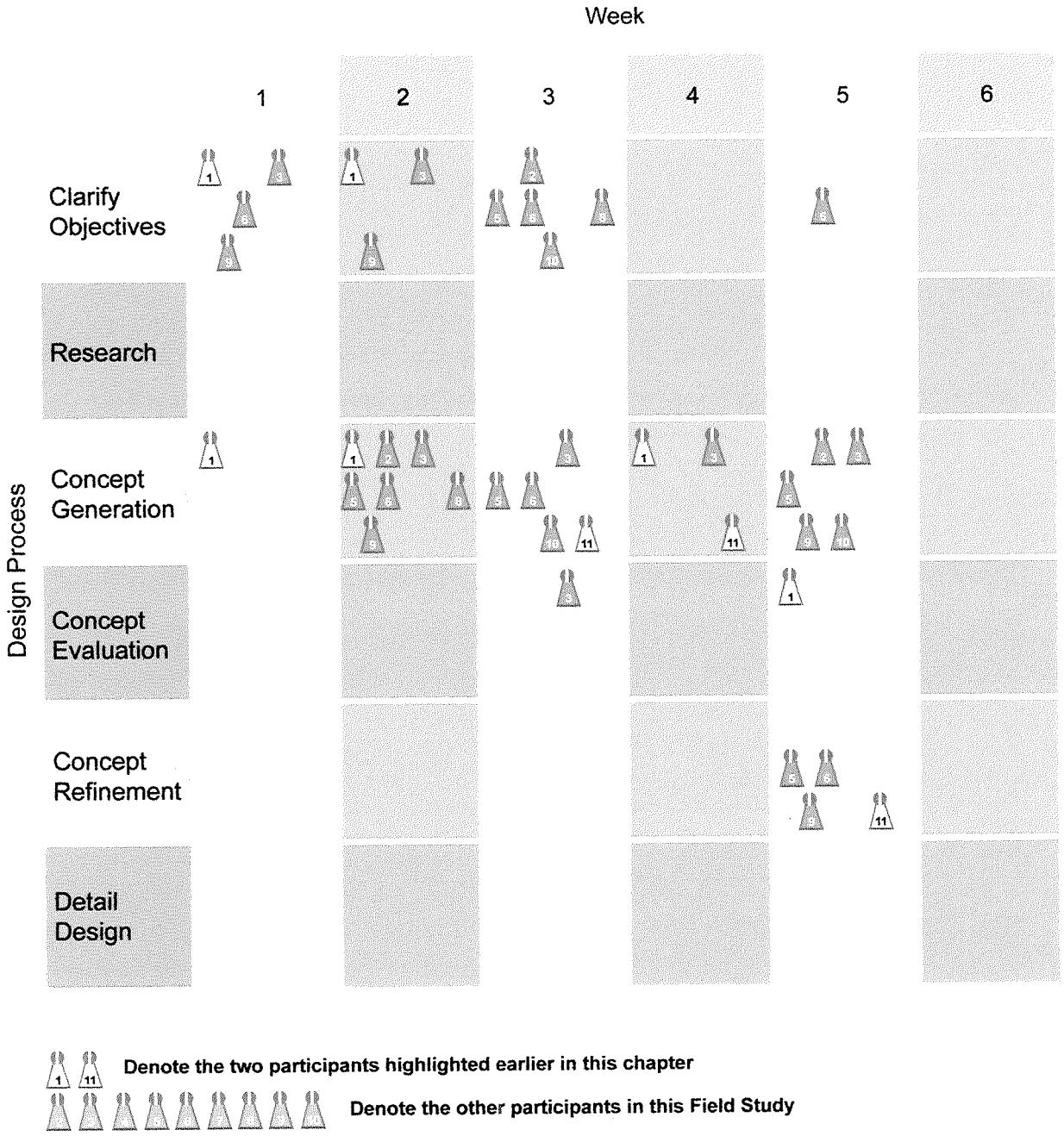


Figure 6.18: tracking the intangible references used by the UK students

Intangible References During the Design Process

Figure 6.19: tracking the intangible references used by the Canadian students

As previously identified, the design process is a nonlinear, iterative process that is cyclic and repetitious; however, there are a number of sequences within the generic model that is shown in figure 3.2 in chapter 3 and in figures 6.16 through 6.19 in this section. The sequential stages are broken into six phases that relate to the design activity occurring *in*

situ, which are used as guidelines to approximate what stage of designing the students are engaged with over the course of each study. This section provides a general description of what each individual within the UK and Canadian groups are doing over the course of their design projects, which is followed by figures for each group that illustrates when the intangible references occur during the process.

The progression of each individual student is charted as a group based on interviews with the students, a dialogue with the participant-instructor about student progress, observations and the researcher's experiences in design practice. The UK group is shown in figure 6.16 and the Canadian group is shown in figure 6.17. These figures illustrate how each participant is doing more than one thing at once while working on their projects. While tracking the design process these figures also represent all references made by all participants during the generic design process.

As a group the UK students predominantly work within the first three stages of the design process, as shown in figure 6.16. Seven students move into concept refinement and only three get to the detail phase where the assigned project is completed. As described in the previous chapter, the UK participant-instructor expects students to negotiate their way through the design process independently. That is, he does not guide them step-by-step through the design process, as this is not considered part of the user-centred module he is teaching. Although the design of an airline meal tray seems relatively straightforward, it is a complex design problem due to the necessity to design a number of components that interface. In addition, this design brief dictates that the students consider two user groups (passengers and in-flight attendants) and three clients (*Virgin* airlines, *Corus* metals, the participant-instructor). The pattern employed by the students is to work on the physical components of the tray followed by work on the dishes and cutlery, while simultaneously researching the users groups, brand and graphics, materials and manufacture. In doing this, the students are working in an iterative way whereby the various overlapping design problems are addressed relatively randomly rather than systematically. The illustration of the design process in figure 6.16 shows that the instructor allows students a great deal of leeway to explore their own personal processes instead of guiding them. During an interview, the instructor said that he felt the students are at a stage where they should not have to be "babysat" through the process.

As a group the Canadian students are equally dedicated to all stages of the design process, as shown in figure 6.17, which is the result of the primary- and support-instructors carefully orchestrating the design process. The Canadian students progress through the design process in a very linear way. In addition to guiding the students'

progress both the primary-instructor and support-instructor have extensive industry experience meaning that they strive for the design of sports eyewear to be as realistic a project as possible. Therefore, there is a desire for the students to develop *real* sports eyewear that is as close as possible to manufacture ready. As a result, all students worked on fine details such as hinges, human-object interface, the exploration of manufacturing processes and the exploration of material selection. The design of sports eyewear is also a complex design problem in that it involves multiple layers of exploration including defining a specific need, creating a superior interface between the user's face / head and the eyewear, and considerable detail design due to the need for three separate parts that interact dynamically. All students create drawings with dimensions that suit their specific user group (*e.g.,* male, female, child) and full-scale models of the final design proposal. All students create physical models while two students complete a CAD model along with a first generation rapid prototype model.

Figures 6.18 and 6.19 illustrate when the intangible references occur during the generic design process. The UK group, shown in figure 6.18, uses the intangible references during four phases of the generic design process while the Canadian group, shown in figure 6.19, uses them during three phases. They are used by both groups while clarifying objectives and during concept generation and evaluation, and by the UK group also during concept refinement. Because intangible references are characterized as being far from the task at hand, it is not possible for an intangible reference to be used for research. That is, research is an activity that is focused on acquiring direct information about something specific and is considered to be tangible by nature. On the other hand, it is possible for an intangible to be used as a starting point for focusing research. For example, when UK1 first discusses a "game" it is an intangible because he is drawing upon childhood experiences from his sociocultural capital; however, this reference leads to other students choosing to research the idea of games.

This section illustrates what each individual within the UK and Canadian groups are doing while referencing design through four different figures. The first two figures represent descriptions of which stages the student-participants are at week-by-week. The second two figures illustrate the intangible references in relation to these stages also week-by-week. By looking at the intangible references within the generic design process model another contextual layer is added to the design environment. Ultimately, it is in this place where the macroscopic design environment and the microscopic references intersect that the sociocultural are examined in detail.

6.7 Conclusion

The goal of design education, to varying degree depending on the instructor(s) the design school and programme, is to explore designing through physical skill development, building mental skills for complex problem-solving and by learning the communication skills related for becoming a design professional. This chapter has discussed the references made by students and instructors *in situ* while designing two particular artefacts. These references relate to the multitude of relationships and events that are occurring within the design environment where these pertain to the *inside* and the *outside*. The references that relate to information from the *inside* are representative of an encultured situation where there are particular expectations and responses based on these. The references that relate to information from the *outside* are relative to the sociocultural capital of the individuals involved. Therefore, this thesis identifies that the sociocultural environments and situations that individuals are immersed in and are present prior to current projects are influential. It is important to note here that value has not been placed on particular kinds of references, for example, those that are tangible appear to serve designing while those that are intangible appear to be superfluous to the process yet each are examined as part of a complete scenario. This examination of the breadth of references within the context of two different design environments facilitates the exploration of a more holistic sociocultural context while providing insights into aspects of design not previously explored.

This chapter has illustrated similarities of references across two studies that relate to the inside of design. These are shown through a series of themes and categories where specific references can be markedly similar or completely idiosyncratic. In addition, this chapter has shown references as being relative to the sociocultural capital of individuals, which are ambiguous and abstract. The qualitative and quantitative results are presented here in five sections that report on the reference-types made, map the holistic processes week-by-week through four highlighted student participants, detail all the reference categories for four participants, detail the intangible references by all the students in the studies, investigate the proportion of tangible-to-intangible, inside-to-outside and local-to-universal references and chart the student's progress through the generic design process model. Through this, it is clear that the sociocultural references, whether tangible or intangible, are drivers in the design process. For example, even though approximately 80% of the references are relative to the inside of design a significant proportion come from the sociocultural capital of individuals. The role that these references play based on the two field studies herein, are summarised in chapter 7. Therefore the final chapter presents the main conclusions of these empirical studies as they relate to the research

questions, provides some of the key implications for design education and practice, and provides recommendations for future research.

7 Towards Understanding Sociocultural References

7.1 Introduction

The overall goal of this research is examine the sociocultural context, which is done through looking between the macroscopic environment and microscopic details that relate to each specific design student by using inductive and deductive approaches. By way of inroad to explore this information, the breadth and depth of artefact creation is examined through the verbal, visual, and textual references made while designing. To this end two groups of university level industrial design students are tracked, one for six weeks and the other for seven, from the onset of their design brief to its completion. According to Gabriella Goldschmidt (1998:263):

> *Every designer is naturally exposed to a multitude of visual images that could potentially be significant for a design search. Many of these images are accidental, encountered in passing, while others are part of a personal inventory of meaningful images, stored in the designer's memory. All of these images belong to countless categories and may include every imaginable entity.*

In general, Goldschmidt's research aims to support the development of design tools that aid in architectural design. Although there are many differences between the intent of her research and the work done in this thesis, Goldschmidt acknowledges that imagery used by designers is infinitely variable because each designer is an individual with a different subjective approach. She also acknowledges that the imagery used by a designer is *referenced* and may be done so in an infinite number of ways during designing. This point of view makes up the basic assumption in this research, which is that each person has a wealth of information about the world around him or her and will use it specifically and randomly, intentionally and unintentionally whenever needed. It is commonly known that designers (and people in general) naturally draw upon information from their memories and experiences. Margaret Boden's work on cognition and creativity supports this by stating that the *human memory acts as a thesaurus* (1998:42). This thesis acknowledges and explores the designers' use of their personal thesaurus, which consists of his or her sociocultural capital. Sociocultural capital is sometimes used in a focused way by

referencing imagery and experiences that relate strongly to the task at hand or more randomly by referencing things that have a greater distance from the task. In view of this, the research reported here explores the use of individual personal and sociocultural information that emerges as (in)tangible references during discussion. In order to fully understand and describe the use of references, it has been argued that the specific design environment must be understood and paralleled with the specific references. In this respect this empirical study has two set outcomes: first to define the sociocultural, tangible and intangible references and second to do so within the macroscopic contextual environment. Having presented both the qualitative and quantitative results of this research, it is now time to assess these results by return to the research questions. The answers to these questions has been displayed in a variety of ways, predominantly in chapters 5 and 6, and are further summarized and evaluated throughout this chapter. First the six research questions are revisited here along with the approaches taken to answering these are:

- What personal and cultural experiences are referred to in the context of designing an artefact?

To answer this question an interdisciplinary research model is developed called 'the design process milieu', shown in chapter 3, based on theories of sociocultural research. It is conceived with artefact creation in mind and is directly applicable to the design environment. This model allows for a more holistic investigation into the design process, and enables the references to be divided into eight categories (*e.g.,* inside, inside-local, outside-universal) and for these to be further defined as tangible and intangible. Through an iterative research process, this model provides the guidelines for creating a set of general categories to better understand the references made. There are two major limitations of this model. First of all, using it assumes an intimate understanding of the holistic environment, which necessitates a great deal of inside information and / or a significant time commitment. Secondly, an examination at a fine-detailed level is needed to glean information about the designers' individual-personal and sociocultural experiences. The detailed search for content morphemes requires video or audio documentation of the discussions taking place *in situ.*

- When do the intangible references occur within the design process?

Using the six-stage generic design process model shown in chapter 3 addresses this question. This model is informed by two well-respected sources, which facilitates the tracking and description of students' progress during the design of an *airline meal tray* and *sports eyewear*. The individual students' activities are placed in the appropriate phases of the model to represent what they are doing in what week of the study. Following this, the specific intangibles are placed in this chart to approximate the stage of

the design process the references are made. On the most part this procedure worked well to approximate when the references occurred during the design process. The main limitation, however, is that sometimes there is a fine line between concept development, evaluation, and detailing especially in the educational context because the students are still learning about process. For example, on more than one occasion a student appeared to be at the detail phase, but then discarded that work and returned to the concept phase.

- Are these intangible references driving the design process and if so, in what way?

The very presence of the intangible references suggests that they have meaning therefore it follows that that they are driving the design process in some way. The question is addressed by using the same procedure as for question two, but with the added layer of looking at how the intangible reference related to the context of the design discussion. Following this, a technique of clustering and identifying patterns among the intangibles, as developed by anthropologists as shown in chapter 4, is applied to discover why they are called in. The limitation of this procedure is, again, that its use necessitates an intimate knowledge of the group.

- Are there any patterns, similarities and / or differences within each field study or between the two?

The central reason for doing two field studies is to examine broader sociocultural issues that are brought to the context of artefact creation. In doing so, it is necessary to develop a reliable method to look at both studies in the same way. Therefore, strict measures are taken in dealing with, displaying and analysing the data as shown in chapter 4. To answer this question, several levels of analysis are accomplished before charting the intangibles in figures and tables that allow for finding parallels between the studies. The limitation with this procedure is the time required to maintain a high level of consistency between two studies. However, the outcome is a systematic method that can be repeated in the future to investigate similar research questions about sociocultural issues in design. Some of the patterns, similarities and differences between the two studies are described in chapter 5 and later in this chapter.

- What is the proportion of the tangible references to the intangibles?

Early in this study it was considered useful to get an indication of how many tangible and intangible references were being made because these are considered to be an important link to sociocultural capital. In sociology and, more recently, in anthropology, quantitative results in combination with qualitative results are considered to provide a broader picture of the situation being studied. In this case, having an indication of the ratio of tangible-to-intangible references provides a breakdown of how often the intangibles are used, which are shown in chapter 6. This question was easily answered by establishing the total

number of references made by each individual student. Even so, although this appears to be a simple task, the sheer volume of references made during each study was enormous. In order to offset this, a pragmatic approach is taken whereby two individuals are highlighting from each study. Once the total number of references for the studies is established and the references are charted using the design process milieu model, the proportion of tangibles-to-intangibles is easily determined. The proportions of the inside-to-outside and local-to-universal are determined as well.

- Are there any links between sociocultural references and the final designed artefact?

The broad all-encompassing nature of the ethnographically oriented study enabled this question to be addressed on a general level even though the notion of influence does not constitute the focus of this research. This is done by observing links between the design discussions, following the development of the artefact through numerous visual iterations, and by observing the context of each group. As an epilogue at the end of the field studies, the students are queried about any influential sources they might have used. This final interview question revealed that four of the nineteen student participants in the two studies used intangible references as key sources of inspiration towards their final artefact design. Four examples identified by different students are discussed later in this chapter.

The rest of this chapter advances from how the research questions are approached to summarising the insights gained through engaging in two empirical ethnographically oriented studies. These sections are summaries of the key findings including insights into the references (tangible, intangible, sociocultural), insights into the purpose of the references, insights into the two inside environments, a reflection on the methods and theories used and developed, the implications for design education and practice, and recommendations for further research.

7.2 Insights into references

Referencing revolves around communicating that occurs in a social forum that is relative to the sociocultural context. References are considered to be the inroad to understanding how sociocultural information is brought to designing, these reflect the duality of situations where people communicate including the individual and the collective. Rather than examining the individual's cognitive world, this research explores the place in which communication occurs where much of the time the design students are making sense of the projects they are engaging with.

References in general are content morphemes that consist of single or multiple words. To identify content morphemes is to look for meaning in a sentence or a string of sentences

uttered during discussion. A content morpheme may be a noun, a metaphor or analogy, or (part of) an experience. References are identified in this research as three basic types: tangible, intangible and sociocultural. Distinctions between the three reference-types are made using the design process milieu model in order to zoom in on the information that is the focus of this work. The first level of distinction is between tangible and intangible references. All references to the inside environment and those that directly relate to the artefact being designed are tangible. The intangible references, therefore, are all remaining ones that relate to the outside environment, which come directly from the sociocultural capital of the individual. An intangible reference may contain information that is individual-personal or sociocultural. It was originally speculated that the references furthest from the design task at hand would likely relate closest to the sociocultural capital of individuals. Therefore, it was considered that through examining the intangible references a better understanding of the sociocultural context would emerge. To an extent this is the case; however, it was discovered that sociocultural references are both tangible and intangible. This section elaborates on the insights discovered about tangible references, intangible references and sociocultural references as a result of the studies described herein.

7.2.1 Tangible

As previously discussed, Schön creates a comprehensive list of the *normative design domains* (1985:45) that he discusses as relating to the material inside an architectural design school. In this same research, Schön indicates that each design school has a different language (*ibid* 50) and that the normative design domains reflect this. Although his research predominantly investigates one-to-one interaction and individual problem-solving, his identification of the normative design domains and different languages specific to design schools is significant to the research herein. That is, the normative design domains are similar to the tangible references, which are all things that relate to the inside environments of design. Schön's normative design domains include elements and principles of design that include, for example: organization of space, form, structure, use and technology (*ibid* 45). The tangible references are all those things that any instructor would expect their students to discuss while designing a given project, which includes the skills and topics taught as well as those things well-known and / or easily accessed through research in the design discipline. Tangible references are easily understood in the context of designing not only because these have been of considerable interest in the design community for some time, but also because it is clear that students (and practitioners) discuss things that are pertinent to their work throughout the design

process. This is further evidenced through the two studies herein where focus on the task at hand occurs the majority of the time.

Beyond illustrating that tangible materials dominate while student design, this thesis provides specific detailed examples of themes and categories that are considered to be tangible references. The tangible references for each field study are identified in chapter 6 whereby broader categories than Schön's normative design domains are illustrated. For instance these include: other projects and modules, instructor(s), visualization techniques, classmates and the specific design brief. It is important to note that the list of broad categories and detailed examples are by no means exhaustive because these are based on the two field studies that are focused on industrial design education. Even so, the ethnographically oriented approach provides insights into a sampling of topical design principles; the particular values of students, instructors and design schools; of the focus of different design briefs; and into two very different instructional strategies. These are discussed in greater detail later in this chapter.

