# Scenarios for Companions

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## ABSTRACT

This paper is concerned with understanding the needs ofCompanion owners (the people formerly known as ‘users’) and in how thoserequirements can be represented, with the whole interaction design, with how the Companion will learn, or be instructed, so that the interaction can be personalised tothe individual. We are concerned with the whole interaction experience and with how the different components fit together.

In this paper we outline the evolution of companion technologies and concepts and attempt to identify the characteristics of companions. This leads into a discussion on designing for relationships followed by an outline of an example of our design methodologies and explorations. Finally some companion specific examples are presented; a mobile assistant for older people, a health and fitness companion and a photo companion.

# 1 Introduction

Over the last five years we have been investigating new forms of human-computer interaction (HCI) based around the concept of 'Companions'. In the context of a three year project looking at technologies for older people we explored the ideas of artificial companions that could move across devices and that were 'personality rich'. A two-week summer school explored the idea of a Companion that accompanied people to a large arts festival. Currently we are exploring the ideas through a four year EC-funded project called Companions. We have also referred to this concept as 'personification technologies' (Benyon and Mival, 2008; Mival, Cringean and Benyon, 2004) because the aim of these new forms of interaction is to encourage people to personify the technology and to attribute human-like characteristics to it. Wilks (2007) has also characterised the Companion concept. He sees it an intelligent, personalised, persistent, multimodal interface to the Internet. Drawing upon recent advances in Human Language Technology (HLT), inference and knowledge representation, he sees a Companion as a humane conversational partner.

Designing for new and possibly disruptive technologies represents a particular challenge for interaction design. The usual process of interaction design consists of requirements generation, conceptual design, physical design, prototyping and evaluation (Benyon, Turner and Turner, 2005). Requirements generation typically concerns undertaking field work, observing people using existing systems and asking people what they would like. With the wholly new experiences that are expected of Companion technology, such approaches are often inadequate. People find it very difficult to imagine and comment on experiences until they are engaged with some concrete examples of those experiences. In this paper we discuss how to envision such experiences using 'wizard-of-Oz' techniques, mock-ups and video scenarios.

Companions will make use of novel speech and language technology and techniques to enable intelligent and personalised interactions. They will be able to exploit modern input and output technologies such as touch screens and a much more powerful Internet. With these developments we see a significant change in the opportunities for interaction. More intuitive and personalised interfaces using gesture, movement and natural language are rapidly becoming available. This provides the opportunity to

move from current graphical user interfaces and a tool-based view of HCI to more engaging interactions with a subsequent greater commitment and involvement of people.

Our view of Companions is that we want to change Human-Computer Interaction into Human-Companion Relationships. This builds upon the ideas of affective computing (Picard, 1997) and designing for emotional involvement. Companions may be represented as a 'virtual human' on-screen character or as a embodied conversational agent (ECA), but they do not have to be. Whilst the term 'Companion' is meant to invoke personification, we see Companions as encompassing the widest possible range of devices and forms of interaction that woven together produce a relationship-building experience for people. A home embedded with ambient intelligence could be a Companion. A character that moves across devices and domains, and understands its owner's needs and wishes could be a Companion.

The paper is organised as follows. Section 2 provides a review of Companion concepts as they have appeared in a wide range of media. Technologies which could be included in this review are developing rapidly and take many forms of embodiment. Section 3 describes some of the empirical investigations that we have undertaken. Reflecting on these experiences leads us to a model of the key components of Companions that designers need to consider if they are to design for relationship building which is presented in Section 4. Section 5 presents some examples and scenarios for Companions and Section 6 offers some conclusions.

We do not believe that Companions will be manifest as a simple device. Companions represent the next generation of people's interactions with information and with each other. If they are to be successful Companions will require new services and service providers. They will have a lifetime, and perhaps an afterlife.

# 2 Notions of Companions

Literature, film and myth have provided thousands of examples of artificial companions from James Stewart's giant rabbit companion, Harvey, to Greyfriars Bobby, the faithful dog that spent twenty years on his owner's grave at Greyfriarskirk in Edinburgh. Companion characters have appeared in computer games for many years and are now appearing in interactive movies. There are companions in the 3D immersive worlds of virtual reality and in the mixed reality of mobile and on-line games. Software systems such as *Poser* allow the rapid production of screen-based characters which are increasingly appearing on interfaces to break up a text and graphics interaction and to provide more engaging interactions through the 'persona effect' (Lester, et al., 1997).