7.2.2 Intangible

Intangible references are understood in relation to two different yet comparative contextual environments. These are each within the subdiscipline of industrial design involving two studio cultures, two different design schools, programme cultures and westernized countries within the generic design education culture. The incident of intangible references, as shown in chapter 6 and detailed in two papers (Strickfaden 2004a, 2004b) is minute in comparison to tangible references, although in general there are examples of intangible references being made throughout the design, process in each study. As evidenced in these studies, intangible referencing is a result of many factors relative to the design scenario. That is, leadership results in different attitudes and behaviors, which is directly reflected in referencing. For example, with the UK study the participant-instructor maintains a focus on information that is tangible in an attempt to maintain the interest and motivate a group of young all-male students. With the Canadian study, on the other hand, the primary-instructor focuses on 'design thinking' and uses personal anecdotes as part of his teaching style. As a consequence, in each case the students emulate their instructors and it can be said that the Canadian group may even value or favour the use of abstracted references. In addition to the leadership, it is speculated that the maturity of a group affects the rate at which they are willing and able to use intangible references. For example, young students have a relatively narrow range of sociocultural capital compared with older students. This lack of life experience likely affects how focused a student is on their topic and how willing or able they are to make

abstract connections. That is, students with a broader experiential-base may be able to make more disparate connections between things.

The design process milieu and the generic design process models aid in understanding when intangible references are used. Within the two highlighted studies intangible references are most commonly used during concept development, for defining the design problem and for evaluating concepts. The majority of the intangible references are characterized as objects and experiences that people easily relate to when placed out of context. Examples from the UK group include objects such as a squeegee, a black dog, a spaceship, wet socks, and a wallet; and from the Canadian group include experiences such as knitting, travel, playing videogames, attending church and attending an art show. There are also intangible references to interpersonal relationships in each study including boyfriends, girlfriends and family members. Detailed examples of these references are illustrated through figures and tables in chapter 6. In general the intangible references tend to be general in nature, which indicates that these are valuable tools for communicating a variety of design issues particularly those that are visual.

7.2.3 Sociocultural

References to the sociocultural environment are those things that fall into the outside environments (local, universal) in the design process milieu model. These are the things that relate to the sociocultural capital of specific individuals. Sociocultural references may be tangible or intangible depending on their closeness to the task at hand. For instance, with the UK group references travel, eating and food are relative to the design brief, yet many of these references are also personal. A specific example is when CAN8 consistently references the natural world, recreation, places and events as these relate to the design of eyewear for kayaking. He uses his personal experiences with kayaking to explain his decision making process and to elaborate on the use-scenario. Interestingly, at the completion of the study CAN8 articulated that he did not feel he needed to do extensive research because he had an intimate understanding of the user-group and use-scenario based on his personal experiences. Most commonly, the participants (students and instructors) make sociocultural references when they want to make a point about something that directly relates to the project, especially when a specific argument or criticism is desirable.

Across the studies, the Canadian group makes more sociocultural references than the UK group. The reason for this is explained through the two studio cultures where there are different leadership styles and approaches, different attitudes towards learning and design and different levels of maturity and behavior. In general, the students in the

Canadian group have a broad range of sociocultural capital because of their ages, their differences in gender, ethnicity and countries of origin. In addition, the Canadian instructors have a history with the group of students having taught them several previous modules, whereas the UK instructor had never taught this group before. These are the central factors that result in significant variations in the themes discussed by the groups including their specific reference-types.

This section has summarised three different reference-types. These are the tangible references that are directly and obviously related to industrial design and the design brief, the intangible references that are abstract and further from the task at hand but nonetheless present, and the sociocultural references that are both tangible and intangible but relate directly the sociocultural capital of the individuals involved in designing. In reiterating that references are made within specific contexts, this thesis recognizes that the individual is acting in a context that is larger than the self (individual) which is shown here as the sociocultural context within the design process milieu.

7.3 Insights into the purpose of references

When Louridas (1999:519-20) stated that a designer acts as a bricoleur who is at the mercy of contingencies including the internal (cognitive) and external environments (local, universal), he was not pinpointing the effects of sociocultural environments on a designer, yet he could have been. A designers' sociocultural capital constitutes a resource that is at the designers' disposal without researching or even thinking too hard. They can select from their personal thesaurus and find the closest match or highest contrast to the task at hand, depending on what is needed or preferred. This personal thesaurus is the script of each individual and it is commonly known that new situations bring out existing scripts and old scripts are revisited (Heylighen 2000:45). As Alexander argued in his book *A Pattern Language* (1977), designers select, adapt, and combine patterns. When specific patterns (*e.g.,* elements of design) are not taught explicitly, designers and design students are left to create their own. The most readily available and easily created patterns are relative to their sociocultural capital. The level of expertise of the student or professional will depend on the degree to which this capital is focuses on.

Due to the predominant focus in design research on cognition it is possible to make two basic assumptions are made about references. These are first that references made relate directly to the artefact; and second that the role of references relates to problem-solving and cognition. It is important, therefore, to emphasize again that although there is a relationship between what people say and what they think the correlation between speech and cognitive processes is not focused on here. The purpose of the references

may relate to creativity and cognitive processes; however, this thesis does not focus on these but focuses on references as part of communication processes within a social forum as defined throughout this work. Furthermore, this research asserts that *all* the references have an impact on the individuals and artefacts being created, even though they are sometimes exploited in a partial way and may penetrate the designed artefact very subtly. It is clear that the tangible references are related to the design process and to the artefact being designed; however, the sociocultural and intangible references are less clear. Memory and evocation involves selection and filtering in relation to the social and personal goals of the individuals involved (Hodder 1998:73). As previously indicated, sociocultural and intangible references are highly idiosyncratic because they refer to the sociocultural capital of individuals. In this regard, there is never an accurate or true representation of reality, only a subjective one based on the individual's recollection of the object, situation, person or experience. By consequence a reference that means something specific to a certain person under certain circumstances may, under the same circumstances, mean something very different or nothing at all to someone else. This means that references are never truly universal; however, they may be indicators of categories.

The impact of sociocultural and intangible reference may not always manifest physically, but they are very much part of the design creation context. That is, because the sociocultural and intangible references are part of the design communication process, they will act to motivate and move the design process forward, test ideas, and even sometimes influence a concept. This section focuses on the purpose of the sociocultural and intangible references, which is summarised in three subsections including how these are a part of making sense of designing, how they serve artefacts and how they support the sociocultural environment.

7.3.1 Making sense of designing

Cuff states that designers spend a great deal of time making sense of situations (1991); and Minneman further elaborates on three ways that designers communicate: making sense of the past, informing the current state of the design problem and framing future action (1991). In general, references are used to make sense of situations within a context that is understood by the people talking about them, but also for explaining new scenarios and ideas to other people. For example, intangible references are sometimes used as metaphorical and analogical descriptions to the things that are being designed. UK5 says that his final design "looks like an oyster shell" and CAN2 talks about "rhinestones" as an aesthetic she will not embody in her design. An example of using an intangible references as a structural analogy is when UK6 references Cornish boxes and

whisky tins, where he draws the connection between the way these are made and how he could construct an airline meal tray. There are many more examples of tangible references being used metaphorically and analogically than there are intangible.

Along with the evidence of references being used as metaphorical and analogical explanations the work of Kevin Dunbar supports the notion that distant analogies are used to *explain and not generate ideas* (1997:473). Dunbar's work is focused on creativity and cognition but uses ethnographically oriented research methods similar to the methods used in this work. References made, particularly those that are easily understood by others, are often associated with broad sociocultural environments and are both tangible and intangible. That is, there are many tangible examples found in the categories of media and generic objects such as a spring, boats, a wire and a bobby pin; and many intangible examples in the categories of generic experiences and the natural world such as a frog, a black dog, sheep and rocks.

7.3.2 Serving artefacts

Although there is little evidence in this research of how intangible references serve artefacts, there is indication that there is sometimes a relationship between the references and the artefact. Discovering how references and the final design connect is not straightforward because it is clear that references play a variety of different roles. In fact, during the final interview with the students in each field study the majority of the students indicated that they did not know where their core design concept had come from. This is not surprising since chapter 6 illustrates thousands of references within dozens of categories that are framed by numerous different contexts. In addition intangible references are often fleeting and made over a relatively short period of time therefore these are not easily identified by individuals. The highly detailed transcription, the holistic nature of the studies, the objective position of the researcher, and the opportunity to query the students directly about influences upon completion of their design make it possible to begin to identify some of the relationships between the intangible references and the final design.

At first glance, many of the intangible references appear to be quite distanced from the design brief and from design in general. But interestingly enough, the majority of these are closer to the target than originally perceived. For example, when UK3 referenced the "Ikea blue bag" it was done to explore sustainability in the design of the meal tray and to consider a different method of storing / removing rubbish from the trays after the airline passengers have consumed their food. Similarly CAN2 uses the idea of dressing-up while working at Safeway as a distant analogy to dressing-up as a motorcyclist (including

wearing the sunglasses / goggles she is designing). Another example is when CAN6 uses the idea of structural engineering, construction and steel-toed boots to explain, first, the significance of safety in design eyewear for skydivers and, second, how something that shows wear (steel-toed boots) can represent a higher level of performance. These may represent principles to embed in a design. These examples illustrate that one of the relationships between the intangible references and artefacts is to use them as explorations of design principles such as sustainability, safety, user-artefact interface and durability. The references in these cases aided in communicating concepts that may be considered more abstract by adding a layer of meaning to designing.

Four specific examples are taken from the studies that illustrate a connection between specific intangible references and final designed artefacts. These students indicate in their final interview that a reference is a starting point for their artefact. The first is when UK6 uses the shape and proportion of "whisky tins and boxes" to inform his meal tray design, shown in figure 7.1.

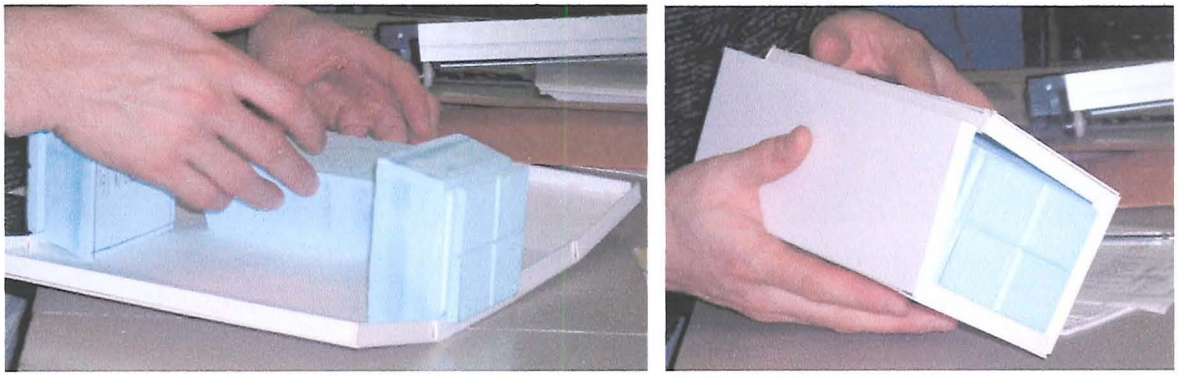


Figure 7.1: whisky boxes and tins influence a folding meal tray design

The final design for UK6's meal tray is one of two three-dimensional forms (the other was the bird-feeder design) completed by this group, while all other tray designs were flat. The second example is when CAN3 identifies "devils horns" for his skateboard eyewear. He proposes that when skateboarders do not need protection over their eyes, the glasses are perched on the tops of their heads so that the profile resembles devils horns. The third is when CAN8 uses rock formations worn away by water and tree branches in his asymmetrical design of kayaking glasses to inform the contour of the frames. The final example is when CAN1 uses the colours of Mexico (*e.g.,* food, natural environment), the form of rocks and shells and the concept of jewelry and hair accessories for her final design.

CAN1's exploration of colour and form are shown in figure 7.2.

Figure 7.2: colour, a necklace and rocks influence the final beach eyewear design

In addition to the intangible references having a direct relationship to the final artefacts designed, the four participants used them in different ways. That is, initially all the students referred to things that were not physically present with exception to CAN1 who followed-up her initial descriptions with researching colour and rocks. She therefore provides material representation in the form of imagery and objects to further elaborates and communicates her concept. In doing so, CAN1 searched for an intermediate representation that is material support for her sociocultural capital before she embodied this in her final artefact. These four students, one from the UK and three from Canada, provide the preliminary examples of intangible references serve to influence artefacts. This subsection provides some evidence that intangible references are used as visual metaphors and analogies and also sometimes by embedding specific characteristics from those references into the artefact being designed. How the intangible references serve the artefact are not conclusive based on the two studies highlighted in this thesis therefore further research is required to fully understand this phenomenon.

7.3.3 Supporting the sociocultural environments

It is well known in the discipline of anthropology that culture is simultaneously *enacted* and *created* by the individuals involved in a group. Therefore it is natural that the references made within a group are a result of the expectations laid out by the leader of the group and the members within the group. This subsection identifies how the two groups support their specific sociocultural environments through referencing, which is connected to approaches to design education, overall attitudes within the group and how culture is fostered. These are identified as central themes across the references that relate to the sociocultural environments of both groups.

Although design education can be approached in a variety of different ways, three approaches are identified in this research as: physical skill development, mental processes and emotional processes (reflection using intuition). Approaching designing as

physical skill development is natural since a designer must have the necessary skills to accomplish the work required in industry. These skills primarily include visualization and applying the elements of design and are supported through visual, verbal and textual communication. Focusing on mental processes includes doing research (primary, secondary, tertiary) and exploring the principles that drive artefact development in a particular direction, which are supported by using tangible and intangible references. Reflection through using intuition entails teaching the students to use their personal sociocultural capital while designing. The two groups highlighted in this thesis approach the three approaches in a variety of ways in an attempt fulfil them all. The Canadian group is considerably more successful in balancing the three than the UK group. To a great extent, this is due to the student-teacher ratio and the focus of the instructors. The UK instructor teaches independently and pushed the students to create accurate physical manifestations of their concepts while teaching them about user-centred principles. The Canadian group has the benefit of having two instructors with different views on what should be the focus of design. The primary-instructor believed the mental processes to be primary and the support-instructor emphasizes the physical, which provides a balance for the students. The two different approaches naturally affects the references made by each group. That is, because the focus in the UK group is predominantly on physical skill development the references made by this group support this, for instance the reference categories are generally about the elements, materials and manufacture of the airline meal tray and the user-centred module. Whereas with the Canadian group the approach is focused on design principles, which are more readily supported by references that relate to the sociocultural capital of individuals.

The overall attitude of the students is also supported by the references that are made throughout their time spent together. As previously identified, the UK students have a high level of negativity and a lack of motivation, which means that the instructor spends less time teaching design and more time motivating the students. That is, the UK participant-instructor consistently instructs the students to attend to the task, whereas the Canadian students are already focused and as a result are more detail orientated. Again, the overall attitude of a group affects the reference-types that are made within that context. As illustrated with the two studies here, negativity creates a breeding ground for more negativity and productivity creates a breeding ground for more productivity. This is evidenced by the fact that in the UK group negativity prevails as an attitude throughout the course of the study and in the Canadian group productivity prevails. This is illustrated in chapter 6 by how far in the generic design process each group gets.

Another theme within the sociocultural environments is how culture is fostered. The UK group did not have a clear sense of culture from the programme, the school or the instructor. Although there is an impression of general design culture (an internationalist global notion of design and a strong focus on independence) this is implicitly present. On the other hand, the Canadian group is exposed to the culture of the programme at the onset of their studies. This includes placing value on the principles of sustainability and design-for-need. In addition, the Canadian students are taken on a design camp as a means to introducing the students to the programme and to the other design disciplines and students. Furthermore, the primary instructor fosters culture through using a specific language of design with his students. This 'inside language' creates a sense of belonging in the group to the extent that when the researcher arrives there is a feeling of exclusion. When culture is fostered explicitly then it is naturally developed and enhanced by the group through references. There seems to be a natural human drive to develop culture even when it is not made explicit or directly supported through leadership. Each group uses play through pranks that support group cohesion. For example, the Canadian group goes to elaborate measures and considerable cost to play pranks on each other, and the UK group uses their interests in girls and sports to support their sociocultural environment. Within groups it is known that a strong sense of culture promotes better interaction. This enhances group motivation and overall productivity. Social facilitation through leadership with an instructor and / or key students provide the support to perform to a high standard. The references made by each group reflect the nature of their sociocultural environments while simultaneously enhancing these. For example, the Canadian group discusses things that belong to the inside environment that are understood by only that group. They enjoy clever word play, abstraction in discussion and the use of personal anecdotes, whereas the UK group predominantly focuses on the task at hand yet connect with each other outside of class time as a male group.

This section provides insights into the purpose of references by identifying three ways they are used in the two studies highlighted in this thesis. Although evidence on the purpose of the references is not the focus of this work general themes have been presented that relate to the studies. Through gaining insights into the references and their purpose insights into the context of these references is also revealed. The next section identifies key insights into the two industrial design education environments highlighted.

7.4 Insights into two inside environments

By following the development of two different artefacts over six and seven week periods through two holistic studies *in situ,* information is revealed about the details of designing through the references and also about the inside environments. The inside environment is

the immediate sociocultural context that envelopes students while they are designing. Within this inside environment there are several layers of context that further influence individuals, which are identified as the inside-local and inside-universal sociocultural environments as defined through the design process milieu model. As indicated in chapter 5, inside-local environments are relative to the approaches, attitudes and resulting behaviors of the group members within. And inside-universal environments are relative to the common currency of general design that is part of encultured design education. Zygmunt Bauman (1999: xiv) writes about inside cultural environments as:

> *Culture is as much about inventing as it is about preserving; about discontinuity as much as about continuation; about novelty as much as about tradition; about routine as much as about pattern-breaking; about norm-following as much as about transcendence of norm; about the unique as much as about the regular; about change as much as about monotony of reproduction; about the unexpected as much as about the predictable.*

Bauman's description of culture applies to the nature of the two inside environments illustrated in this thesis because each has a strong sense of culture. The inside environment includes that which is shared within groups and the rituals around these. Culture within the inside environment is demonstrated through the attitudes and behaviors exhibited by the individuals within the group including rules, relationships, hierarchies, language-use and play. In addition to this the physical setting and resources available also play roles. The rituals enacted by design students are about how ideas are generated, work patterns, how projects get completed, how the students engage with their instructors and how group cohesion is created. Some of these have been touched on in the previous sections; however, this section details specific insights that are made about the two layers of culture defined within the two inside environments. These insights represent a first step towards a more articulate understanding of the multiple layered sociocultural contexts that envelop the designer while engaged in the design process.

7.4.1 Inside-local as studio culture

The inside-local context involves the overall sociocultural environment that envelops the student in that situation. This context is also called the studio culture and includes the nature of the task at hand, project stakeholders, project users and instructors' perspectives. The two field studies are distinct sociocultural settings because the way design is approached and the way each group interacts and handles the design problems vary significantly. There are five major factors that contribute to the two studio cultures highlighted in this work. These factors are identified as things that are common to both groups and are: hierarchical behavior and play in the studio. Whereas others are contrasting and are: egocentric versus sociocentric behavior, the results of a single

gender versus having a gender balance, and the results of a mono- versus a multicultural group.

Ashton (2001) explores the issue of hierarchy through her work on the social capital of design students; and the research herein identifies that hierarchy is present in both groups. The notion of hierarchy is deeply connected to leadership, in this case, student leadership that aids in guiding the attitudes and behaviors of the group. Hierarchical structure is part of the studio culture whereby it affects the individual students in different ways. While hierarchy is empowering for some it is disempowering for others. Hierarchy among students may also provide leadership and even raise the overall standard for a group but it can also do the opposite. With the UK group there is a clear lack of student leadership when it comes to designing, which puts the entire group at a disadvantage because there is no precedent for achievement. In contrast with the Canadian group there are clear male and female leaders that challenge the individuals within the group to strive for their personal best.

Kelley and Littman (2001) identify play through pranks as a characteristic of the IDEO design studio culture. In their book they indicate that play makes a positive environment by providing a sense of belonging. The incident of play through pranks is evident with both groups detailed here. The UK group engages in 'taking-the-piss' out of each other; and the Canadian group engages in a senior-junior rivalry through four increasingly more elaborate pranks. Interestingly each group takes a culturally appropriate approach to playing pranks, that is, the UK group uses a technique of teasing that is typically Scottish and the Canadian group uses a technique of respect that is typically Canadian. Group cohesion is inspired through the pranks for the majority of the participants in each group; however, sometimes it has the opposite effect where greater introversion results with those individuals who feel excluded. It is demonstrated principally in the Canadian study that group cohesion results from play, yet even with this group there are two participants who are excluded resulting in distancing from the rest of the group. It is clear that inclusion or exclusion of individuals within a group and that group cohesion has an overall effect on the attitudes and behaviors that result within that group.

There are two basic ways that people view themselves in the world: either as an egocentric who is individualistic, self reliant, and autonomous; or as a sociocentric who believes that their position in society depends on context (Robbins 2001:170). The UK group takes an individualistic egocentric approach to design where they tend to work independently as students and predominantly discuss things one-to-one with their instructor. As a consequence, the individuals in the group become proficient at the skills

required to design because they do not rely on each other to 'fill gaps' but learn how to do all things for designing independently (*e.g.,* sketching, model-making). In contrast the Canadian group takes a sociocentric approach where the students' outlook on designing depends on each other. A significant part of their work occurs within groups that are orchestrated by the instructor while the students establish additional group-work through mini-critiques. The egocentric and sociocentric worldviews clearly affect the identities of the individuals within the group. For example, when a sociocentric individual is situated in a group that has the same worldview they thrive, whereas when they are situated in an egocentric group they will likely struggle. In contrast an egocentric individual tends to do equally well in either situation. This is because the egocentric predominantly acts for him or herself and is characterized as involving a positive self-image and sometimes a negative image of others (Robbins 2001:176). In the case of the studies in this thesis, the majority of the group members of both the UK and Canadian groups suit the overall worldview of the group. In fact, the negativity displayed in the UK group is likely a result of the egocentric worldview where a negative image is sometimes portrayed. Interestingly, in the Canadian group the two students at the top of the hierarchical ladder are ones who seemed to have a tendency towards an egocentric rather than sociocentric worldview. It is easy to deduce that the worldview of a specific studio culture has an impact on the attitudes, approaches and behaviors that occur within that environment.

Gender is another factor that characterizes a particular studio culture. Historically in industrial design it is common for the instructors and the majority of the students to be male. All the instructors in both the UK and Canadian programmes in this these are all male. In addition, the UK student group is all male while the Canadian student group has an equal balance of males and females. It is commonly known that males and females in North America and westernized countries are encouraged to behave differently from one another. That is, males are encouraged to be aggressive and competitive, whereby females are encouraged to be helpful and caring (Robbins 2001:176). In speech, male conversation types tend to be louder and more aggressive whereby females tend to interrupt less, be more collaborative and provide more positive feedback (Good 2001:90). As previously discussed, the UK group follows a more typical 'boys club' theme. In contrast the Canadian group is generally more supportive. Even so, generalisations about gender are not entirely verifiable by the two studies. It is interesting, however, that the line of discussion is more open with the Canadian group where there is higher incident of sociocultural and intangible references than with the UK group. Again, it is easy to ascertain from the two studies that gender is a factor in establishing a particular kind of

studio culture; however in spite of this issues surrounding gender in design education are worthy of further investigation.

The term multicultural describes demographic diversity; however, non-western people are often placed in an inferior position to westerners (Gunew & Rizvi 1994:4). More appropriately, multiculturalism is defined by cultural variances and different values, which provide different points of view within a group. Cultural variances and different values are clearly present in the Canadian group whereas the UK group is relatively monocultural. One of the biggest challenges of multiculturalism is the variation in the worldview of the individuals. The Chinese culture, for example, is driven by four key concepts including: being life-centred, having a sense of totality (holism), being reflective, and believing in unification (Leong & Clark 2003:52). In addition people from Chinese and Japanese cultures are more likely to express shame and less likely to express pride (Okano in Gray 2002:544). These different cultural expectations provide additional challenges within the educational scenario and add another layer to the overall character of the studio. Along with engendering a rich sense of diversity multiculturalism may result in cultural schisms where misunderstanding results in a disconnect within verbal communication. There are several instances of this occurring within the Canadian study that involve interactions between the Mexican student and the instructors and the Chinese student and instructors. For example, the Mexican student takes offence to a line of discussion led by the support-instructor on more than one occasion. The Chinese student misunderstands a need to clarify his work and instead begins his project anew. In general, the different worldview of the international students is an emphasis on the patrilineal with a typical family grouping including parents and grandparents. The result of this are more references from each of these students that focus on gendered hierarchies and the hierarchy of the instructor-student relationship. For example, the Mexican student criticizes the instructors for what she perceives as their casual relationships with the other students. In addition, there is a higher incident of referencing family and interpersonal relationships coming to the forefront of the international students discussions. Again, the evidence showing the effects of mono- or multiculturalism on groups is not conclusive with the field studies; however, it is clear that this is another factor that has an effect on the inside-local studio culture.

7.4.2 Inside-universal as design culture

The inside-universal environment is relative to industrial design, the notion of design culture and how design education culture is enacted. This context is also called design culture. The notion of the design culture, especially of industrial design, is tied to the economic system, to the notion of design as innovation (including problem solving

processes and creativity), and currently to issues such as safety and the environment. There is a great deal of information published in books, journals and on the internet about design; however, availability of this material is relative to the resources and facilities of a given design school. This subsection identifies three characteristics relating to how design culture and design education are enacted in the two field studies. These are: identification with the international, regional or local economy; relating to design from a capitalist or socially-conscious point of view; and engagement with high and low design.

A significant characteristic of design culture is that industrial design is interpretable as serving the international, regional, local or a combination of these economies. The current focus is on the international economy where westernized countries dominate the marketplace. Artefact may be, for example, designed in one geographical location and then manufactured in another. According to Penny Sparke (1986:56) when a country is design conscious there is awareness that design represents the countries ability to compete on the world market. She elaborates that:

> *Design is essential to the national and international economy, and to the image a country presents to the rest of the world (ibid).*

Even with the economic influence of American corporate giants overwhelming the global marketplace, Fox (2004:14) asserts that the principle effects of globalization is a strengthening of nationalization, devolution and self determination, and a resurgence of concern for ethnicity and cultural identity in almost all parts of the world. Although design schools need to educate student on how compete on the global marketplace the way that this interpreted varies from school to school. The UK design school concentrates on designing within the international economy and the Canadian design school focuses on designing within regional and local economies. This is partially due to the geographical locations of each school where there are different opportunities afforded. That is, Britain has a history of designing for the global marketplace whereas western Canada has been focused predominantly on local design. Another reason for differing relationships with economic systems is the different approaches of each school. The UK school engages in national design competitions with a focus on collaborative projects with industry (*e.g.,* D & AD, RSA); whereas the Canadian school engages in socially-conscious design projects that collaborate with small communities (*e.g.,* light up the world, Nobec). Because industrial design is interpretable in a number of different ways it is important to understand the over-riding assumptions that are made by a design school in how design is presented.

In addition to the design programmes' interpretation of how design should serve the economic system industrial design can be related to from a capitalist or socially-conscious point of view. The UK design school clearly takes a capitalist view on industrial design where there is a more traditional competitive attitude. The Canadian design school, on the other hand, supports localized design where there is a predominant focus on designing socially- and environmentally-conscious artefacts. For example, several discussions occur that indicate that there is a distinct bias against branding and commercial design in the Canadian school. One of these is concentrated on the notion of branding which is the antithesis of socially- and environmentally-conscious design.

In this discussion the primary instructor (PI) begins by asking a question, which is followed up by a discussion among three students (CAN6, CAN5, CAN7):

> *PI: [...] Where is everyone's comfort level with a more consumer project like this?*
> *CAN6: [Name] and I actually talked about this a lot in terms of the Nike project. We got accosted by a lot of other students about what we were doing. People were really pissed off that we were designing with a Nike logo. People who never even talked with me before were coming up to me and were almost yelling at me and until I described the project and it was like that was what we were doing almost mocking Nike and the whole futurist thing. Then they were okay with it. But people who have never talked with me before were really upset with me.*
> *CAN5: But that is the faculty.*
> *CAN7: it was because you were designing for a corporation.*
> *CAN6: It was because it was for a corporation 'A' because it is Nike 'B' and because everything in the media is representing Nike as negative.*

Excerpt 7.1: socially- and environmentally-conscious design at the Canadian design school

This discussion illustrates the Canadian group has an overriding notion that design should be altruistic (good) and not just commercial (bad), and that students should strive towards what is perceived as good design. Along with the point of view taken on the nature of design this characteristic is relative to the instructors approach and student attitudes and behaviors. It is speculated that the capitalist-internationalist approach encourages egocentric behavior while the localist-socially-conscious approach encourages pro-social behavior. This hypothesis requires further investigation.

How the design school and programme engages with high and low design is the final characteristic detailed in this subsection. In the UK group and Canadian group there are references to both high and low design. However, the UK group references 'famous' expert designers' work and high-end design items that are described by Dormer (1990:107) as 'heavenly goods' and 'tokens' more often; whereas the Canadian group references low design or popular culture more often. In both studies the references to high and low design are a direct response to the leadership where the instructors emphasize one over the other. For example, some design instructors emphasize what is

perceived as good design or those materials that are identified as culture with an upper-case 'C' (*e.g.,* high design or well-known designers, architects, artefacts) as opposed to popular culture (*e.g.,* everyday artefacts, films, television). Naturally references to culture with an upper-case 'C' always belong inside the design environment, whereas references to low design often belong outside. Interestingly, the UK instructor does not often reference low design, which seems to result in considerably fewer references from the students. In contrast the Canadian instructors references low design resulting in many references from students. It is as if the Canadian instructors recognise the inherent value of what the students already have for sociocultural capital (Strickfaden, Heylighen *et al.* 2005; 2006). The field studies indicate that how high and low design is engaged with is another characteristic of the inside-universal environment.

Studio cultures are idiosyncratic and ambiguous, and involve references and activities that are spontaneous and random. That is, the studio culture is created and maintained in a super-organic manner by the individuals involved in that scenario. The individuals in the studio environments bring with them their individual-personal and sociocultural capital, which is explored, supported, evaluated, integrated, and / or discarded in the process of reproducing culture. Mirroring this, the individuals are exposed to, absorb, and construct an evolved cultural environment for themselves. The two field studies illustrate two different ways of enacting an inside-local culture and two ways of interpreting design, neither of which is right or wrong. In addition, it is clear that the instructor(s) are sometimes limited by the resources of the programme, his or her background in design, the structure of the programme (modular or integrated), the timing of the project, and the group of students. These summaries of inside-local studio culture and inside-universal design culture begs the question: to what extent are the instructors or groups aware that the focus of their programme, the design culture, and the studio culture provide a whole new set of tools, information and resources that are added to the sociocultural capital of each individual and vice versa? There is considerable potential for further research into the nature of different inside-local studio cultures and inside-universal design cultures.

7.5 Reflections on methods and theories

The choice of the research paradigm including the methods to collect data and the theories for interpretation are naturally dependent on factors such as the goals of research and the objects and subjects of the study. Furthermore, it is commonly understood that studying groups of people differs considerably from studying the individual. Typically methods used for exploring sociocultural issues such as interaction, relationships and leadership involves gathering a broad range of data in a relatively natural

setting. In addition, it is the norm to observe the communicative processes as natural behavior, which predominantly includes the observation of verbalization, sharing and behaviors of groups. In this case, the sociocultural context is traced through the communication process during the development of design projects. Further, the theories examined in this research act on a number of different levels, whereby these inform the research questions, methods for collecting data and system of interpretation. The theories used in this work are interdisciplinary being drawn from cultural anthropology, social psychology and social cognition. These three intellectual traditions form a foundation and act as signposts to aid in the research process. Like with the theories, an interdisciplinary research methodology is used that draws upon the traditions of anthropology, sociology and psychology. An ethnographically oriented approach to gathering information about the sociocultural environments of design students is used to collect data that are qualitative and quantitative this allows for inductive and deductive approaches. This section briefly evaluates the interdisciplinary methodologies and theories used in this research.

Upon evaluating the research method it can be said that a great deal is learned about procedures for gaining insights into sociocultural contexts. Furthermore, applying the multiple layers of method to two projects allows for further evaluation of these methods. One of the primary goals in doing two studies is to develop procedures that can be duplicated. Chapter 4 identifies how two pilot studies are completed prior to the onset of the field studies, which allowed for a streamlining of the methods used. Procedurally the two studies are identical in approach allowing these to be compared. Using an ethnographically oriented method such as this enables a broad look into designing from perspectives that are not common in design research. This perspective on design provides new insights into the design process where the sociocultural context is brought to the forefront. The two greatest shortcomings of this method are the sheer volume of data and a lack of standardization in how this data is interpreted. That is, the intellectual traditions that use these methods do not have particular approaches to interpreting data because these are typically accomplished relatively subjectively. Because of this a considerable understanding of the theoretical underpinnings of the methodologies employed is necessary. These are identified in chapter 3 and 4.

Sociocultural theories are used as a basic approach to interpreting the data; however, there are boundaries with these basic beliefs. In the best situations it is difficult to deal with subjective interpretation in qualitative research, which is a considerable challenge in this research. Looking at designing-in-depth provides too few data to generalise conclusions about broader sociocultural issues; however, the empirical data from two

field studies provides a good beginning that explores the sociocultural context and clarifies some of the questions for further research. The primary outcome of inductive research is new theories, which is the case for this project. The design process milieu model developed through this research is an example of a small-scale theory that fits a specific problem and situation, which is the design environment. Through iterative processes that include combining more general theories about the sociocultural environment and reflecting on data this model is created. The design process milieu model provides a framework that represents how designers engage with the multiple levels of their sociocultural environment. Chapter 3 has presented the model along with the detailed methods for using this model. Again, this system of interpretation is developed based on well-known sociocultural theories. The model needs to be exercised in both educational and practice-based settings where the system of interpretation undergoes intensive testing.

Research projects from inside and outside design are used as precedents to develop a broad understanding of sound research practice. The ethnographically oriented methods employed have high internal validity which means that much of what is qualitatively reported rings true to insiders, in this case design instructors and practitioners.

7.6 Recommendations for designing and further research

In general the concept that the designer is part of a sociocultural system is under-recognized in the design community. In a sense, artefacts can be likened to organisms that are born into an ecosystem within a context where they must survive. The artefacts' ecosystem is one that contains other artefacts and the experiences surrounding people's interactions with the designed world of objects, places, spaces and experiences. In the case of industrial design, those objects and experiences relate to the everyday lives and sociocultural environments of the designers. This research indicates that sociocultural and intangible references have consequences, especially among student groups. Following this line of argument it is easy to ask the question: why have the intangible references gone unrecognized thus far in the design process? Is it because the majority of design research has been about finding the common denominator and not the ambiguities? Whatever the reason, design educators and practitioners may be surprised to discover that those things that seem so intangible and unrelated to design at first sight may be of considerable value when teaching design and when designing an artefact. The first stage is to acknowledge that references to things that are idiosyncratic and sociocultural are, in fact, serving a purpose in the design process and are not just fleeting and egocentric.

The results of this research are not intended to prescribe recommendations for educators on how to teach design. It cannot be emphasized enough that there is no good or bad way to teach something as complex as design. Having said this, the recommendations presented here result from reflecting on the research findings with an aim to understand the inherent value and potential of sociocultural and intangible references set within the context of the design environment. They are presented as guidelines to aid in considering how the material behind intangible references can be incorporated into the design process milieu. The following two subsections provide recommendations for design education and practice, and recommendations for future research into the sociocultural forces as a result of the research described herein.

7.6.1 Design education and practice

Design education consists, to varying degrees, of teaching the physical skills, mental thought processes, and reflection (emotional aspects) on designing. Most industrial design programmes teach processes and techniques through design briefs that allow practice in design, especially at the senior level. There are rituals around how ideas are generated, differing work patterns, how projects get completed, how the students engage with their instructors and how group cohesion is created. Design instructors act as coaches (Schön 1983:6,63) and mentors by moving students through their project and facilitating the learning processes through focused objectives. In the Canadian study, the design process was taught through practice by systematically taking students through the different phases of the process with very strict deliverables. The UK studio focused chiefly on primary research and user-centred approaches. Each field study emphasized the physical skills and mental processes of designing, but paid little attention to the emotional aspects. For the most part the students are left to pick these up on their own. This is not surprising since the generic models that currently define what is relevant to the design process do not include the outside references (where the majority of the emotional aspects of designing would come from). This shortfall in how the design process is defined results in a generic design culture that does not recognize the sociocultural and intangible references as worthwhile in this process.

By contrast, the results of this research strongly suggest that using intangibles while designing is a powerful way of verbally relaying visual imagery that others can easily relate to. Yet, because they appear to be mundane, like everyday objects and experiences, they are discarded as unworthy. These references are not necessarily valuable in themselves; what is more interesting is the way they are used. That is, the sociocultural and intangible references are typically used in unconventional contexts. This subsection provides recommendations on how the material behind the references (individual-personal and

sociocultural capital) might be used both in an educational context and in design practice. The recommendations include teaching design by linking new concepts to known things (linked learning), embracing a broader range of reference-types, using the design process milieu model for reflection, and encouraging sociocultural cohesion.

One of the fundamental ways to learn, integrate and retain information is by relating new things to what individuals already understand. For example, it is common knowledge that new number sequences are most easily remembered if they relate to ones that have some prior meaning, such as birth dates or anniversaries. Experienced teachers and learners know that connecting new things to the old will provide a better understanding of what to do next. The basis of linked learning is understood through analogical reasoning where Gentner (2003) indicates that paralleling something to something else is fundamental to human cognition. For example, designers are known to use the precedence of previous projects towards new projects, illustrated by case-based design programmes (Oxman 1994) and common approaches to design history. Therefore, instructors need to build upon the past projects and modules to provide a richer learning scenario, along with linking new concepts to the individual-personal and sociocultural capital of individuals. Linked learning with non-design related things (such as cultural capital) is especially valuable when teaching younger groups of students (or non-designers) who do not have focused design capital as of yet. Linked learning in design requires an understanding of previous course material, the design school and programme of study, and also the individual students. The tradition of design education is to hire instructors that are currently practicing design. In addition many of these instructors are part-time and involved with the design school on a limited basis. This trend in design education provides a significant challenge for instructors to employ linked learning because of their limited connection with the contextual environment. In addition to this, with a focus on linked learning there is a propensity for seemingly less focused discussion. In general discussions meander over topics — sometimes changing quickly and frequently, sometimes circling back or dissolving — but they always test the topic in order to clarify or add to broaden concepts. People naturally interject personalized statements that hold meaning for them, which is a way of being involved and of integrating the material being discussed. There is some evidence of this in the Canadian study where the instructors and students talk about previous projects, others students projects and also involve their sociocultural capital. Employing the concept of linked learning is the first recommendation for design education.

The majority of students in the field studies presented here were unaware of using the intangibles, which is likely a reflection of the current lack of worth and awareness of what

lies behind sociocultural and intangible references in the design process. In general this means that they are less likely to be used. Judging from this study and one that uncovers the instructors' point of view as well (Strickfaden, Heylighen *et al.* 2005), the current emphasis on culture with an upper-case 'C' (the inside of design) in design education is wrongfully excluding students' personal and sociocultural backgrounds. It is important to note, that teaching design with an emphasis on culture with an upper-case 'C' is considered to be useful for different things than teaching to encourage use of sociocultural capital. It is recommended that there be a better balance between teaching to what is perceived as high and low culture in order to develop a greater breadth in 'design capital', especially in industrial design where the everyday is ultimately the typical outcome. One way to teach to this is to use memory books (Strickfaden, Heylighen *et al.* 2005), log books, blogs and camera phones that give recognition to personal sociocultural capital and support reflection. These personal and reflective techniques allow the student (and instructor) to discern the worthwhile information from what is less valuable. In the field studies, the students are using information from their sociocultural capital despite themselves and their instructors therefore it seems to make good sense to provide some support for its use.