Artificial companions which are commercially available tend to fall under one of four categories of function: entertainment, educational, informative or medical. They come as 2-dimensional software characters, '3D' animated screed-based characters or true 3-dimensional embodied products. They range greatly in price and sophistication. In this review we highlight the main features as we see it of the history of companions. We resist the temptation to categorize these as all too frequently one companion will slide effortlessly form one category to another.

The first companion to have mainstream success was the extremely basic but hugely popular Tamagotchi (Figure 1). Meaning "lovable egg", the Tamagotchi was launched in November 1996. To date approximately 35 million have been sold worldwide and there are many dedicated websites dedicated to Tamagotchi issues (e.g. Virtualpet 2007). Costing fifteen to twenty dollars the Tamagotchi consists of a small egg shaped electronic device with LCD display depicting a new born bird. The owner interacts with the bird through a very simple interface of three buttons. The intention is to care for the bird through choices of food, discipline, and other factors influencing its healthy development. The average life-span is 10-18 days, but negligence results in a premature virtual "death" (in North America, "flying away"), signified by a loud squawking.

**Figure 1. The Tamagotchi**

Although the press of a button leads to the immediate birth of a new creature, people form such strong relationships with their Tamagotchi that they write poetry, eulogies and even songs dedicated to their dear departed virtual birds. Although this may be considered tongue-in-cheek behaviour there have been cases of people treated for depression following the death of their creature. The financial success of the Tamagotchi led to a host of imitators such as the GigaPet and other clones referred to as Keychain Pets, but none has captured the imagination of popular culture to the same degree.

The Tamagotchi was also the direct influence for the next virtual pet craze, the Furby (Figure 2). Rather than interacting through graphics and button pushing, a Furby uses a series of sensors to initiate behaviour. It will react to light and dark, movement, sounds and pressure and will respond with limited movement of its eyes, ears, eyebrows and mouth alongside an auditory response. The sounds a Furby makes range from simple chirps, clicks and whistles to limited bursts of childlike speech and singing, dubbed Furbish. One of the key features of the Furby is the inability to switch it off other than to remove its batteries. For instance, putting one into a cupboard will lead to the response “Me scared” followed by sobbing sounds. One of the most important technical ad-

vances over the Tamagotchi is the ability of Furbies to interact with one another in what appears as a childish conversation.

**Figure 2. The Furby**

Possibly the best known virtual pet utilizes a much higher level of software sophistication to generate emotional attachment, Sony's AIBO (Figure 3). Sony introduced the first AIBO, meaning Artificial Intelligence roBOt, in Japan in 1999. It went through a number of incarnations before it was withdrawn from sale in 2006.

**Figure 3. Sony AIBO model ERS-111**

Central to AIBO's appeal, was both it's technical capabilities and its endearing behaviours. It is capable of recognizing and responding to between 50 and 100 words, can track objects using the camera in its head and search for things such as its pink ball. It will interact with people through them moving, speaking or touching. It can learn tricks such as rolling its ball back and forth with its owner, or dancing at a pre-defined signal. It even knows when its batteries are running low and will return to a docking station and charge itself. Its movements are remarkably realistic leading people to attribute all manner of intentions and personality traits that it does not possess. It can stand from lying down, dance, walk and wiggle its head. When ignored or abused, AIBO will appear to be upset or angry as indicated by a light display on its head and a change in posture. It will subsequently refuse to interact or may perform tricks incorrectly. The ease with which it will get upset, decreases with time to mimic the transformation from infant to mature individual. Thus to achieve the

most from an AIBO requires an investment of time and affection, much like a real pet.

Since the release of the AIBO family and their subsequent success, there has been a flood of robot pets ranging in sophistication and consequently price, Breazeal provides a good review (Breazeal, 2002). Most cost under $100 and have limited movement and the sensory capability of a Furby, and aim to imitate animals from dogs to fish to parrots.