Besides pinpointing the need for design educators to become aware of the inherent value of different reference-types through reflection, a more holistic model of the design process milieu is developed that is also useful for reflection. The model is developed with the purpose of exploring the sociocultural environments through reference-types. While expanding the notion of the design process to include elements from outside the design environment, the model of the design process milieu also outlines the types of things that are discussed inside and outside design. These are not intended to represent *everything* that is discussed in design, nor are these meant to limit what is taught. However, they do provide a breakdown of themes and categories that may be explored while designing. As such, the design educator may wish to use this model for reflecting on their teaching style, for questioning their values and assumptions about design, or to track what is happening in their own design studio from time to time. Furthermore, the design process milieu model can be deconstructed (used in part) or used as a whole to aid students or design professionals in reflecting on their sociocultural capital.

The final recommendation of design education and practitioners is related to studio culture. The design studio culture is an environment created for and by the individuals involved in the situation. This culture holds the potential to be an environment that is productive or destructive, dynamic or stagnant, negative or positive. Rather than simply teaching design in the studio, instructors need to be aware of their power to facilitate a

culture that reflects a particular design focus. An instructor's lack of awareness or caring for the sociocultural studio environment illustrates a disregard for the power of the learning scenario. Csikszentmihalyi (1996) explores the notion of creating a cultural environment that supports creativity and allows for advantages such as motivating learning, becoming experts, innovating and striking out in new directions (*ibid* 341). This is echoed by Kelly and Littman's book on the studio culture of IDEO (2001). Design educators need to think of the overall picture as well as the details of teaching the physical, mental, and emotional skills to be a designer. Along with this, a design programme has the potential to address how the students are encultured in general and what types of transferable skills are taught in their programme as a whole. The structure of the programme and the resources available are known to contribute towards or against learning processes, which is emphasized when comparing the two field studies. Along with the studio culture, naturally, these factors make up the design culture of a specific school. Studio culture and design culture cannot be underestimated in their potential to affect the design process.

7.6.2 Research for further investigation

The research presented in this thesis is the first step in the investigation of sociocultural and (in)tangible references made during the design process milieu. It is accomplished through an iterative process where there are unanticipated directions by the results. For example, pilot study two aided in refining the procedures used to gather data; and the UK field study produced a clearer definition of the reference-types, which refined the analysis and display of data and results. In addition, the findings from both pilot study two and the UK study directed the focus towards developing the design process milieu model—the practical tool with guidelines for determining where references come from and the resulting theory that is at the heart of this research. This subsection identifies recommendations for four areas of further research. These are: to exercise the design process milieu model; to further investigate reference-types, categories and themes; and to continue to research general information on sociocultural context and forces including how these directly affect artefacts.

The primary outcome of this research contributes the theoretical model called the design process milieu. Along with this model is a detailed set of procedures for data gathering and a system of procedures for analyses and data display. As previously indicated further research is needed to exercise the model. It is recommended that this be done in different design environments, with students of different levels, with design practitioners of varying levels of expertise and across design disciplines.

The second contribution of this research is the identification of reference-types including themes and categories. These reference-types are identified as tangible, intangible and sociocultural. Having identified reference-types further research can be done on how these references function within a context. For example, the details of how references are 'chained' is necessary. Investigating chaining includes interconnectivity, patterns, strength, diversity, and duration. In addition, analogy- and metaphor-use could be studied in greater detail. At the present time intangible references are known to provide a key source for verbally discussing visual information by using them as metaphors or analogies. With more work completed in this area, it may be possible to integrate some of the information about intangibles into a computer modeling system (much like case-based reasoning and the precedence based modeling programmes) to aid the designer with concept development processes. Currently there is a range of programmes that support, for example: musicians, graphic designers, storywriters, and mathematicians (Boden 1995). Even so, the majority of these match to the closest example (analogy) are relatively constrained, and do not consider the analogies that have a high contrast (intangibles). Within the design community there are a number of case-based programmes for architectural practice and education (Heylighen 2000; Heylighen & Versijen 2003). One that stands out in aiding concept development processes uses DYNAMO created in 1998 by Nicole Segers, which promotes new ideas through connecting a personal idea with a collective dynamic memory of a design case in sketching (Heylighen & Segers 2003). The notion of intangible use could be used to further enhance a computer support programme such as this that focuses on the early stages of the design process.

It is further recommended that research be done, in general, on the sociocultural context and forces that affect the design student and designer during the artefact creation process. To date, very little is known about the sociocultural environments that have a potential effect on design students, design educators, designers and artefacts. Research in this area is especially important because these may be inadvertently affecting the process or unintentionally embedded into artefacts. This begs the question of: who is designing the artefact — the individual or the sociocultural context? Through the exploration of references it is made clear that the sociocultural environment has a significant effect on the individuals involved in the design process. However, based on the studies presented in this thesis it is inconclusive as to exactly how the sociocultural context directly affect the artefacts being created. This research has shown that, through choice and by accident the sociocultural capital of individuals are having consequences for design activities and the final artefact. If this is indeed by choice, we need a clearer

understanding of the role(s) that the sociocultural factors play in order to design towards these. Furthermore, because industrial design does not have the traditions of other design disciplines, such as architecture, it is recommended that research on the sociocultural context be done in architecture. That is, it is easy to say that a greater breadth of information is required in industrial design because of the range needed in practice. This begs the question: is the use of sociocultural and intangible references more prevalent among industrial designers than among architects? In addition, it is recommended that, in general, research be done specifically in the area of the outside social capital to better understand the effects on and enculturation in design education. Future research that investigates design from the inside could include work on 'design capital' and how it is used during artefact creation. It is clear that, in order to fully understand what, how, when and why sociocultural information is used in designing further research needs to involve not only design students, but also professional designers in different contexts and at different levels of expertise.

This section has focused on recommendations for design education and practice and recommendations for further investigation. These are based on the primary outcomes of this research: the design process milieu model, the details of reference-types including the sociocultural and (in)tangible, and insights into two inside environments on different continents including studio culture and design culture.

7.7 Conclusion

The idea that students refer to their individual-personal and sociocultural make-up during the design process provided the starting point for this research and the six research questions. This thesis has shown that exploring design activities within an educational context holds a wealth of information about the sociocultural processes that parallel artefact creation. It has been revealed that sociocultural references refer to the different sociocultural environments that envelop the designers. In this case these environments include the inside-local (design school, design brief, instructor(s) and other students), the inside-universal (design culture, design education culture), the outside-local (immediately surrounding the students) and the outside-universal. When the students reference the sociocultural they are referencing those things that are closely related to the task at hand (tangible) and those things that are further away (intangible).

Furthermore, this research has looked at two different approaches to educating industrial designers at a time when design education is undergoing a great deal of change, especially related to new forms of technology. As design educators, it is particularly valuable to reflect on the nature of design education, and to better understand what is

being delivered to students and how future designers are being molded. This research studies industrial design students *in situ* while being involved with a typical design project. Studying design *in situ* offers insights into the design processes in a way that captures the reality of the situation as well as the complexity of design discussion and behavior.

Engaging in an ethnographically oriented study that provides both quantitative and qualitative data allows for thick descriptions of the design process and the design context that are currently less common to design research. This study builds upon and complements previous research accomplished on design practice and design education and contributes to the growing area of design theory. Even so, it has taken a slightly different path in that it has explored the nuances of designing along with two macroscopic views of studio culture, rather than looking for designers' universal, systematic actions and thoughts. Where there was a need for generic design processes and a generic understanding of design culture in the past, this thesis has begun to look at the antithesis—the ambiguities of the design process and culture.

Many questions remain about how sociocultural and (in)tangible references relate to the context of artefact creation and about the ambiguous nature of culture in design. However, engaging with this research has revealed that a great deal can be learned through empirical studies on designing. The statement made at the onset of this thesis—that designers create meaning during the design process and that this meaning is linked to the artefacts they are developing—turns out to be an understatement.

Working Definitions

Artefact – refers to material things that are created by designers such as electronic products, furniture, cutlery and vehicles; references to artefacts in this thesis are those that will be industrially produced usually in standardized multiples by industrial manufacturing processes.

Bricolage – a term coined by Anthropologist Levi-Strauss (1978) and developed; bricolage is the act of appropriating sources and transferring these as a re-assemblage or new concept (see design transference).

Charette – a compressed module typically occurring over a one to two week period; as defined by the Canadian university featured in this thesis.

Content morphemes – the parts of the sentence that carry meaning; typically content morphemes are nouns, verbs, adjectives, and adverbs that stand for objects, events, characteristics and relationships.

Context – refers to environment in which an artefact is designed; the context includes all aspects of the environment that may affect the design of an artefact; context includes the immediate environment that designing occurs within such as the particular room or school and the external environment that a designer is exposed to such as a particular city or country.

Cultural capital – a theory developed by sociologist Bourdieu (1984) that considers the non-explicit activities of everyday life as those that define individuals and their class-based status in society; cultural capital is acted out through individual-personal everyday activities and can be considered to be perpetuated in the design of artefacts, for example the cultural capital of designers is reproduced by those designers by embodying these in artefacts they create.

Design process milieu – all activities discussed in a designing scenario including all references, tangible and intangible, that make up the design process; comprised of the inside-local, inside-universal, outside-local and outside-universal; a more holistic model proposed in this thesis.

Design transference – refers to when an element, material, method of production, aesthetic or any other piece of design information is taken from one designed object to another; design transference is generally a process of speculation and contemplation by design critics or historians to re-construct the design process but are observable in the design process; direct design transference is when canonic devices or same-type artefacts directly inform design decisions; indirect design transference is when an abstract transference occurs between different-type artefacts or situations, these are more difficult to trace in the design process.

Discipline – refers to a branch of teaching and learning such as design; multidisciplinary is when more than one discipline is involved; interdisciplinary (Moran 2002) is between more than one branch of learning; transdisciplinary is when two or more disciplines cross boundaries and exchange characteristics.

Drivers – external factors that strongly influence the observable behavior of a design process and not inevitably causing particular consequences (*Eckert et al.* 2004).

Ethnographically oriented – primary research done through the use of ethnography supported by other collection techniques; more than one method used; in this field study described in this paper, these include observation, questionnaires, and interviews.

Emic – inside or within a specific context; over here or nearby; being at home; treading familiar ground; things seen and met habitually; routine, day-to-day activities with a degree of domestication and familiarity; comprised of the inside-local and inside universal defined in the design context milieu.

Etic – outside or outwith a context; unfamiliar; comprised of the outside-local and outside-universal defined in the design context milieu.

Immateriality – aspects that are not measurable in a material sense; these relate to any individuals' (designer or nondesigner) sociocultural capital including memories; the intangible references are considered references to things immaterial.

Individual-personal – refers to the experience base of designers involved in the design process; these experiences are from the designer's immediate environment and include personal relationships such as family and friends, and idiosyncratic experiences.

Intangible references – those statements that are abstract, unusual, ambiguous, and idiosyncratic and refer to objects and experiences outside of the design environment; difficult to measure; individual, dynamic; not fixed; dependent on context; further from the task at hand.

Interdiscipline – see discipline.

Little narratives – a term used to describe a specific set of events or stories that relate to individuals or individual artefacts (Dormer 1990); the little narratives are not generalizable and relate to the specifics and differences of individual situation such as the affects of an individual's background and experiences on an artefact.

Meta-narratives – modes of communication that fall outside the level of narration that is considered to contain references; these include emotions, clarification, question-posing, and gesturing; these are embedded beneath, behind or beside the references.

Mini-crits – a critique done by students to evaluate each other's design work without an instructor present; not a comparison of design work, but instead a critique similar what their instructors do; defined by the students from the Canadian field study.

Multidiscipline – see discipline.

Popular culture – refers to the general culture of the people and includes artefacts, media (*e.g.,* television, film, Internet).

Reflexive – when the researcher reflects on his or her position in the research process; extreme exploration into the researchers own cultural and social identity (Alvesson & Sköldberg 2000).

Sociocultural – used synonymously with social-cultural; refers to the social and culture experience base of designers or nondesigners; sociocultural experiences are formed by the immediate (inside) and external (outside) environments including popular culture and country of origin.

Sociocultural context – the sociocultural context includes all the environments that have formed the experience base of designers and nondesigners that may be influencing him or her; these include the inside-local, the inside-universal, the outside-local and the outside-universal.

Sub-subdisciplines – a highly specialized area of expertise within a subdiscipline; for example, architecture is a subdiscipline of design and an architect who only designs public libraries and nothing else would be considered a designer who works within his or her own sub-subdiscipline.

Tangible references – those statements about the known aspects of the design process, for example, the elements and principles of design; these refer to the inside-local and inside-universal.

Textual data – design ideas that are articulated through text in the design process; textual communication includes something that is written or printed in words or is numeric or diagrammatic; all written documentation including that which is written in questionnaires.

Transdiscipline – see discipline.

Verbal data – design ideas that are articulated verbally or orally in the design process; verbal communication includes formal and informal communication involving one-to-one and group discussions.

Visual data – design ideas that are articulated through visual images, displays or pictures in the design process; visual communication includes sketches, visual diagrams, visual graphs, image montages, photographs, renderings, illustrations, computer models, physical models, and prototypes; representations of reality through an individual's perspective (photos, sketches) or print media (glossy pictures, illustrations, charts) made by people (models, mock-ups) or mass produced (everything from the built environment).

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Brief history of design education: Appendix I

The history of design education in western civilization is relatively brief and surprisingly homogenous. Pedagogically there are more similarities between the design schools than there are differences (Giard 1990:23). This is likely due to the fact that, when industrial design education began to soar, it was also a time that local, international and global publications were popularized. The outcome of this was publicity about the schools and publications featuring the artefacts that were designed at the schools. Many of these publications came directly from the design schools such as *Ark* from the Royal College of Art, and books such as *Bauhaus 1919-1928* edited by Herbert Bayer and Walter & Ise Gropius (1938).

In the early days, there were few design schools and yet fewer that taught industrial design. Three key design schools based in England and Germany, and two based in North America can be considered to have developed the foundations of curriculum in design schools across the United Kingdom and North America. These are:

- 1837 The Government School of Design, and 1896/7 to present The Royal College of Art (RCA), London England
- 1919 The Bauhaus, Weimar Germany, and 1925 to 1933 Dessau Germany
- 1937 The New Bauhaus, 1939 The School of Design, and 1944 to present The Illinois Institute of Technology, Chicago Illinois USA
- 1938 to present Pratt Institute, New York USA
- 1954 to 1968 Hochschule fur Gestaltung Design School (HfG Ulm), Ulm Germany.

The key design school based in London, England began as the Government School of Design and is now called the Royal College of Art (RCA). Upon opening in 1837, the central focus of the school was to promote creative excellence in art and design and to improve the quality of Britain's manufacturers (Frayling & Catterall 1995:6). The Government School of Design embraced an art approach that involved visualizing real artefacts through life drawing and was considered to train designers to become ornamentists. That is, designers would apply ornament to many artefacts and surfaces, especially ceramics and textiles (Frayling 1987:17). The differences between art and design were defined by ornamentation and by improving everyday artefacts. In order to do this the designer was taught to observe three-dimensional artefacts, often ones in the Victoria and Albert Museum (V & A), and visualize these into two-dimensional drawings, renderings and illustrations. This was taught through introducing design as a language that included the illusion of perspective, line quality and texture (the elements of design), which would result in accurate copies of architectural details,

objects in glass cases and plaster casts of famous sculptures (Frayling 1995:8). This rigid method of teaching drawing has been highly criticized as being too prescriptive with strict rules and can been viewed as a precursor to design methods research (Oak 2001: 48). Furthermore, it is clear that this early version of design education was intrinsically linked to the British government's idea of design as being art applied to industrial artefacts in order to improve Britain's economic position. Interestingly, even though one of the school's mandates was to improve the quality of Britain's manufacturers, manufacture and industrial production was absent from the programme of study. In 1896 the Government School of Design was renamed the RCA and at this time underwent several significant changes. There was a new emphasis on studio practice that added *doing* design to teaching the language of design (Frayling 1995:10). Therefore, design was taught as a three-fold system that included visual basics (the elements of design), doing at least one craft, and mastering that craft through producing independent design work. This shift toward *doing* was largely due to the ideals of John Ruskin and William Morris and the direct influences of Walter Crane, an architect who worked with Morris and the Arts and Crafts Movement of Britain. In addition, the seeds of the German Werkbund and the Bauhaus were growing and defined designing by materials, hands-on activity, and manufacture. The period of design education at the RCA up until the 1960s was primarily about skill acquisition. The curriculum was criticized for not giving students enough room to be creative and inventive (Frayling 1995:11) and gradually underwent several major changes to include a more *mindful* way of designing. In the 1960s Bruce Archer joined the RCA and turned the Industrial Design Research Unit into the Department of Design Research. He instigated a change from commercial projects to theoretical enquiries and worked on the rigid analysis of the design process (McIntyre 1995:61). These factors influenced the delivery of design materials by making them more specialized (into design disciplines) and by combining skill development with rigour in design thinking (Frayling 1995:12). Although the Department of Design Research was disbanded in 1987, this more reflective approach to designing through careful analysis of the design process has lead to a clearer understanding of design as a discipline. While the RCA is historically the first key design school, it has undergone a significant evolution over the past sixteen decades. There has been a great deal of cross-fertilization among design schools. The RCA is known to have been influenced by the German Bauhaus, yet at the same time, the RCA has clearly had an impact on the way the design curriculum is approached in western civilization in general.

The Bauhaus school in Germany is considered to have been an organic, dynamic school with an ever-changing curriculum exploring design from many angles. There were a number of directors and instructors who aided in the curriculum design over the mere fourteen years that the Bauhaus was in existence. A few of the high profile directors of the Bauhaus included Walter Gropius, Johannes Itten, Wassily Kandinsky, Paul Klee, Lãslõ Moholy-Nagy, Josef Albers, Oskar Schlemmer and Hannes Meyer. Over the span of the Bauhaus' operation, the curriculum began as a servant to the workshop, introduced cross-disciplinary approaches, combined science and technology, invented the grammar of visual language, accepted the machine, shifted from craft-based production to prototyping, and encouraged commissions and industrial liaisons. Industrial liaisons encouraged a connection with the broader sociocultural environment and thus began a deepening relationship between the

designer and his or her context. The evolving Bauhaus curriculum inherited, reinterpreted and finally rejected the craft ideals of the 19th century. The earliest visions of the Bauhaus were heavily influenced by the German context, which included the Werkbund or Werkstätte. This was an alliance of artists, architects, designers, tradesmen, and manufacturers (Naylor 1993:39). The Werkbund emphasized art and industry, craftsmanship and trade, and trade and industry (Wingler 1981:19). The Werkbund was based on the notion of apprenticeship found in the manual trades of guilds. The emphasis on combining art and industry was a move towards combining the idea of German culture with the idea of profit. German culture, including ideals and quality, would be embodied in artefacts for export, therefore increasing profit and the economy of Germany. Walter Gropius, an architect and the first director of the Bauhaus in 1919, established two key goals at the onset of the school. The first goal was to create a foundation course of study in design that focused on the skills of drawing and the craft guilds. The second goal was to develop and teach a universal visual language of form (Naylor 1993:9). The idea of this visual language was particularly emphasized and developed by numerous instructors at the Bauhaus including Itten, Albers and Kandinsky. These and other individuals from the Bauhaus wrote many of the seminal books on the visual language of form. For example, Kandinsky was instrumental in developing a colour course and the basic elements of form, which he called the synthetic method (Naylor 1993:87). Kandinsky's book on form called *Point and Line to Plane* (1926) advocated systematic research, and presented a theory of composition and a dictionary relating to the visual language. This example of the standardization of the visual language in the form of the elements of design (reviewed more in detail later in this chapter) is not the only aspect of the Bauhaus curriculum that emphasized standardization. Standardization was also emphasized in architecture and in industrial furniture production. When the Bauhaus closed, the instructors of the school scattered around the globe. Gropius and Breuer first emigrated from Germany to England. Moholy-Nagy, Albers and eventually Gropius immigrated to the USA. Klee went to Switzerland, Kandinsky to Paris, and Itten and Schlemmer stayed in Germany (Naylor 1993:177/8). Although the German Bauhaus was active for less than a tenth of the time of the RCA, it is considered to be the most influential design school in western civilization. The impact of the Bauhaus on design curricula is far reaching. The majority of design schools today use a foundation year to introduce students to the discipline(s) of design and many design schools base their approaches on an apprenticeship / guild system of learning by doing. The volume of material about the Bauhaus school and curriculum available has likely aided in the proliferation of its approach.

Lãszlõ Moholy-Nagy, formerly from the German Bauhaus, founded the New Bauhaus in Chicago. Naturally, Moholy-Nagy brought a great deal of knowledge of the Bauhaus curriculum and approach to the new school. He focused especially on the relationship between art and technology and the notion of laboratory-style workshops. Moholy-Nagy based the general course of study on Bauhaus principles that included the one year preliminary course followed by a three year specialized programme. The preliminary course (later renamed the foundation course) was made up of two categories including the plastic elements (the elements of design) and tools and materials (*e.g.,* pen, power tool, camera, clay, wood) (Findeli 1990:8). The formalism of the elements of design and the use of the preliminary course for skill acquisition and refinement were enhanced by Moholy-Nagy's desire to encourage a sense of

responsibility within the student. This process-orientated approach to education was predominantly about the social implications of design and reflected Moholy-Nagy's holistic attitude towards design and design education (Naylor 1993: 145). This approach places the artefact in a secondary position to the processes of design, which is similar to Archer's research into design processes in the 1960s. In addition, the intent of the New Bauhaus was to immerse students in contemporary scientific thought (Wingler 1981:195). Students were encouraged to use art as their presentation and science as the mode to understanding knowledge, and in doing so the two (art and science) would be integrated (*ibid*). The New Bauhaus approach focused more directly on the students' growth and their abilities to reflect on what they were doing. It is said that the roots of the New Bauhaus began with a focus on architecture (curriculum that was tied to the vision of Gropius' Bauhaus in Germany) (Hannah 2002); however, architecture disappeared from the curriculum in 1955 (Findeli 1990:7). Even though it was derived from the European Bauhaus and drew its vision and substance from the European emigrants, the New Bauhaus is said to be intimately linked with the North American context (Wingler 1981:612). The New Bauhaus, now known as the Illinois Institute of Design, is characterized as being based on American thought processes including John Dewey's philosophy, and the American way of life (*ibid*). It is impossible to escape the North American context that the Illinois Institute of Technology developed from and continues to be informed by to date. Currently, the Illinois Institute of Technology is recognized as one of the world's top design schools. One of the reasons is because of the strong tradition of combining design practice with scientific investigation.

In 1938 Alexander Kostellow, Donald Dohner and Rowena Reed Kostellow established an industrial design department at Pratt Institute in Brooklyn, New York. Interestingly, not long before this the work of instructors and students from the Bauhaus were publicized in an exhibition as early as 1931 at the Museum of Modern Art (Wingler 1981:569). Kostellow, Dohner and Reed Kostellow developed an industrial design programme that included the philosophical, the aesthetic and the practical, which became the triangular foundation of three-dimensional design at Pratt (Hannah 2002:24). Reed Kostellow's experiences and background in art and sculpture inspired the first year foundation programme at the Pratt Institute. The goal, according to Kostellow, was to provide the students with:

> ... *an organized approach to the mechanics of design and the necessary inner discipline to carry out assigned problems* ... (*ibid*:26).

Kostellow, Dohner and Reed Kostellow criticized the apprenticeship / workshop programme established by the Bauhaus and the New Bauhaus for not involving enough real design and for being too fragmented. The Pratt and Bauhaus programmes have many similarities but also some key differences. They each drew from scientific methods, identified the elements of design, focused on aesthetic development, identified artefact outcomes as having multiple solutions, and aimed to serve the industrial economy (*ibid*:28). The differences in the programmes are that the ideology at Pratt clarifies the functional and maintained aesthetic expression as central to the artefact (*ibid*). That is, Bauhausian architectural education is interpreted as considering spatial issues and the building as separate, whereas Pratt industrial design education is concerned with spatial issues as part of artefacts. Furthermore, the Bauhaus approach is considered to study form from the perspective of

architecture with the object being the primary (*ibid*), whereby Pratt's approach recognized the consideration of space as distinguishable from objects (*ibid*:29). By 1953 Pratt's programme incorporated numerous liaisons with industry and went from being a three- to a four-year degree-granting programme. From the onset of the programme to Reed Kostellow's passing in 1988, she established and implemented a series of visual relationships for three-dimensional design for industrial designers (elements and structure). This theory of design is presented as a series of exercises developed by Reed Kostellow and is detailed in Hannah's recent book. Like many of the books on the elements of design, Reed Kostellow's method begins by enabling the manipulation of simple forms and then moves on to more difficult design problems. Although the curriculum at Pratt is set apart from that of the Illinois Institute of Technology, it is interesting that many of the curricular details are embodied in a similar way (*i.e.,* through systematic, prescriptive approaches towards designing). Although many of the theories of visual perception from the German Bauhaus seem to be more two-dimensionally oriented and were adopted by the graphic design discipline, the theories of visual perception developed by Reed Kostellow extrapolates this approach to the three-dimensions. The elements of design will be presented in greater detail later in this chapter.

The first director for the Hochschule fur Gestaltung Design School (HfG Ulm) was Max Bill a graduate from the Bauhaus. The original goal for the HfG Ulm was to build a Bauhaus-like community of the arts that would educate the political elite (Jacob 1988:221). Along with Bill's influences, the HfG Ulm is considered to have been highly influenced by Moholy-Nagy's tightened pedagogical programme at the New Bauhaus in Chicago (Wingler 1981:582). Technology, science, aptness of material, and tooling were said to be central to the curriculum (Aicher 1988:232). However, it is known that HfG Ulm was not on the cutting edge in terms of equipment for prototyping, nor did it embrace innovations in materials (Bonsiepe 1995). In fact, HfG Ulm is criticized for the lack of technological sensitivity and is described as ignoring the onset of plastics in mass production and the introduction of television to popular audiences (Jacob 1988:228). This lack of technological sensitivity is interpretable as divorcing design processes and artefacts from context. Even so, the HfG curriculum is considered to be very dynamic as it was reshaped by the director, the full-time staff and the visiting lecturers each year (*ibid*:227), perhaps a model following the organic curriculum of the German Bauhaus. This recognition of the need for a dynamic and fluid curriculum is an interesting approach towards design education. Many design schools today pride themselves on a fresh curriculum each year by keeping up with the changes in technology. At HfG Ulm the studios / workshops on design practice were counterbalanced with seminars on design theory. An attempt was made to integrate the two; however, practice and theory were taught one-week-on and one-week-off (*ibid*:228), thus maintaining a tight distinction between the two. The intellectual underpinnings of their programme emphasized the social sciences including sociology and psychology (Oak 2001:53), just as the New Bauhaus emphasized science as a paradigm for examining design. HfG Ulm can be considered ahead of its time in respect to an interdisciplinary approach focusing on the social sciences in design education. Its curriculum was fixed on the notions of functionalism and anti-art (painting and sculpture were absent from the curriculum), which demonstrate a more defined and systematic notion of design. This systematic idea of design was emphasized by Tomás Maldonado, the second director of HfG Ulm, who considered the design process to be a sequence of quantifiable steps,

along with instructor Horst Rittel who considered designing to be like mathematical problem solving (Aicher 1988:233). On the other hand, HfG Ulm was about creativity and defining design as a social *human* science. Maldonado believed that students should work collaboratively in groups and always be in contact with their teachers (Wingler 1981:575). These contrasting notions in design, between the hard sciences and the social sciences, continue to perpetuate in current day design thinking and education. There has been a great deal of research into design methods and design as problem solving, which present a relatively prescriptive approach towards accomplishing the design of an artefact but have laid the foundations for software design and artificial intelligence. There has also been a great deal of interest into creativity in the design process and the social environment of the artefact / designer.

Design education is said to have been exported from the RCA to North America, specifically Canada and Massachusetts, USA, in the late 19th century (Frayling 1995:9). Many schools of art and architecture are said to follow the teachings of the Bauhaus, especially in the USA and England (Naylor 1993:179). The RCA is said to have been influenced by the Bauhaus' educational philosophy (Frayling & Catterall 1995: 6) and the Bauhaus is said to have been influenced by Karl Marx, John Ruskin (Naylor 1993:16) and William Morris (Wingler 1981:19) of England. Design schools today generally have a core component of visualization through drawing (RCA), some development of skills for model-making (RCA, Bauhaus), some attention to visual language (Bauhaus, New Bauhaus, Pratt) and some reflection on the design process (RCA). One thing that is clear about design education and its pedagogical philosophies is that there has been a great deal of cross-fertilization between schools and their cultural context. The idea of the design studio is a spin-off from the workshop or laboratory of the RCA and Bauhaus. Interdisciplinarity among design disciplines is inherent to most design schools, and precedents for that interdisciplinarity were laid outside of design (*e.g.,* social sciences, pure sciences). The history and current day design education programmes can be divided into two categories: the content-orientated versus the process-orientated approaches. The content-orientated approach focuses on skill development, which resembles an educational system that is more like a vocational school. The process-orientated approach is comprised of thought-based activities including reflection and understanding, which are typically taught in university programmes (Findeli 1990:). Design education in the university environment has evolved to generically include both of these approaches, but is typically considered to take a more process-orientated approach. Giard (1990:25) conducted a study of design schools fifteen years ago and surprisingly discovered that, at that time, manual skills were still the underlying element in industrial design education. While it is difficult to know whether this remains the norm today, it is clear that historically industrial design education has covered a vast amount of terrain. It follows then that the design instructor requires a vast range of knowledge in practice and theory including:

1. a range of skills to visualize and create through drawing, using the computer and understanding materials and manufacturing;
2. the ability to communicate verbally, visually and textually;
3. the ability to think and act upon those thoughts to create something with meaningful content; and
4. the ability to trust ones intuition, to engage with personal feelings and to reflect on themselves and the world around them.

Appendix I

Items one and two on the list relate to content-oriented skill development, which can also be described as developing the mechanical tools necessary for designing. Items three and four relate to process-oriented approaches, which are thought-based and described as the conceptual tools of design. Designing is known to require these two basic sets of tools: mechanical and conceptual (Alterberry & Block 2000). The research conducted in the two field studies presented in this thesis begins to get at what makes up a design educational culture from the inside and how this is positioned in relation to the rest of the sociocultural world. This is done by distinguishing the references to known tools for designing (*i.e.*, mechanical and conceptual) from the references that relate to the experiences of an individual (idiosyncratic and sociocultural).

Design briefs: Appendix II

(a) Summary of the UK design brief

(b) Design of an airline meal tray

(c) Summary of the Canadian design brief

(d) Design of sports eyewear

Summary of the UK design brief: Appendix II (a)

Design of an in-flight meal tray

Of course the field study is tied intimately to a number of different contextual details. The first, but not necessarily the most important, is the design brief. In both field studies the primary instructor of the student group chose the design brief. The UK instructor chose a brief from the prestigious British Design and Art Direction Award (D&AD). D&AD is a design competition that has been running for four decades and has categories for professionals and students. An external brief was desirable in order to control the subjectivity of the instructors' involvement in the field study. The 2003 D&AD competition had *18,629 individual entries in 23 categories judged by a panel of 230 internationally-renowned creatives.* The 23 categories were established and sponsored by industry, such as the design brief used in this field study, which is sponsored by *Virgin Atlantic Airways* and *Corus Steel Packaging Plus. Virgin* is a well-known British airline company, *Corus* an international steel manufacturer.

The design brief details the need for an in-flight meal tray to be made from *Corus* steel that reflects the brand values of *Virgin Atlantic Airways*. The design brief states that students need to make specific considerations when designing the in-flight meal tray. These are that the meal tray:

- be innovative,
- be environmentally sound,
- be user friendly,
- integrate serving dishes,
- integrate packaging,
- and be for an economy meal.

Current meal trays are relatively standard across airlines and with this design brief *Virgin* wants a trademark meal tray that will be manufactured by *Corus*. Figure 1 illustrates a typical meal tray used by *British Airways*. It consists of a plate, bowl, coffee / teacup, water glass, cutlery (in glass), wine glass (not shown), napkin, and a tray with a no slip tablecloth (in blue on tray).

Figure 1: an existing airline meal tray design

The design brief indicates that the students should create a tray; packaging(s); positions on the tray for cold starter, hot main course, and dessert; and provisions for a tablecloth, condiments, cutlery, a wine glass and cup.

The traveling customers are defined as all nationalities and age groups who travel on economy fares. The airline servers are considered to be of equal importance to the customers since they are serving the airline meal. The economy meal is typically served on a fold-down table that needs to be hygienic, practical and easy to use. The design brief emphasizes that the meal tray is a point of interaction between cabin crew and the customers and that the ritual of eating is a focus. The final meal tray should challenge the preconceptions of current airline meal tray designs. Along with this, the brand values of *Virgin* must be considered in the design. In the fourth week of the field study the participant-instructor brought in a sample of give-away items from *Virgin* airlines provided by another instructor at the design school. Figure 2 shows a sample of these.

Figure 2: Virgin branded objects including eye shields, sugar, salt and pepper, an airline sickness bag, a menu, a toothbrush, and a shoehorn

Figure 2 represents a sample of the brand values that are currently part of the *Virgin* airline identity. *Virgin* is colourful, fun, and clever in their branding. For example, the eye shields have the words 'wakey wakey' written across them.

Because *Corus* is a steel manufacturer, steel is indicated as the predominant material to be used in the final design. A thirteen-page handout about steel provided by *Corus* was given to the students. The handout identifies how steel is made; different grades of steel including special grades for the food and beverage industry; different coatings and finishes for steel; how steel packaging can be stacked; how steel is joined and shaped; how steel is decorated with graphics, embossing, textures; and the environmental characteristics of steel. Even so, the design brief does allow the students to explore other materials in combination with steel, provided that steel is the predominant material.

The design brief is considered consistent with those common in educational and industrial practice. For example, the design problem is complex because of the layered requirements and the limitations of working with a number of clients (*i.e., Virgin, Corus*, the instructor). In addition, the students were provided with a specific user group and use scenario (*i.e.,* in-flight attendants and travelers confined to an economy seat on an airplane), as well as particular materials and manufacturing processes. It is important to note here that the problems inherent to this type of design brief are common to the problems that the students will encounter in design practice. Therefore, the design of an in-flight meal tray is considered to represent a common design problem. The complexity of this design brief is illustrated through the codes and indicators found relevant to it, which are discussed in detail in Chapter 6.

Design of an airline meal tray: Appendix II (b)

BSc(Hons) Industrial Design
Semester 1 - 2002-2003
User Centred Design- Context

User Centred Design is essentially a design methodology which places the end-user at the centre of the design and development process.
The user is observed, consulted ,simulated ,modelled and interpreted throughout the constantly. The net result of this is (theoretically) a product , service or space which successfully answers the needs of the target user .

Fundamental to this is a clear unambiguous understanding of the users which is why the user centred approach is associated with video studies, focus groups and primary research. User Centred design is not associated with supposition, personal opinion and subjectivity.

It has been said that a product has to be sold twice. Once at the point of sale in the retail environment and once when the user establishes a relationship with the product in its functional environment.
Employing a user centred methodology lessens the risk of a gulf between the perceived, untried promises of a product and the actual user experience. A bank may have a fantastically alluring marketing strategy for its new flexible account but if you are unable to figure out how to use the web site or cash machine it is ultimately going to fail- witness the recent disaster with Sainsbury's Nectar promotion. Have you ever tried hoovering a car using one of the upright Dyson Cyclone hoovers?

Due to the need for empirical research when employing user centred methodologies designers use a large range of research tools ;-

Direct observation
Interviews
Focus groups
Group discussion
Scenario modelling
Questionnaires
User trials
Empathic modelling
User trips
Expert opinion
Brainstorming

Some are more user centred and some less- Interviewing someone is a direct primary source of information, brainstorming seems much less user centred however getting a user group to brainstorm could be extremely valuable.
It is important however that when employing these methods a record is kept. Without a record of the interview or event ,decisions made as a result cannot be justified. Video, photography and sound recording are all valid forms of recording your research.

Appendix II (b)

You will be constantly required to justify your actions and decisions and to illustrate these decisions with research work and collated information.
In an educational context work cannot be assessed unless the research is there to back it up.

Design projects.

Project 2 D&AD.
Brief TBA.

Assessment.-Project weighting
RSA 40%
Deliverables.-See attached brief +
Research Results,Image boards, sketch books ,sketch models

Week 2 - 250 word statement of proposed Methodologies and Creative influences. Visual Imagery must be included.

Week 3- Interim Presentation – Proposed Concept

D&AD 60%
Deliverables TBA

Criteria.

Your assessment team will be asking the following questions of your submission.(this is not an exhaustive or exclusive list)

Does the proposal answer the brief ?
Is the target user group clearly evidenced in the submission.
Did the designer employ User Centred methodologies ?
Does the proposal challenge existing conventions of Functionality, Aesthetics, Inclusivity and Manufacturing ?
Is there evidence of multiple concept development ?
Does the presentation reflect the context of the proposal?

A pass will be awarded if all the above are met . Attendance at all tutorials and assessment points is mandatory.

CORUS STEEL PACKAGING DESIGN AWARDS
VIRGIN ATLANTIC AIRWAYS

DESIGN BRIEF
3/3

TO PROVIDE AN INNOVATIVE, ENVIRONMENTALLY SOUND AND USER FRIENDLY MEAL TRAY, INTEGRATED SERVING DISHES AND PACKAGING FOR THE VIRGIN ATLANTIC AIRWAYS ECONOMY MEAL

SPONSORED BY
CORUS PACKAGING PLUS

corus

Background
Sir Richard Branson started Virgin Atlantic Airways in 1984. It gives great effort to being an airline that people love to fly. Virgin Atlantic Airways sets great emphasis on product differentiation to give its customers a travel experience that reflects its brand values. It is renowned world-wide, for its innovative products and excellent service and is continually changing its onboard product.

Target audience
Virgin Atlantic Airways fly to America, the Caribbean, Africa and the Far East. As a consequence Virgin Atlantic Airways cater for all nationalities and age groups.

Brand proposition
Brand values areas: fun, innovative, caring, honest and value.

Key competition
Any airline that shares the same routes. However, the design department at Virgin Atlantic Airways set their aspirations higher than other airlines and the aim is that designs produced should beat similar products that their customers would purchase on the ground.

Design environment
Virgin Atlantic Airways fly a fleet of Boeing 747s and Airbus A340s. There are approximately 200 economy seats. The majority have a fold-down table in front of the customer. Space is a premium and weight is a significant economic factor directly proportionate to fuel costs.

Design objectives
To provide an innovative, user friendly, meal tray and integrated serving dishes design for the Virgin Atlantic Airways economy meal. To ensure the design captures these brand values whilst being hygienic, practical and easy to use. The challenge is to create a more interesting and enjoyable meal time experience for the consumer whilst addressing environmental issues.

The interaction between the crew and the customer during the meal service is an ideal time to inject theatre into the ritual of eating and give the customer the brand experience related to Virgin Atlantic Airways.

Design considerations
Steel must be the predominant material used to fulfil this brief, using its structural and aesthetic qualities to provide the experience required. The meal tray set up has historically comprised of plastics and paper packaging. Aluminium, plastic and paper are common place in this application, and the brief should find an innovative use for steel as it has high food safety credentials. Virgin Atlantic Airways has not previously used steel in its meal service packaging or tray design. Innovation is a core brand value and new ways of improving the Virgin service are constantly being evaluated.

There is increasing pressure on airlines to be environmentally considerate with their waste. There are two main options for the meal packaging; either to be a disposable but easily recyclable product or to be a re-used product that is restocked after being cleaned. Both these options have different associated costs.

As space is critical in any aircraft the way in which the layout of the food product and its packaging is arranged before, during and after the meal is critical. Consider the target audience and their expectations from the Virgin brand. The ability to challenge the preconceptions of airline meals is essential if the design is to support the Virgin Atlantic Airways brand value of innovation.