The most technologically advanced entertainment artificial companions do not take their form from a cat or a dog, but rather a human, Two examples are the Sony SDR (Sony Dream Robot, Figure 4) series, and Honda's ASIMO. The SDR is a 2 foot tall humanoid robot and is a successor to the AIBO technology, but is now capable of very advanced behaviour. It can walk around a room and recognize its owner, either through speech or sight. It can recognize objects placed in its way and devise a route around them, and should it be pushed it will correct its balance in real time. It has an emotionally expressive voice and posture and has been designed with safe joint structure so as not to trap hands or fingers.

**Figure 4. Sony's SDR-4x humanoid robot**

'EveR-2 Muse', Figure 5, designed by KITEC (Korea Institute of Industrial Technology), is made of silicon material has 60 joints in her face, neck, and lower body enable her to demonstrate various facial expressions and some dance moves. She is 161cm tall and weighs 60kg, average figures of Korean women in their twenties. She made her debut singing performance at Robot World 2006 in Seoul according to the Korean Times.

**Figure 5. EveR-2 Muse**

For younger people there are a myriad of characters and toys such as Robosapien, the wow wee family and Pixel chix. Chatterbots which play a version of the imitation game using primitive artificial intelligence techniques are also very popular (see, e.g. Jabberwacky, 2007). Nabaztag is a rabbit like creature that makes engaging noises and expressions in repose to internet feeds such as weather reports, stock market movements or typed messages, and in the new Nabaztag Tag, RFID tags.

Strommen (1999) describes a number of educational toy companions including Barney the Dinosaur who appears in various other media such as TV, books and CD-ROM. Barney watches the TV programme with his owner, making comments and engaging him or her in conversation about the programme's content. Other examples of educational companions include PETS (Personal Electronic Teller of Stories) from the University of Maryland's Human Computer Interaction Laboratory. Designed as a storytelling robot for use with children in rehabilitation, it allows children to remotely control a large furry robot by using a variety of body sensors adapted to their disability or rehabilitation goal. The intention is to teach the robot to act out emotions, such as happiness or sadness, and then write stories using the storytelling software and include those emotions in the story. The story is subsequently enacted by the remote controlled robot. The children respond well to the robot referring to it as their friend, perhaps the most obvious example of a companion (Plaissant, 2000).

The most prevalent role of 2-dimensional software based artificial companions is as an information source. Perhaps the most infamous is the Microsoft paperclip. Designed as a simplified help interface for Microsoft Word (see Figure 6), Clippy as he was named proved so unpopular that Microsoft removed him from the Windows XP operating system. More advanced characters are becoming increasingly common as online guides and assistants. The defunct company Boo.com used a female character to guide users through the process of buying clothes and to answer queries. When returning to the site she would greet the user in a reflection of a shop assistant greeting a returning customer in a real world scenario.


**Figure 6. The Microsoft Paperclip**

One of the most famous online virtual characters, or avatars, is Ananova of ananova.com. Originally a Scottish news gathering service, the company Ananova was bought by the telecommunications company Orange who sought to market the character as an online artificial news reader. The advanced animation, lip synchronization and text to speech (TTS) technology allow Ananova to very realistically read breaking news in real time. Recent advances in TTS systems are making informative companions such as Jane in the TomTom navigation system commonplace.

The role of a medical or care assistant is another type of companion. The most advanced example of this is Flo a nurse-bot developed by Carnegie Mellon University and the University of Pittsburgh (CMU undated). Flo serves several functions, firstly as an intelligent reminder of when to take medication or to go to a doctor's appointment and as Flo follows a person around it cannot get left behind or lost. Secondly it allows professional care givers to estab-

lish a tele-presence and interact directly with remote patients utilizing a camera and monitor interface. This is economically beneficial as well as time saving as many medical visits are unnecessary and are simply regular appointments or to reassure a worried patient. Thirdly Flo is capable of undertaking regular medical data collection, monitoring vital signs and recognizing potentially worrying symptoms. In addition to this, in trials older people who interacted with Flo began to think of her as a real care assistant and strike up conversation even though speech recognition is not present, demonstrating a level of companionship that surprised the researchers (Montemerlo, 2002).