Mandatories
- Create a complete meal tray and integrated serving dishes that can be stored in the existing galley carts which don't change the way Virgin Atlantic Airlines currently prepare and serve.
- The meal tray size is 10mm x 276mm x 380mm.
- The brief covers: the tray, packaging and positions for cold starter, hot main course and dessert. Provision for the tablecloth, condiments, cutlery, a wine glass and a cup should be provided for. All these elements together should not exceed a height of 60mm (tray depth included) in its stowed position.
- Meal lid packaging must indicate expiry date and meal type.
- It must store food hygienically and be easily accessed by all customers. The design must not be detrimental to customer safety in any way.
- There is no need to directly brand the packaging. The product in itself should reflect the brand.

Judgement criteria
In priority order:
- Overall conceptual idea
- Understanding and interpretation of the brief
- Functional viability
- Fit with Virgin Atlantic Airways brand
- Innovative use of steel
- Something that will be memorable to customers
- Finish and presentation
- Although it is essential that steel is the primary component, additional materials may be specified to enhance the design
- Show you've had fun creating the design

Deliverables
3D drawings along with support materials (e.g. explanatory notes, design sheets, materials board) mounted on no more than four A2 lightweight boards and the option of sending a model of your design. Please demonstrate your research.

Support facts/contacts
www.virgin.com/atlantic
www.corusspace.com
E-mail: space@corusgroup.com

Brief set by
Joe Ferry, Virgin Atlantic Airways

virgin atlantic

Summary of the Canadian design brief: Appendix II (c)

Design of sports eyewear

Vision in Sport is the title of the design brief that was created by the two participant-instructors involved with this study. The goal of the design brief is to design a pair of sports eyewear for a sport the students choose. The design brief is created to compliment previous projects completed by the students. The primary goals are to provide a breadth of experiences and a range of products for the students' future portfolios. Although the researcher preferred an external brief to be used for the field study, this was left to the discretion of the instructors. The design brief states that the students first needed to choose a sport from a prepared list of appropriate sports. If desired, students could propose a sport that was not on the list, but this had to be passed by the instructors before beginning the design work. One of the project guidelines specified that students not use a sport that required eyewear to be fixed to any other part such as a helmet or mouthpiece; it must sit freely on the face. The general learning objectives for the project were to build on the previous project (discussed later in this section) and for the students to learn design as a contextual exercise. The details of the design brief are summarized as:

- defining the product positioning in an appropriate marketplace,
- addressing aesthetics,
- addressing function,
- involving investigation,
- and involving innovation.

The design brief implies that students create an ergonomic, safe, fashionable and functional pair of eyewear. It is not specified whether this eyewear be used in the sun or for night or indoor conditions. However, the design brief does indicate that, although students are to choose who will use the product, they must relate to the demographic of the activity that is chosen (*e.g.,* age, gender). In addition, students must provide a breakdown of the eyewear that is currently available for the chosen sport and demographic. The design brief includes clear deliverables in four stages including design brief / positioning statement, design exploration/concept development, design development, and design detailing.

Sports eyewear is currently undergoing a revolution. Many different extreme sports that have become popular over the past decade, require highly functional and fashionable design features. *Oakley* designs one of the most popular, versatile, and expensive brands of sports eyewear. Along with the *Oakley Water Jacket* a number of generic examples of sports eyewear were referenced during the course of the project. Dozens such examples were referenced through images in magazines, video clips acquired from the Internet, and by bringing in existing products. Some of the physical examples belonged to the students personally, others were borrowed for the project. The most creative acquisition of goggles is through a local gym's lost property box. A student designing swimming goggles got numerous examples for the purpose of detailed examination and deconstruction. Several members of the group, not just the student who brought them in, examined the materials and hinge features on these goggles. Figure 3 shows a variety of existing products including swim goggles, prescription *Rec Specs*, and generic sunglasses.

Figure 3: existing eyewear referenced by the students

This design brief is considered similar to other ones used in both educational settings and industrial practice. In fact, the two instructors who set the design brief each have many years of practice and have conceived this design brief to strongly resemble ones they have encountered in industrial practice. It is unknown whether the instructors have been specifically involved in the design of sports eyewear; however, both have designed a variety of other sporting products (discussed later in this section).

The design of sports eyewear is considered to be a complex problem because of the ergonomic quality, the different parts necessary, the necessity for moving parts, and a need for extensive research into materials and manufacture. Although the students do not have a specified user group and choose the specific sports activity, the use-scenario is one that requires a robust design with a sensitivity to aesthetics. Like the design of an airline meal tray, the complexity of this design brief is illustrated through the codes and indicators found relevant to it, which are discussed in detail in chapter 6.

Design of sports eyewear: Appendix II (d)

EVDS 792.20 PROJECT 3 – WINTER TERM 2004

Course Managers:

Studio Time: 2pm to 6pm Monday, Tuesday, Wednesday & Friday
Meeting Room: PF 4140

PROJECT 3: VISION IN SPORT
PROJECT DURATION: 6 weeks

INTRODUCTION: Group meeting PF4140 Friday Mar. 5th

This project is intended to build on the lessons of the previous two studio exercises. Given the requirement to understand design projects as a contextual exercise, students are required to choose one of the sports listed below and to develop the design for a dedicated piece of eyewear that would be used exclusively for that sport. A significant aspect of the exercise is to understand how this new product will be positioned in the marketplace and so students must as a first step develop a succinct positioning strategy for their chosen product. This will establish the direction for later design development.

The available sports choices include:

Scuba/snorkelling	swimming	racquet sports
Climbing	cycling (road/mtn)	snowboarding
Skiing	skydiving	jogging/running
golf	windsurfing	sailing

The positioning statement is in exercise in establishing the context of design inquiry. The positioning can arise from the development of some new use or mechanical feature for a given product or it can arise from an understanding of the product aesthetics and the role or place of the product in its intended market. Sometimes the positioning is the result of a combination of both approaches. Keeping in mind that this is an industrial design studio students are advised to develop a positioning statement that does not place excessive emphasis on invention or a new mechanical aspect of the design, rather that emphasis is placed on the formal investigation of the identified position. Students are also strongly encouraged to develop highly unique (and indeed off-the-wall) premises for their positioning statements.

EVDS 792.20 PROJECT 3 – WINTER TERM 2004

Presentation: 2pm PF 4140 Fri. Mar. 12th

STAGE 1 – Design Brief (5% of studio grade)

Students should prepare a brief presentation (10 min) that outlines the following:

- The chosen activity;
- Positioning and problem statement
- Breakdown of activities demographics (age, gender, etc);
- Current offerings in the applicable consumer marketplace
- A design statement which provides;
  - Specific design direction for the project
  - How the intended design will effectively separate itself from existing product(s)
  - Price point and target market.

Deliverables:

- 2-3 page design brief document (This should include an outline of the overview, critique and problem statement as a background to the brief).
  - The document should be well layed out, with attention given to format, use of graphics, page composition, spelling, grammar etc.
- Student are required to create 1-2 material / concept / collage story boards showing:
  - Product use environment and users
  - Possible materials, colours, and textures (etc.)
  - Design theme and inspiration

STAGE 2 – Design Exploration (10% of studio grade)

Design Concept Presentation 2pm PF4140 Fri. Mar. 26th

Students are required to thoughtfully and rigorously explore a variety of design ideas in this initial design stage and should be developing designs that effectively reflect their chosen activity and product. Design development should go beyond schematic creation - although relevant to start, the bulk of the stage should be spent developing a handful of well thought-out concepts (for presentation). This development work should be both 2D and 3D – exploration is encouraged - but all concept work should be concise, pointed, thorough and usable towards the concept's development.

Deliverables:

- A minimum of 20 A3 pages is required – colour is encouraged.
  - All pages should have a consistent lay-out with appropriate titling
  - Concepts shown should not be schematic, but reflect 5-6 well considered dominant themes geared towards one final design.
- A minimum of 5 3D concept sketches reflecting the design themes is also required.

EVDS 792.20 PROJECT 3 – WINTER TERM 2004

STAGE 3 – Design Development (10% of studio grade)

Due: 2pm PF 4140 Fri. Apr. 2nd

Based on the work developed in Stage 2, students will choose one design directions for further development and refinement. These can be one of the concepts shown in Stage 2, or derived from post crit evaluations.

Deliverables:
- 3D study/sketch model for the design at 1:1 scale.
- A set of refined concept sketch illustrating;
    - Design details
    - *Overall dims,*
    - Final product colour

STAGE 4 - Design Detailing (20% of studio grade)

Final Presentation of the design: 2pm PF 4140 Fri. Apr. 16th

The final design will provide an effective resolution of the design objectives and criteria as identified in the design brief.

Final Deliverables:
- 4 A3 presentation boards with consistent format. Attention is to be paid to composition, graphic layout, and use of text, colour and information presentation.
- The boards are to illustrate the following:
    - View(s) showing the design in context
    - 3D and orthographic CAD views of the design
    - Positioning/problem statement and short list of design criteria
    - 1 board showing your design approach and concept development
- Technical drawings are required showing the following:
    - Orthographic line drawings of the design
    - A complete technical drawing of one part
    - An exploded view of the design (if applicable) detailing all of the product discreet parts.
- A monochromatic study model;
- A CD with archival material of all of the above, in appropriate formats.

Student questionnaires: Appendix III

(a) Questionnaire one

(b) Questionnaire two

Questionnaire One – Past and Present Identifying Information

Name	
Birth date	
Birth place	
Significant moves (districts, cities, countries with duration)	
Present address with Postcode	
Permanent home address with postcode	
Previous education (certificates, diplomas, degrees)	
Work experience including past part-time employment	
Relevant design experience outside of university	
Travel (place with length of stay)	
Interests and Hobbies (clubs, sports, religion)	
Parents / Guardians occupation	1 2
Number of siblings and their occupations	

Questionnaire Two – Present Educational Experience

Name	
Program	
Desired occupation	
Elective(s) with year	
What courses have you enjoyed most in this program (briefly why)	
What courses have you disliked in this program (briefly why)	
Have you taken any breaks from program (include duration)	**Y / N**

Overview of the population for each study: Appendix IV

(a) Summary of the UK population

(b) Summary of the Canadian population

Summary of the UK population: Appendix IV (a)

Understanding the populations involved in the studies provide essential information for understanding the cultural capital of each individual and subsequently the nature of the references. The design brief is assigned to a group of fourth year design students in the first term of their honours degree year. The population consists of eleven undergraduate students and one instructor who make up the primary participants in this study. Two other instructors took secondary roles by providing additional information about other modules and the programme of study, and were also involved to varying degrees with the students. This particular group was selected because of the manageable and limited size, and its willingness to participate in a lengthy study. The students and instructor were treated equally, all as participants, in order to maintain research distance and to provide a reassuring environment for the students.

Senior students were selected for their level of knowledge in design and their confidence with the subject. One could argue that they are no longer novices in design as they have completed three years of a design degree. However, they cannot be considered experts in their field either, as they do not have numerous project successes, nor have they worked within the constraints of budgets and market supply systems. The participant-instructor has extensive knowledge in materials, manufacture and current CAD design practice. His background and his educational approach are detailed later in this section.

Although this social group was comprised of eleven students with different backgrounds, there were remarkably numerous similarities among them. Many constants are present in this population.

Constants among the UK population
BSc Industrial design
All participants are male
All students were born between January 1980 & November 1981
All students are ages 21 to 22 at the time of the study
All students have been engaged in a 4 to 6 month design-related work placement
All are high school educated

Table 1: constants among the student participants

As shown in table 1, five variables are constant, which ultimately reduce the contributing factors that might muddy the data (*i.e.,* make it difficult to understand why the information is present). Neutralizing the variables in any investigation is excellent, therefore the numerous constants are viewed as highly beneficial particularly because this is the first field study. For example, within this group having a single gender, being of a similar age, and having a similar level of education and life experiences among the participants are factors that are neutralized when analysing the data. Although the breadth and variety of indicators may be more limited in this field study due to a notably high number of constants, this provides a refined research scenario. In addition, the high number of constants means that this field study is more easily compared and cross-referenced to other studies. For example, variables such as gender and age may be explored in another study and compared to this one.

Appendix IV (a)

These details and those that follow regarding the population are understood based on the questionnaires the group filled out on the first day of the study. These are summarized in figure 2. Table 2 shows that the majority of participants are born in Scotland and had lived within 100 miles of Edinburgh all their lives. Of the eleven student participants, seven are from Edinburgh, one is from the Orkney Islands, one from England, and two lived abroad for extended periods of time. The instructor, not shown in table 2, is also from Scotland. Even so, the participants had extensive exposure to other cultures, ideas and values through travel. Ten of the participants had traveled extensively in Europe and Internationally. For example, each participant who had traveled in Europe had been to a minimum of three countries including Spain, Greece, Switzerland, Germany, and the Netherlands. International travelers had been to Thailand, Malaysia, Pakistan, India, Egypt and New York. Only one participant had never traveled beyond the UK. The instructor routinely travels to the Netherlands and has also traveled internationally.

	UK1	UK2	UK3	UK4	UK5	UK6	UK7	UK8	UK9	UK10	UK11
Gender	m	m	m	m	m	m	m	m	m	m	m
Age	21	21	21	22	21	22	22	21	21	21	21
County of birth											
Prior education			•Life saving •First aid •Swimming •Sailing •Music	•3D studies			•Understand. industry •TEFL •Radio license				•Art & design found.
Relevant design experience	•Graphic design	•Engineer	•Landscape artchitect	•Toy design		•Set design	•Lighting design •Graphics	•Engineer	•Architect		•Music product design
Travel											
Interests & hobbies	•Sports •Church	•Sports	•Sports •Extreme sports	•Extreme sports •Music	•Sports •Socializing	•Extreme sports •Socializing	•Music •Travel •Sports •Socializing	•Sports •Extreme sports	•Sports	•Socializing •Extreme sports	•Church •Music
Electives	•Packaging •CAD	•Packaging •CAD		•Life drawing •CAD	•Graphic comm.. •CAD	•Auto engineer •CAD	•Life drawing •CAD •Photo	•Graphic comm.. •CAD	•Life drawing •CAD	•CAD •Photo	•CAD •Italian
Direct entry		yes									yes
Taken breaks				yes		yes					

= the participants highlighted in chapter 6

= all other participants

Table 2: a breakdown of the UK student population

Appendix IV (a)

Working part-time while studying is a factor that contributes to a student's success. Half of the students had part-time jobs, predominantly on the weekends. All their jobs are in the service industry including working at a bank, in shops (*e.g.*, grocery store, motorcycle shop), and in bars. The students' summer employment or work done prior to this term encompasses a variety of jobs including manual labour such as assembly line work and grass cutting. Two of the participants had worked as coaches teaching sports.

In terms of recreation, the number of participants who are engaged in sports activities is striking. There is also a relatively narrow range within these. References to sports and recreational activities are themes throughout the data in this study. For example, participants wrote about their interests and hobbies in questionnaires, but also discussed them frequently throughout their daily work and during the interviews. It seems, that this group of participants particularly value sporting and recreational activities. In the questionnaire, the category of recreation and sports has the largest number of responses; each participant provided two to six responses with a total of 49 responses overall, including 27 responses to sports alone. Along with sports and extreme sports the responses are easily divided into four other types of recreation: travel, church, music, and socializing. Next to sports, socializing and music are the most common responses. Examples of the responses from each type are:

1. sports – football, badminton, volleyball, rugby, swimming, squash;
2. extreme sports – downhill mountain biking, snowboarding, motorcycling, climbing;
3. socializing – clubbing, dancing, going to parties, playing darts;
4. music – DJ'ing, playing the violin, playing the guitar;
5. church – belief in Christianity;
6. and travel – generic enjoyment of travel for recreational purposes.

Participant responses to the category of hobbies and interests in the questionnaires are straightforward, however, in the observational and interview parts of this study details of each are revealed. For example, most participants took part in sports activities once or twice per week. Several participants were involved in recreational teams and one participant was on the Scottish national volleyball team. The references to extreme sports included involvement over longer periods of time. Participants seem to equate extreme sports with being masculine and having the image of being cool. Two participants are involved in motorcycling on a daily basis by commuting to and from university. These individuals also indicated that motorcycling went beyond being functional and is also a sporting activity for them. Two participants noted involvement with church as part of their recreational activities. One participant noted church attendance on the questionnaire, but never mentioned it again. The second participant was more extensively involved with church activities, which included involvement with the university church group, another club, and church attendance several times per week. Travel is not examined to a great extent in this part of the study because a multitude of references to traveling were triggered by the travel-related design brief. All references to travel are considered highly relevant to the brief, and are therefore regarded as tangible references that come from outside of the design process. These are discussed in greater detail in chapter 6. The recreational

interests of the instructor were not pursued; however it is known that the instructor enjoys travel and is relatively sports orientated. In general the population is well educated and from middle class families; yet, because of their young ages the participants are not particularly self-aware. Within this group only one participant reflected on his actions, thoughts and abilities. This participant made the connection between his actions and thoughts being relevant to design practice. The other group members did not understand or recognize the value of this. The majority of the participants come from a family with two or more siblings. Just one participant is an only child. The majority of the participants' siblings are students (*e.g.,* grade school, university), others work in the service industry (*e.g.,* building maintenance, occupational therapist, caregiver, hotel management), and one is an army officer. The participants' parents are engaged in a variety of occupations, including many design-orientated jobs such as photography, advertising, engineering, and architecture. Therefore, half of the participants have been exposed to art and design through their families. The occupations of the parents with non-design related occupations include teachers (*i.e.,* grade school, university), a bank worker, a farmer, and a doctor. Two of the participants have mothers that are full-time homemakers. The family background of the instructor was not pursued.

All the participants, including the students and instructor, are considered to have cultural capital that is relatively typical for individuals who have had opportunities to explore a range of high and low culture. For example, the students come from middle class families that encourage travel, which provides exposure to cultures other than Scottish and British. In addition to travel, the participants are involved and surrounded by Edinburgh, which is a vibrant international city. In this way, the participants gain a wide variety of information about the world that they are involved in. Because the group make-up is homogeneous in terms of gender and age, certain characteristics of it's cultural capital are brought out. Examples of these are illustrated through the high number of references to sporting activities that are male orientated. References to the popular culture of media including the Internet, films, and television are considered to be highly influential because of easy access to these media. Globalization and popular culture are discussed later in this chapter when the two field studies are compared. The cultural capital of the individuals is illustrated in detail by examining all the references made by two participants during the design process and the intangible references of all participants, which are shown in chapter 6.

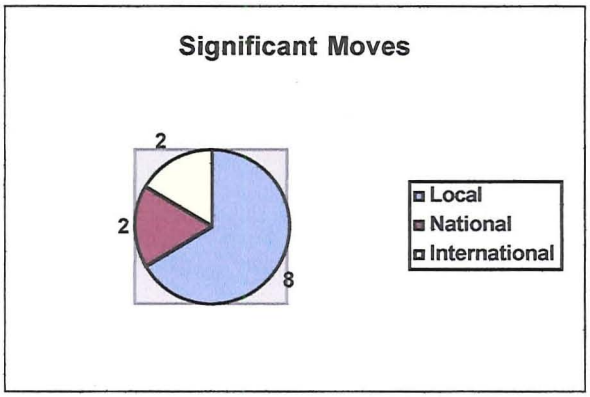
Information about the constants within the population, the participants' birthplaces and moves, their current work situation and prior experience, and their recreational interests are the key to unveiling the intangible reference-use during the design process. This personal information about the participants is primarily provided through the questionnaires with naturally occurring references being made about these during designing. Carefully documenting the attributes of the population enables cross-referencing and contextualization with the interviews and observations. In addition, the family backgrounds and general make-up of the group provide a context for the references being made during designing. This information about the population provides markers for pinpointing the participants' individual personal experiences and memories, or more specifically the outside factors that are made part of the design process. The following subsections provide the context for the inside factors including the design school, the programme, the instructor's educational approach, and the studio culture.