# 3 Investigating Concepts of Companions

During the period of our investigations we have undertaken a number of empirical studies of companions using a variety of different methods. During a 3 month internship we explored the design of a mobile companion to assist elderly people. Another short study involved working with a focus group of ten elderly people and developing a 'wizard of oz' experiment of AIBO playing chess. During a 2-week summer school involving eight students and extensive empirical work, we developed ideas for a companion to help people visiting the Edinburgh arts festival. In addition, focus groups and small-group studies of older people using mobile phones, e-mail clients and games have informed our analysis and understanding of the companion concept.

More recently we have undertaken wizard of oz studies with over forty people using the PhotoPal application (discussed insection 3.3). In this section we use these experiences to illustrate the characteristics that companions might have. Three cases studies are presented, following some more general interventions.

## 3.1 When Andrew met AIBO

AIBO is the robot pet developed by Sony (see section 2). In order to explore some concepts of artificial companions for older people we undertook two focus groups, lasting approximately two hours each, of between ten and twelve people, aged from 64 to 93. These focus groups were undertaken within a retirement and day care centre in Livingston, Scotland.

**Figure 7 A focus group in action**

The focus groups took place in the lounge area of the home (see Figure 7). In order to relax the group members and therefore gain as much interaction and information as possible, an informal and open atmosphere was encouraged. Participants were assured that there was no right or wrong answer to any question and it was their honest opinion that was important. Both groups were video recorded with both a fixed position and a hand held camera to allow for the analysis of the session at a future time.

It quickly became apparent that the older people were less concerned with micro-level issues of behaviour and were concerned more with the macro-level; they wanted to know what the AIBO could do or more importantly what it could do for them. A consensus was reached by both groups on the desire for a robot servant able to undertake tasks ranging from making the tea to doing the ironing and other household chores. Although AIBO was moving around during the focus groups very few comments directly related to AIBO'sbehaviours.

While the implementation of a robot servant was beyond scope, there was another idea that was just as well received by both groups. Despite an earlier outright rejection of artificial companions, the idea proved to be more appealing when it could be seen as a game-playing companion. The attitude of many participants changed noticeably when it was proposed that technologies such as AIBO could offer a range of entertainment possibilities.

In order to explore this further a second meeting with one of the participants, Andrew, was set up in which he would play chess with AIBO. In fact this was a 'Wizard of Oz' experiment where one of the researchers controlled AIBO through a text to speech wireless communications link from a hidden location. It was surprising just how much Andrew actually talked to AIBO during this second session. Throughout the session he speaks directly to AIBO directing his gaze towards it and speaking in a slow and deliberate tone, much as one would speak to a child or animal (see Figure 8).

**Figure 8 Andrew talking to AIBO, note the direction of his gaze.**

All of the verbal interaction between Andrew and AIBO seemed genuine and flowed quite naturally from the current situation and conversation. Whenever Andrew didn't hear exactly what AIBO had said, he turned to the interviewer to confirm what was said but always turned back to give his response directly to AIBO.

This experimental design also allowed the researcher to make AIBO more pro-active. At one point AIBO walks across the chess board and volunteers the remark 'I am going to beat you'. AIBO tells a joke and otherwise takes the initiative in the conversation. As Andrew said "It's nice when it's proactive, 'cos then you feel it is a bit more than a lump of plastic".

These studies demonstrate some important characteristics of the companion concept. The first is that, for elderly people, the usefulness of the technology is important. AIBO's movements are very endearing. AIBO make nice noises and ahs cute ways of holding its head, or shaking its tail. These were not remarked upon by our elderly participants; the important thing is that things need to be useful. A second key finding from this work was the importance of some pro-activity in the companion. A companion that takes the initiative will generate a greater emotional response.

## 3.2 A Festival Companion concept

'Companions' was one of the ateliers that took place during the Convivio interaction design summer school in August 2006. The setting of the school was coincident with the Edinburgh arts festivals that dominate the city during August. The summer school consisted of five ateliers, each of which had 8 – 10

international students with varying backgrounds, but with a shared interest in the design of new technologies and new experiences for people.

The brief for the students was to develop a Festival Companion. The Festival is vast with over 150 venues, thousands of shows and tens of thousands of people. As individuals and in pairs or small groups the students immersed themselves in this context,. They went out and observed people at the festival, interviewed people, discussed and experienced the festival for themselves, reflecting on what a festival companion could be like. Overall over fifty people were involved in the investigation. The following day the students came together in the atelier to share their experiences and summarise people's views of what makes a companion. Two rich descriptions were formulated.

### 3.2.1 Companion 1

A festival companion could be like a pet, or human-like, a 'good companion'. It should have the ability to talk and share ideas, available on demand. There would be a need for several companions, responsible for different tasks and they should embody, somehow, the characteristics of humans. It should not be just a thing or object. Companions could explore the world together, remind you of things, provide an emotional connection. Some people wanted a same-sex companion. Festival companions would help on small tasks though they should not be too smart. They could help with filtering information and providing information, but should not be making choices. The companion should provide recommendations based on social context and historical data. It could be an imaginary friend, an assistant, a butler, somebody to blame or even an annoying companion.

### 3.2.2 Companion 2

Another group formulated a different view. A companion should provide a memory of things, and have a connection to its owner and to others. It should be a container for basic and elementary everyday artefacts. There was a need for dependency on the companion but how much was an issue. The companion should have some flexibility (change form) and be evolving (becoming older and wiser). It should have the ability to access knowledge and information and switch roles, depending on context. It should be emotional as well as

functional and needs to understand people's moods. It should challenge its owner to do new things. It sometimes behaves badly and with its owner contributes to making mistakes together.

### 3.2.3 Festival Companion Concepts

As the atelier progressed, a key conceptual representation of the Festival Companion emerged as illustrated in Figure 9. This shows the cycle of companionship activities. People discover interesting things as individuals or small groups – a nice restaurant, a good pub, a great show. Typically they then gather to share their experiences which helps them to form a group and an identity relationship. They then split up and have different experiences, coming back together to share and so the cycle continues.

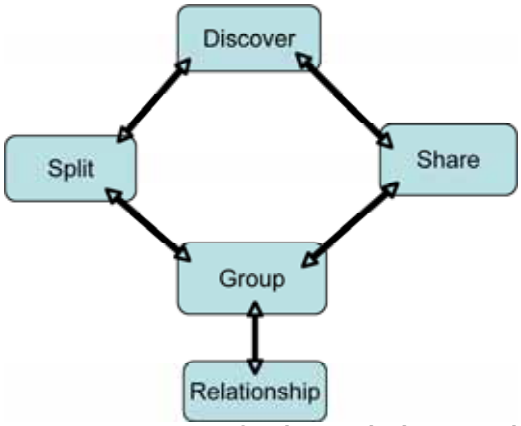



**Figure 9 Key concepts for the Festival Companion**

The focus of this work, as is on understanding the relationships that are important in this context. A traditional systems analysis, or even a traditional interaction design activity, would be looking to design a product, or solution to a perceived problem. In the festival companion the emphasis was on understanding how relationships could be facilitated, what those relationships were and what form and function a companion might take.

Later in the atelier, a number of ideas were prototyped and evaluated that aimed to capture some of the engagement and excitement of the festival. A pipe and keys were personal items carried with you. They could provide speech output, answer questions, provide reminders and offer emotional relationships. The voices of famous people could tell stories around the city. A badge could identify a group or an activity. A pop-up character (using aug-

mented reality) could provide a more engaging interaction and help in finding a table companion, offering different characters for different people.

The experience of developing a festival companion resulted in the conceptual model of companions (Figure 8) and in the importance of emotion, personality and having shared experiences and social values. It is these things that enable people to build relationships, taking interaction to a new level meaning and engagement.

## 3.3 PhotoPal

Wilks (2006) introduces the idea of a companion to help older people sort out their photos and life memories. With many of us now having thousands and thousands of digital photos, sorting them, classifying them and organizing them becomes a huge issue. How could the average person with no classification or editing skills even begin to make a coherent shape of such a mass of data? It is with this question, against the background of a lot of interest in 'photoware' (Kirk, et al., 2006) that the concept of the PhotoPal has been examined.