Gender and Age

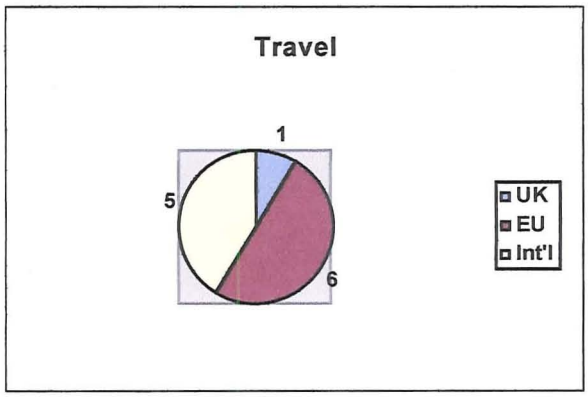
All participants are within the **ages** of 22 and 23 during the study. All participants are **male**.

Birthplace, Moves and Travel

1. **Locals** are those who are born in Edinburgh and area and continued to live in the region throughout their lives,
2. **Nationals** are those who are born in England and on the Orkney Islands and lived in those places the majority of their lives,
3. **Internationals** are those who were born and/or lived abroad for a significant period of time, in each case these individuals had lived for extended periods of time in a number of places (*i.e.,* India, Germany, Korea, Dubai).



1. **UK-only** travelers were those who had never traveled beyond England, Wales and Scotland,
2. **European** travelers were those who had traveled to Europe, each participant in this category had been to a minimum of three countries (*i.e.,* Spain, Greece, Switzerland, Germany, Holland) with several being holiday resort destinations (*i.e.,* Ibiza, Minorca),
3. **International** travelers were those who had traveled to Africa, America, Asia, Australia, and/or Europe (*i.e.,* Thailand, Malaysia, Pakistan, India, Egypt, New York), each participant in this category had traveled to many different places with a combination of at least two continents (*i.e.,* Asia, Europe, USA).

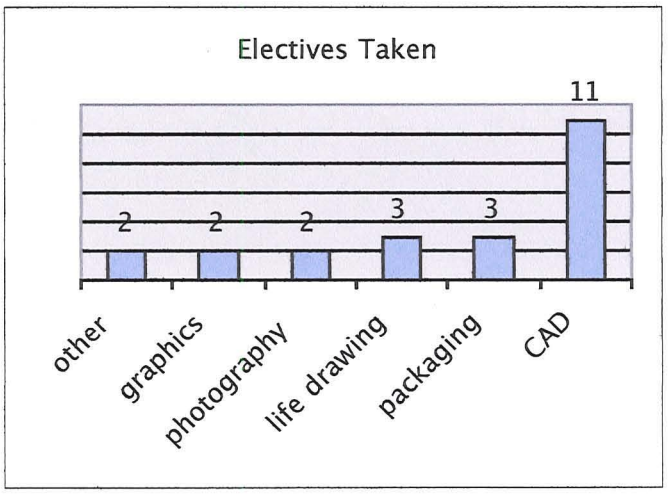


Prior Education to and at the University

At the University the majority of students come into year one, but some gain **direct entry** to year two or three. In this study 2 of 12 participants gained direct entry into year two of the BSc programme. One of these students was given direct entry based on the merits of his portfolio and the other was a transfer student from another institution in the UK.

Another significant point in regards to prior educational experience is that 2 of 12 participants (different from those who gained direct entry) took a **year out** from the BSc programme of study at Napier. One student did this in order to study abroad and the other did so for unknown personal reasons.

Each student took between **2-3 electives** with one participant indicating that he took none. Most of the electives relate in some way to the study of design with exception to an automotive engineering module and an Italian language module. Two different participants took each of these. The design relevant electives include graphics, photography, life drawing, packaging design and CAD skills.



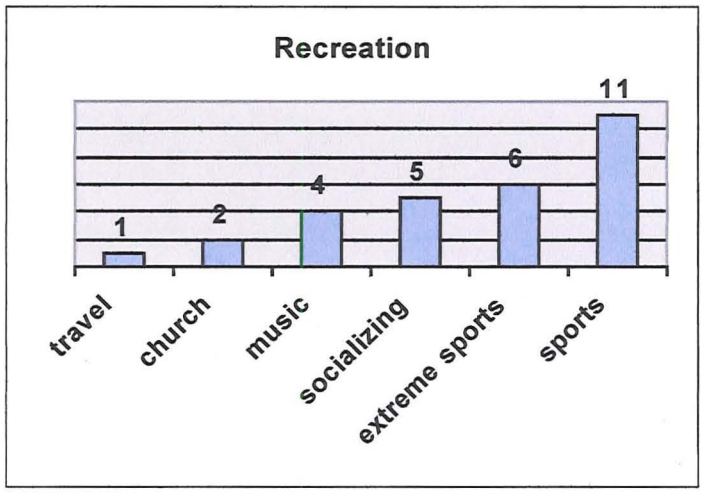
Work Experience and Recreation

Another factor that reveals the intangibles of design are work experience and recreation (originally called hobbies and interests). Exactly half of the students had **part time jobs** that they worked at on the weekends. These are in the service industry, such as in banks, shops, and bars. Two participants had taught sports, and several others had labor related jobs such as assembly and grass cutting.

Many students indicated some design related work experience, however, when scrutinized all this experience was due to their recent university **work placements**. The placements included work along side graphic designers, landscape architects, game designers, and lighting designers. One participant indicated having worked on set design during his year out.

In terms of recreation, it was striking the number of participants who engaged in **sports activities** and the relatively narrow range within these. Recreation was a theme that was found throughout the data in this study. For example, participants wrote about their interests and hobbies in questionnaires, but also discussed them frequently throughout their daily work and during the interviews. It seems, that this group of participants particularly value recreational activities.

Each participant provided **2-6 responses** to the category of **hobbies and interests** with a total of 49 responses overall. These were easily placed into six different types; travel, church, music, socializing, extreme sports and sports. For the purpose of this research, the responses were organized according to the number of participants who made reference to each category, not according to the total number of responses.



Individual participants made numerous responses to each category, for example, there were 27 references to sports alone. Examples of responses in the six categories are:

7. **sports** - football, badminton, volleyball, rugby, swimming, squash;
8. **extreme sports** - downhill mountain biking, snowboarding, motorcycling, climbing;
9. **socializing** – clubbing, dancing, going to parties, playing darts;
10. **music** – DJ'ing, playing the violin, playing the guitar;
11. **church** – belief in Christianity;
12. **travel** – generic enjoyment of travel for recreational purposes.

Summary of the Canadian population: Appendix IV (b)

The design brief was assigned to group of design students in their final year of coursework (the second year) in a three-year master's degree programme. The population consists of eight students with one primary instructor and one supporting instructor. A module such as this is typically taught with two primary instructors at this design school; however, due to personal circumstances the supporting instructor had a significantly lesser role than the primary instructor. The primary instructor is a full-time faculty member at the design school, the support instructor is a part-time instructor who is actively engaged in industry. Up until this point, the students had the benefit of gaining instruction from both of these instructors equally in this module. In addition to their formal instructors, a visiting instructor assisted the students to a varying degree. This visiting instructor teaches at a design school in Mexico and is upgrading by doing a funded master's degree in Calgary. Because he has over three decades of industry experience and a decade of teaching experience at the university level, he acts as instructor with this group on several occasions during the course of this field study. He is particularly supportive of a Mexican student with whom he shares the mother-language of Spanish. All instructors involved with this module are male. This group, as with the first field study, was selected because of the manageable size and willingness to participate in a lengthy study. As with the first field study, students and instructors are treated equally, as participants, in order to maintain research distance and to provide a reassuring environment for the students.

Senior students of this master's degree programme are selected for their level of knowledge in design and their confidence with the subject matter. Because of the limited number of design schools teaching industrial design in Canada this group was considered acceptable for the purpose of the study. It is understood that the differences between undergraduate and master's degree programmes may be significant; however, when deciding on a programme to study it was considered more important that the programme be in industrial design and that the group be a manageable size.

As noted previously, the instructors are not novices either in teaching nor in the practice of industrial design. The primary instructor has more than fifteen years of experience in industrial practice and a decade of teaching experience. His experience in practice includes electronic products, medical products, baby products, telecom devices, and sports and leisure equipment. The support instructor has more than a decade of experience in industrial practice and has taught part-time for two years. His experience in practice includes electronic products and recreational equipment. The visiting instructor, along with his years of teaching experience, also has a range of industry experience including the design of telephone products and services, the design of flashlights, and furniture design. He was also the director of a forest products laboratory.

The eight student participants in this field study do not show as striking similarities as the participants in the previous field study. Even so, there are some constants present in the population. These are shown in table 3.

Constants among the Canadian population
MDes Industrial design
All hold previous degrees
All are in second year and have not taken any time out
All indicate that they like their studio module and projects best
All have siblings

Table 3: constants among the student participants

Table 4 summarises the Canadian population based on questionnaires completed at the onset of the study.

	1 CAN1	2 CAN2	3 CAN3	4 CAN4	5 CAN5	6 CAN6	7 CAN7	8 CAN8
Gender	f	f	m	m	m	f	f	m
Age	27	28	26	26	37	26	28	31
Country of birth								
Prior education	EngDip	BFA	BCom	BFA	BEd	BDes	BSc	BPSc
Relevant design experience		• Mural design • Prop builder • Display design • Graphics	• Graphics	• Art teaching • Graphics	•Medical device design • Technician and shop teacher	• Architecture • Graphics • Medical product design	•Exhibit design	• Graphics • Leather book binding
Travel								
Interests & hobbies	• Dancing • Music	• Art	•Snowboarding • Music	• Art • Music • Christianity	• Family • Jewelry • Religion	• Water sports • Art and art galleries • Movies • Friends	• Volleyball • Snowboarding • Soccer • Skiing	• Music • Hockey • Climbing • Kayaking • IDSA member
Electives	•Commercializing industrial design • Emotion and design • Sustainable living	• People and products • Emotion and design • Participatory design • Multimedia	• Furniture design • Design criticism • Sustainable living	• People and products • Commercializing industrial design • Emotion and design • Sustainable living • Multimedia	• People and products • Emotion and design • Sustainable living • Multimedia	• Emotion and products • Sustainable living • Product and technology assessment • Design criticism	• Commercializing industrial design • Design criticism • Multimedia • Sustainable living	•Furniture design • Design criticism • Sustainable living • Product and technology assessment

 = the participants highlighted in chapter 6

 = all other participants

Table 4: a breakdown of the Canadian student population

The most significant of the five constants are that all the students hold a previous degree, which is described in detail later. In addition, the students are all at the same stage of their studies having taken no time off along the way. This; however, does not take into account those who had a number of years off between their undergraduate degree and this degree. Nor does it take into account those who took years off prior to going to university in the first place. All the students in this group have siblings. This is common to Canadian culture where two children in the family are considered to be average. The student populations personal details are understood based on the questionnaires that the group filled out on the first day of the study. The ages among the Canadian group are varied and range from 26 to 37 years old. This reflects the trend in Canadian postsecondary education where it is usual for students to take time off after high school and return to higher education as mature students. Unlike the UK field study, this group has a broader population beginning with a balance of gender. There are four male and four female participants. To a certain degree this allows for an investigation into gender. With no females in the UK study, gender can be examined as a factor and be a key point of comparison between the two studies. Unlike the UK study where the majority of participants were single the majority of the participants in this study are not. Two are married, four others living with their boyfriend or girlfriend, and two are single. In addition, this group is multicultural in its make-up. There are five students who are visibly Caucasian and three students who are not. Of these three, one is Mexican, another is Chinese, and the third is of an unknown origin. Only two people in the group come from western Canada, with three others come from eastern Canada (*i.e.,* Ontario, Nova Scotia), and three others are international students coming from Mexico, Hong Kong and Britain. There is a marked breadth and variety of differences with the population in this field study. This is reflected in a broader range of indicators and categories than in the UK study. This is explored in detail in the chapter 6.

Table 4 shows that the majority of the participants are born in Canada. The three participants not born in Canada are born in Mexico, England and Hong Kong. For two of these individuals English is a second language. These participants sometimes struggle with communication, cultural, and social differences; however, they have an excellent command of the English language. The cultural differences are explored in greater detail later in this section. Within the Canadian student population there are only two individuals who are originally from western Canada and three are from eastern Canada. Therefore the majority of the population has come a great distance to take this programme.

The majority of the participants have traveled extensively, especially by Canadian standards. That is, due to great geographical distances between places in North America travel is costly. Unlike people in the UK or Europe, the majority of North American's do not gain extensive exposure to other places or cultures. For example, people from Calgary may travel frequently to the Rocky mountains for recreation on the west of the province of Alberta; however, the same individuals may never venture to the east of the province. In addition, many Canadians do not venture from North America and are consistently exposed to cultures within the boundaries of the continent. However, among more affluent and / or educated families it is not uncommon to travel, for example, to Europe, the UK or Thailand on graduation from high school. Interestingly, some Canadians may have traveled abroad but may not

have been to many locations in North America. The students in this group represent a reasonably common range of travel experience among Canadians. Three of the students had traveled within North America, one had been to Europe only, and three had traveled internationally. The North American travelers had done some traveling in Canada and the USA. Of these three, one was the participant from Mexico who had traveled within Canada and Mexico only. The European traveler had been to seven different countries as well as several major cities in Canada and the USA. The international travelers had taken lengthy and more exotic trips including work experiences in New Zealand, Thailand, Malaysia, India, and China. Of these participants one is the student born in Hong Kong. This participant had traveled to a European country, in Canada, and in China. Both instructors indicated having traveled for business and pleasure. The primary instructor indicated a desire to travel more extensively; however, his current travel experiences are unknown. The support instructor spent one year living in London England, which seems to have impacted him significantly since he references this frequently. Greater detail on the experience levels of the instructors is presented later in this section.

All but one student-participant had relevant design experience prior to entering the programme of study. This experience ranged from theatre design to graphics, from art education to architecture, and from craft to industrial design. The majority of the students had at least two years experience in design, which is likely why they chose to study industrial design. Four students had other prior work experience where they worked in the retail industry. One of these was in a sporting goods store, which is of course relevant to the design brief. Other relevant work experience is that one student worked as a ski coach and another worked in the home construction and renovation industry prior to attending the programme. Finally, one of the students taught industrial arts education to secondary students for a decade prior to returning to study industrial design.

As previously indicated with the UK field study, working part-time while studying is a factor contributing to the success of a student. It is usual that students in Canada hold at least one part-time job while studying. This is likely due to more mature age groups studying but is also due to the expense of being a student. Therefore it was considered unusual that only one of the students in this group has a part-time job. This job is at the design school as a workshop technician assisting other students in building models and prototypes. It is important to note that this student is married with children and if he did not have this job he would likely have had another. Of the other students, two others had also worked part-time at the design school but as teaching assistants. It is common that during the compressed modules (*i.e.,* furniture design, sustainable living) one or two students are employed to assist with the administration of the module. In addition, the design school has an in-house gallery where two additional students worked to design and fabricate several exhibits. Furthermore, one student is actively involved on the student council and this student along with one other are involved with a newly created design student publication. Along with this part-time paid and voluntary work, two of these students worked full-time at the design school over the summer on a collaborative long-term project designing health care products. It is clear that the design school supports the students wherever possible by providing relevant design experience and by providing partial funding through part-time activities.

In terms of recreational activities all the participants in this group indicate that they do not have time at present to engage in these types of activities. Just half of the group responded to being involved or having interest in sports on the questionnaire. Of these four, the range of sporting activities is similar to the UK group. Popular sports are the winter sports such as hockey, snowboarding, and skiing; as well as other more extreme sports such as mountain climbing and kayaking. Each participant had between one and five responses to the category of hobbies and interests with a total of 27 responses overall. The range of interests are varied and not easily categorized.

During the observational and interview portions of this study, the students indicated greater detail about their recreational experiences and interests. Six of the students had participated in the sport they had chosen to design for, which are kayaking, surfing, skateboarding, swimming, skydiving, and mountain biking. The students' level of confidence with each sport is revealed through the study. For example, the two students (one male and one female) who had experience with kayaking and surfing are over-confident about their experience and did not feel that it necessary to do a great deal of research about the sport or the user's experience over and above what they personally knew. Although the students who had done skateboarding, swimming, skydiving and mountain biking seemed to have personal knowledge-bases that are similar to the others, these individuals are much more humble about this and supplemented their knowledge base with a significant amount of additional research. The two students who did not have prior experience in their chosen sport are designing for horse racing and motorcycling. The first student chose horse racing because he wanted to keep himself interested in the project and provide a challenge. The other student chose motorcycling because it is a sport she is interested in doing in the future. There are three students who openly stated that they are not 'sporty' and that they thought they would have difficulty with the project because of this. Interestingly, sports and recreation did not get discussed as frequently as expected in this study. Naturally all references to sports activities are considered tangible references even when these come from outside of the design process. These are discussed in greater detail in chapter 6. Other topics discussed about the hobbies and interests of the students are travel, trips to art exhibitions, and watching movies. The recreational interests of the instructors are not discussed at to any detail; however, the observational sessions with the student(s) and instructor(s) revealed that the instructors have direct experience with some of the sports the students are designing for. For example, the primary instructor had skydived and had worked as a swimming coach, and the supporting instructor showed knowledge in all the sports but horse racing and skydiving.

In general, it is easy to state that the participants in this group are well-educated and come from middle and upper class families. This is substantiated by their participation in the graduate level of study. In addition, the students are self-aware in regards to their interests and their personal beliefs / value systems. However, there is only an emerging awareness about their individual design processes. The students are aware of the need to build their portfolios therefore within the group a number of students did not participate in activities they did not feel to be worthwhile. That is, the students always followed the directions of the instructors; however, they made many personal choices about how they approached the project on their own terms. For example, one student felt the project was primarily a 'styling' exercise, which he did not think was

particularly worthwhile. Therefore he chose a sport where eyewear is needed as protection making function the primary concern. All the participants in this group reflected upon their actions during design on one or more occasion sometime during the course of the study. The primary instructor supported reflection by reflecting on his own work in industry and recounting various personal experiences.

As previously stated, the participants in this group all come from families with between one and four siblings. Four of the students have one sibling, one has two siblings, one has three siblings, and two have four siblings. The majority of the students' siblings have professional occupations such as law, accounting, and engineering. Only two of the students' siblings have occupations that are creative. These are interior design and production co-ordination for film and television. The participants' parents are also engaged in a variety of occupations such as being doctors, business people, engineers, a librarian, and a nurse. Only one parent is engaged in a design-oriented, yet craft-based, occupation where he or she is making rugs and quilts. The students are, therefore, not directly exposed to design through their families. The family backgrounds of the instructors are not pursued.

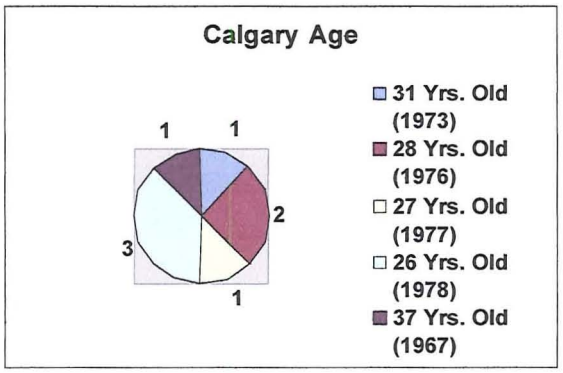
All the participants in this field study, including the students and instructors, are considered to have cultural capital that is useful and relevant to the design brief. Some of these have been discussed earlier in this section including information about design related work and experiences with sports activities. The majority of the participants have been exposed to or have participated in the sport of their choice (which is logical) and the instructors are knowledgeable about the design of sports related equipment. In addition the cultural capital of the individuals is considered to be fairly typical to individuals who live in Canada, come from middle class families, and have the opportunity to explore a range of high and low culture. For example, the majority of the participants have traveled extensively and have therefore been exposed to a variety of cultures, social groups and situation. It is important to note, that even though the majority of the students may have been influenced by similar aspects of popular culture, the international students in the group come from a very different background carrying a different type of cultural capital. This is illustrated through some of the problems that occur with communication, and with social and cultural differences of a multicultural group. Although the majority of the group have no difficulty using and referencing popular culture (*e.g.,* films) the two international students do not understand how this may be relevant to the design of sports eyewear. In all occasions when these students are asked to watch a film for the purpose of learning about their user group, the students are reluctant to comply and when they do watch the recommended film they later voice uncertainty about the process. The cultural schism is illustrated in greater detail later in this section. The cultural capital of two individuals from this group are further examined, displayed, and illustrated in detail by using the references made during the design process shown in chapter 6.