We have implemented a prototype PhotoPal and used this with forty people (see figure 10). The PhotoPal concept can be considered a digital photo editing, sorting and sharing companion. The owner interacts through natural language dialogue with the companion, represented by an on screen avatar. Through the process of talking about the quality of their photos ("that's a little dark"), the location where they were taken ("oh, I took this picture this in my garden"), the time it was taken ("this was on my birthday") and the content ("on the right is my brother, he's holding his daughter in his arms"), the companion is able to fix quality issues, organize folders by content location and date, and most importantly develop a rich amount of metadata. This interaction – where rich descriptions in natural language are used to identify the semantics and affective aspects of the photos is being called "Talk2Tag". Furthermore, the PhotoPal companion can then use the social and familial networking knowledge structure that the Talk2Tag process has generated to engage in smart sharing. For example, pictures from a family gathering can be sent to the interactive smart photo frames of the family members who were there, or perhaps those that were not. Having the photos tagged in this way will also facilitate the owner reminiscing with the companion and hence allow-

ing PhotoPal to gather even more information about the details and relationships depicted in the photographs.


**Figure 10. Screenshot of the COMPANIONS project PhotoPal**

The development approach to PhotoPal has again been based on a Wizard of Oz paradigm. The participants in the studies interact through natural language discussing their photos with their companion. In fact a wizard is listening to the comments and typing responses using a wireless connection with text-to-speech software speaking these to the participants.

# 4 Characteristics of Companions

There are clearly many challenges for ‘companion technology’ that are illustrated in the descriptions and investigations reported above. Companions are a development of agents. Agents appear in the literature as software agents, interface agents or embodied conversational agents (ECA). ECAs have typically been more concerned with behaviours (Pelachaud, 2005). Interface agents have focused on dealing with some specific aspects of HCI. Some early thoughts on interacting with interface agents did highlight speech as a key element (Norman, 1994). In software the traditional model of agents is that they have beliefs, desires and intentions, sometimes referred to as BDI agents. Companions draw upon all of these, and on spoken natural language technologies. It is this combination which we believe will shift interactions into relationships.

Bickmore and Picard (2005) argue that maintaining relationships involves managing expectations, attitudes and intentions. They emphasise that relationships are long-term built up over time through many interactions. Relationships are fundamentally social and emotional, persistent and personalised. Citing Kelley they say that relationships demonstrate interdependence between two parties – a change in one results in a change to the other. Relationships demonstrate unique patterns of interaction for a particular dyad, a sense of ‘reliable alliance’.

It is these characteristics of relationships as rich and extended forms of affective and social interaction that we are trying to tease apart so that we can provide advice for people designing companions. Digesting all our experience to date we describe companions by looking at the characteristics of companions in terms of utility, form, personality, emotion, social aspects and trust.

### 4.1.1 Utility

The issue of the utility of companions is a good place to start as there is a spectrum of usefulness for companions. At one end is non-specific purpose (i.e. companions that serve no specific function) whilst at the other is specific

purpose. A cat has no specific function other than to be a cat, while a care assistant undertakes specific tasks such as distributing medication, monitoring health and supervising exercise; but both may be considered companions. A companion can be concerned with entertainment and having fun resulting in pleasure, or it can be about providing aid in whatever format is suitable. Somewhere in the middle is PhotoPal which aims to provide basic functionality for people who find using software such as iPhoto difficult, but which also provides a less purposeful facility for conversation.

Utility is also concerned with the allocation of function between the two participants in a relationship. For example, PhotoPal could send the photo to an identified friend or relation, because PhotoPal can access the necessary addresses and functions to do this. PhotoPal would be able to discard blurred pictures, but would be unlikely to argue that one was a bit too dark (unless is was much too dark). This sort of judgment should rightly come from the human in this relationship. Leave PhotoPal to perform the function of lightening the picture, but leave the human to judge which pictures to lighten. This reflects the discussions on the allocation of authority and functions in the festival companion investigation.

The ‘instrumental support’ (Bickmore and Picard, 2005) provided by a companion is a key part of relationship building. In the festival companion scenario, the companion was needed to filter the large amount of information and conflicting views and ideas on the various shows. An important issue concerning utility and function allocation that came out of the Andrew and AIBO study is the issue of pro-activeness. Andrew enjoyed the interaction when AIBO took the initiative and was pro-active in starting some new activity, when AIBO told a joke or pushed the conversation forward.