The constants in the population, the participants' birthplaces and moves, their past and present work situation, their relevant design experience, and their recreational interests are the key to discovering the intangible references during the design process. The personal information about the individual participants is constructed through the questionnaires and through naturally occurring references made while

observing the students interacting. The attributes of the population are cross-referenced and contextualized in order to answer the research questions that relate to individual personal experiences and memories. These references are defined as coming from outside of the design process but are distinctly a part of the process.

Gender and Age

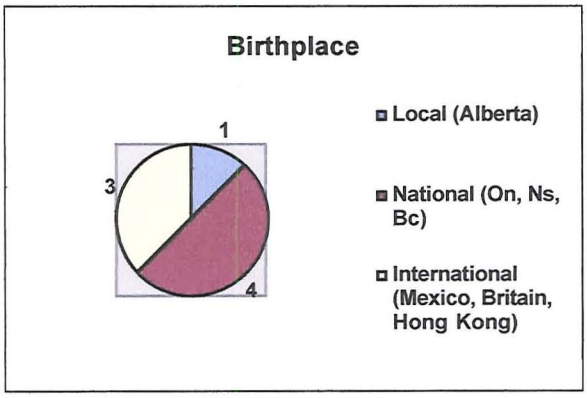
All participants are within the **ages** of 26 and 37 during the study. There are **4 male and 4 female** participants.



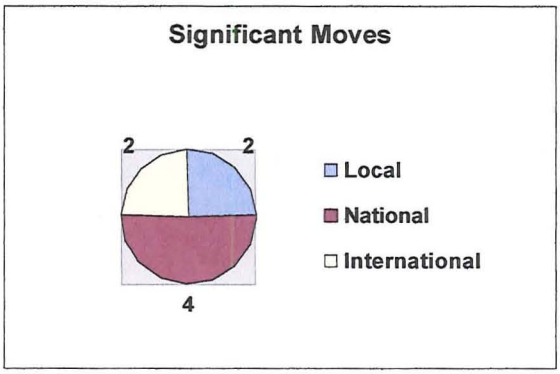
Birthplace, Moves and Travel

The programme at the university of Calgary prides itself on being multicultural. English is a second language (**ESL**) for 2 participants and they are part of a visible minority. These participants struggle at times with cultural, social, and communication differences and are often on the fringes of the group. Both have a reasonable command of the English language.

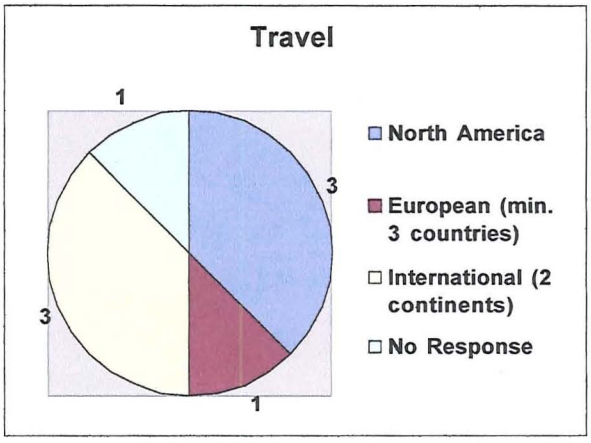
1. **Locals** are those who are born in the province of Alberta and continued to live in the region throughout their lives,
2. **Nationals** are those who are born in Canada and lived in there the majority of their lives,
3. **Internationals** are those who were born and/or lived abroad for a significant period of time.



Significant moves indicates those participants who have moved from another place to study at this university.

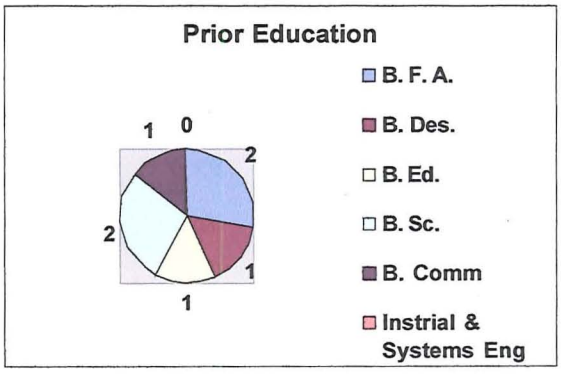


1. **North America only** travelers were those who had never traveled beyond Canada and the United States.
2. **European** travelers were those who had traveled to Europe, each participant in this category had been to a minimum of three countries (*i.e.,* Spain, Greece, Switzerland, Germany, Holland).
3. **International** travelers were those who had traveled to Africa, America, Asia, Australia, and/or Europe (*i.e.,* Thailand, Malaysia, Pakistan, India, Egypt, New York), each participant in this category had traveled to many different places with a combination of at least two continents (*i.e.,* Asia, Europe, USA).

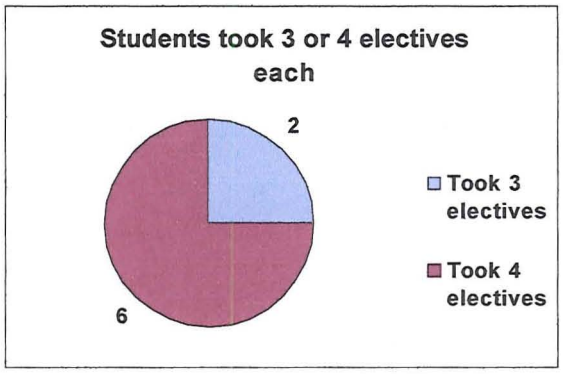


Prior Education to and at the University

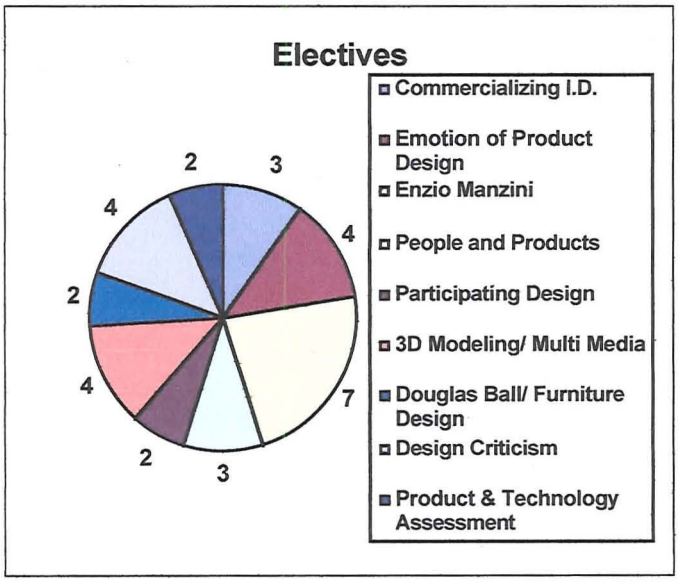
It is a programme requirement for students to have prior educational qualifications therefore all the participants have a prior degree or diploma.



Each participant took between **3-4 electives.** All electives taken are specialized and directly relevant to industrial design. These include block modules and charettes, which are specialized modules taken over reading week. These are compressed modules that are intensive with full emersion over a 2-3 week period.



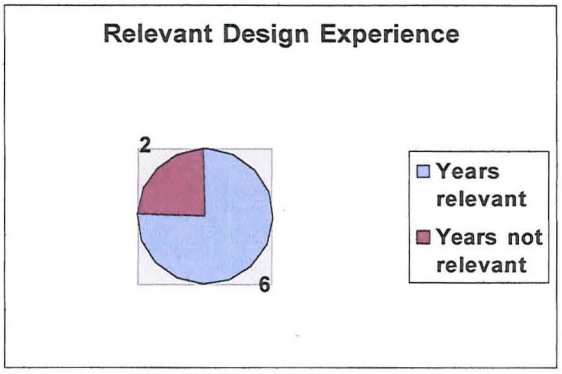
The electives cover topics such as user-centered design, participatory design, ergonomics, furniture design, interdisciplinary design, CAD, and design criticism.



Work Experience and Recreation

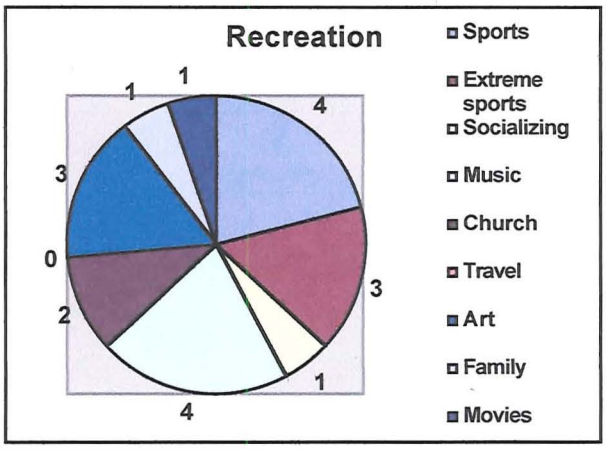
None of the participants have part time jobs however 2 have worked as **teaching assistants** during block model modules. Another 1 works as a **technician** in the workshop. Another 1 is actively involved on the **student council** and on a **student publication.** In addition, 2 participants worked on **health care products** for summer employment at the university the previous summer.

All participants had relevant **work experience** in the area of design, with most having more than 2 years experience. The design related experience is in the areas of architecture, graphic, theatre, exhibition and product design.



All participants indicated having no time for recreation. However, 6 participants had participated in the sport that they were designing for (*i.e.,* kayaking, surfing, skateboarding, swimming, skydiving, mountain biking). 3 participants indicated that they were **not sporty**, which they indicated that it made the project difficult for them.

Each participant provided **1-6 responses** to the category of **hobbies and interests** with a total of 27 responses overall. The range of interests are varied and not easily generalized but fit into 9 categories as indicted.



The top nine categories and examples within each are:

1. **sports** – swimming, yoga, hockey;
2. **music** – playing instruments (guitar, piano), DJ'ing, listening to music ;
3. **extreme sports** – kayaking, mountain climbing, downhill skiing;
4. **art** – visiting galleries, painting;
5. **church** – Roman Catholic, Mormon, Evangelical;
6. **socialization** – visiting with friends;
7. **movies** – watching videos or going to the cinema;
8. **family** – spending quality time with family;
9. **travel** – experiencing other cultures, places and people.

Interview guide and schedules: Appendix V

(a) Generic interview guide

(b) Interview schedule for all students

(c) Interview schedule for instructors

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Interview schedule for all students: Appendix V (b)

Week 3

Motivation / Inspiration / Creative Process

- can you give me some insight into where some of the ideas are coming from?
- is there anything that is motivating you on this project?
- absolutely anything that is helping you to work towards coming up with ideas for this project?
- that also includes what you might be doing to distract yourself into being creative in that way?
- what have you been looking at in terms of other stuff outside of the class?
- have you been looking at any websites or books? magazines, movies?
- previous projects?
- fieldtrips that helped you?
- specific objects?

Other Project Work

- how about for your dissertation?
- have you been looking at books and that in regards to that topic of your major project?

Personal Experience

- have you been drawing upon any personal experiences?

User Design / Primary Research

- how are you nailing down the user?
- how do you combine technology and user?
- How are you getting into the research process?
- Primary research? Questionnaires, interviews, focus groups?

The Unmotivated Student

- what research can you do to motivate you to do something with this project?
- where do you think you could go with it?
- how are you going to accomplish things?
- are you going to keep doing nothing?

Week 4

Touching Base

- what happened last week?
- what have you been up to this week?

Other Course Work

- what other courses are you working on?
- how many courses do you have right now?

Design Work Pattern / Place of Work

- what is your work pattern?
- where do you typically work? (home and school)?

Weekly Routine

- what is your daily weekly routine? describe this
- do you do part time work?
- activities? sports? Clubs?
- family commitments? boyfriend/girlfriend?

Balancing Work

- how are you at juggling all the things you do? courses, clubs, recreation, social life?
- how do you find the balance of work in general?
- do you feel distressed about getting everything done?
- what is your approach? systematically?
- how are you managing the time? deadlines and such?.
- do you kick yourself or do you want others to kick you?

Connection Between Design and Outside Activities

- do you see any connections between design and outside things?

Motivation on this Project

- what is motivating you on this project?
- anything that you have personally drawing upon? like books, magazines, movies?
- how do you feel about the subject of project?
- how do you feel about looking at other objects?
- How do you feel about looking at other classmates projects?
- Are you taking a user-centered approach?

Personal Approach

- your approach can you tell me about that?

Weeks 5 & 6

Catch Up with Visuals / Narrative

- show me where you have gone with the sketchbook
- can you get me up to speed on where you are at?
- describe what you have done from where you left off?
- you had several different concepts on the board.
- one was this one how have you developed this one?
- how did you go forward?
- what were your original other two concepts?
- how many generations of the design do you have?

Influences

- you have some interesting connections to designers work, can you tell me more about that?
- were there any sources of inspiration?
- did this idea come from somewhere?
- were the ideas of organic form driven by sketching repetitively?
- what made you think to do this particular idea?
- can you trace where that compartment idea came from?
- where are your forms coming from?

Upon completion of the project

Thought on Your Final Design

- How do you feel about the final design?
- aside from your final grade on this, how do you think you will do in the competition?
- are you satisfied with this final design?

Thoughts on the Project

- Project in general?
- what did you like about this project?

Project Details

- What computer programs have you used in the process?
- Sketching?
- Models?
- Presentations
- Where did you get the ideas for these?

Process

- Reflect on your process, how do you feel?
- What have you learned about yourself?
- What would you change about this process?
- What have you learned from others?
- you've combined many different skills here — sketching, computer stuff, physical models, vacuum formed model. how do you feel about this process?

Interview schedule for instructors: Appendix V (c)

Questionnaire X – Personal and Professional Background

Name	
Educational Qualifications (place, year, degrees held)	
Relevant Personal Design Experience	
Industry Experience	
Number of Years Teaching	
Teaching at other Institutions (indicate places and duration with years)	**Y / N**
Individuals who have Influenced your Teaching	
Relevant Design Books / Information used for General Teaching of this Course and / or anything else that may have influenced your teaching style	
General Strength of this Programme	
Define Design Succinctly	
State the Focus of Design as you see it (keywords only)	

Analyses categories for the field studies: Appendix VI

(a) UK analyses categories

(b) Canadian analyses categories

UK analyses categories: Appendix VI (a)

Brief specific	Meal tray	
	virgin	
	Corus/stainless steel	
	flights	
	criteria/specifications	
	project definition	
	User-centered design	
	User experience	
	materials	
	manufacture	
	confusion	
	questions	
Project specific/ design	elements of design	form
		colour
		line
		texture
		size
	principles of design	unity
		Emphasis/figure/ground
		scale/proportions
		balance
		rhythm
	direct design transfer	
	indirect design transfer	
	aesthetics	
	time	
	Feature/concept	
	technology	
	function	
	visualization	Sketches /drawings
		diagram
		model
		graphics
		notes
		presentation
		Rapid prototyping

analogy	with objects	
	other projects	
	abstract	
	Personal memories	
	Personal experience	
	Self aware of process/ reflexive	
Family /friends	interpersonal	classmates
		teachers
		from university
		girlf/boyfriend
		flatmates
		other friends
	family	parents
		siblings
		other
media/ pop culture	televison	
	video	
	music	
	magazine	
	movies	
	internet	
	computer	
Education	Major project	
	other modules	
	high school	
	other	
Macro-environment	transportation	
	religion	
	economic	
	govt	
	culture	
	workplace	
	practicum	
	travel	
	hobbies	
	recreation	
	gender	
	male	
	female	

Appendix VI (a)

research	primary	generic
		interview
		focus group
		questions
		General people
	secondary	designers
		books
		websites
		design specific
		objects
	inspiration	

Canadian analyses categories: Appendix VI (b)

Brief specific	eyewear	
	Sports (especially extreme)	
	context	
	criteria/specifications	
	project definition	
	subculture	
	Positioning statement	
	materials	
	manufacture	
	confusion	
	questions	
Project specific/ design	elements of design	form
		colour
		line
		texture
		size
	principles of design	unity
		Emphasis/figure/ground
		scale/proportions
		balance
		rhythm
	direct design transfer	
	indirect design transfer	
	aesthetics	
	time	
	Feature/concept	
	technology	
	function	
	visualization	Sketches /drawings
		diagram
		model
		graphics
		notes
		presentation
		Rapid prototyping

analogy	with objects	
	other projects	
	abstract	
	Personal memories	
	Personal experience	
	Self aware of process/ reflexive	
Family /friends	interpersonal	classmates
		teachers
		from university
		girlf/boyfriend
		flatmates
		other friends
	family	parents
		siblings
		other
media/ pop culture	televison	
	video	
	music	
	magazine	
	movies	
	internet	
	computer	
Education	mpd	
	other modules	
	high school	
	other	
Macro-environment	transportation	
	religion	
	economic	
	govt	
	culture	
	workplace	
	practicum	
	travel	
	hobbies	
	recreation	
	gender	
	male	
	female	

Appendix VI (b)

research	primary	generic
		interview
		focus group
		questions
		General people
	secondary	designers
		books
		websites
		design specific
		objects
	inspiration	

Weekly activities for each field study: Appendix VII

(a) UK weekly activities

(b) Canadian weekly activities

UK weekly activities: Appendix VII (a)

Week 1 (14 pages)

A.M.

- Questionnaires and introduction to programme with Researcher
- Tutorials with instructor
- Lecture on research

P.M.

- Reporting primary research

Week 2 (35 pages)

A.M.

- Desk critiques with instructor

P.M.

- Round table discussions with instructor

Week 3 (47 pages)

A.M.

- Desk critiques with instructor

P.M.

- Interview #1

Week 4 (25 pages)

A.M.

- Desk critiques with instructor

P.M.

- Interview #2

Week 5 (23 pages)

A.M. & P.M.

- Formal critiques with instructor

Week 6 (15 pages)

A.M.

- Interview #3

Interviews with Instructors

Instructor 1 – Primary
Instructor 2 – Professor
Instructor 3 – Programme leader

Total number of transcribed pages 159

Canadian weekly activities: Appendix VII (b)

Week 1 (10 pages)

Day 1

- Project introduction with instructor 1
- Questionnaires and introduction to programme with Researcher

Week 2 (111 pages)

Day 2

- Desk critiques with instructor 1

Day 3

- Interview set #1

Day 4

- Formal critique with instructor 1

Week 3 (75 pages)

Day 5

- Desk critiques with instructor 1 & 2

Day 6

- Desk critiques with instructor 1 & 2

Week 4 (63 pages)

Day 7

- Desk critiques with instructor 1 & 2

Day 8

- Formal critique with instructor 1

Week 5 (110 pages)

Day 9

- Introduction to Solidworks with instructor 1
- Desk critiques with instructor 2

Day 10

- Desk critiques with instructor 1

Day 11

- Interviews set #2

Day 12

- Formal critique with instructor 1 & 2

Week 6 (30pages)

Day 13

- Desk critiques with instructor 1 & 2

Observations only

- Solidworks in the lab with instructor 1 & 2

Week 7 (44 pages)

Day 14

- Desk critiques with instructor 1 & 2

Day 15

- Interview set #3

Day 16

- Final critique with instructor 1 & 2

Interviews with Instructors

Instructor 1 – Professor
Instructor 2 – Adjunct Professor
Instructor 3 – Visiting Professor

Total number of transcribed pages 443

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Generic interview guide: Appendix V (a)

Keyword prompts. Some or all of these may be used to enquire about the participant's inspirational sources that currently inform their design work.

Designer
Artist
Building
Place/Environment
Culture
Natural Form
Product
Vehicle
Author (*i.e.*, fiction)
Book
Movie
Music
Radio (*i.e.*, station)
Magazine
Newspaper
Other

Note: at the completion of their project the Canadian group was asked to provide one or two examples they may have used for inspiration from each category.