### 4.1.2 Form

The form that a companion takes refers to all the issues of interaction such as dialogues, gestures, behviours and the other operational aspects of the interaction. It also refers to the representational aspects such as whether it is 2D, graphical 3D or true 3D, whether it has a humanoid, abstract or animal form, and the modalities that is uses. The many aesthetic issues are also consid-

ered under this heading. The form and the behaviours of the companion are likely to vary widely between different owners. We observed in the older people's focus groups that although the detailed behaviours of AIBO were noted, they were not fore-grounded. Utility was the big issue and the details were secondary. This represents a utilitarian view of technology that we might expect of the older generation. Younger people tend to be more relaxed about usefulness and more focused on design details.

Certainly the attention that Sony paid to the behaviours of AIBO lead to a stronger emotional attachment. In a number of informal evaluations of AIBO, people would regularly comment on 'him' being upset, enjoying something, being grumpy and so on. The attribution of beliefs, desires and intentions to an essentially inanimate object is an important aspect designing for relationships. For example people say that AIBO likes having his ears stroked, when there are no sensors in his ears. The careful construction of a mixture of interface characteristics — sound, ear movement and lights on the head in this case – result in people enjoying the interaction and attributing intelligence and emotion to the product.

### 4.1.3 Emotion

Designing for pleasure and design for affect are key issues for companions. Norman discusses the three types of pleasure that need to be considered; visceral, behavioural and reflective. Attractive things make people feel good which makes them more creative and more able (Norman, 2004). Relationships provide emotional support. Emotional integration and stability are key aspects of relationships (Bickmore and Picard, 2005). There should be opportunities for each partner to talk about themselves to help self-disclose and to help with self-expression. Relationships provide reassurance of worth and value and emotional interchange will help increasing familiarity. Interactions should establish common ground and overall be polite. Politeness is a key attribute of the media equation described by Reeves and Nass (1996).

Emotional aspects of the interaction also come through meta relational communication, such as checking that everything is all right, use of humour and talking about the past and future. Another key aspect of an interaction if it is to

become a relationship is empathy; empathy leads to emotional support and provides foundations for relationship-enhancing behaviours.

These aspects emphasize the personalised nature of relationships – as only in highly personalised interactions can empathy occur. In the festival companion investigation we saw that one of the important aspects was that the companion could be taken home after the festival as a souvenir. The emotional features of memories and sharing memories is also apparent in PhotoPal.

### 4.1.4 Personality and Trust

Personality is treated as a key aspect of the media equation by Reeves and Nass (1996). They undertook a number of studies that showed how assertive people prefer to interact with an assertive computer and submissive people prefer interacting with submissive devices. As soon as interaction moves from the utilitarian to the complexity of a relationship, people will want to interact with personalities that they like.

Trust is “A positive belief about the perceived reliability of, dependability of, and confidence in a person, object or process” (Fogg, 2003). Trust is a key relationship that develops over time through small talk, getting acquainted talk and through acceptable ‘continuity’ behaviours. Routine behaviours and interactions contribute to developing a relationship where they are emphasizing commonalities and shared values.

### 4.1.5 Social attitudes

The social side of relationships came through very strongly in the festival companion study, but it was also in both PhotoPal and Andrew and AIBO. Bickmore and Picard (2005) emphasise appraisal support as a key aspect of relationship building and the importance of other social ties such as group belonging, opportunities to nurture, autonomy support and social network support. None of our investigations have involved opportunities to nurture, but of course the Tamagotchi demonstrates this clearly. In the festival companion studies, overcoming loneliness and acting as a social lubricant were two important principles that the designs sought to achieve. Reeves and Nass (1996)

identify specialists and team mates as different social roles that make media equal real life.

Relationships also play a key role in persuasion. The rather controversial idea of ‘persuasive technologies’ (Fogg, 2003) is based on getting people to do things they would not otherwise do. In the context of companions, though, this is exactly what you would hope a companion would do — providing it was ultimately for the good. A Health and Fitness companion, for example, should try to persuade its owner to run harder, or train more energetically. It is for their own good after all.

The art of HCI will need to change if designers are to create experiences that allow people to build relationships with their companions. We do not accept that it is possible to design relationships per se, but it is possible to design artifacts that will enable people to develop relationships with them. We summarise our approach as a ‘star model’ of designing for relationships (Figure 11).

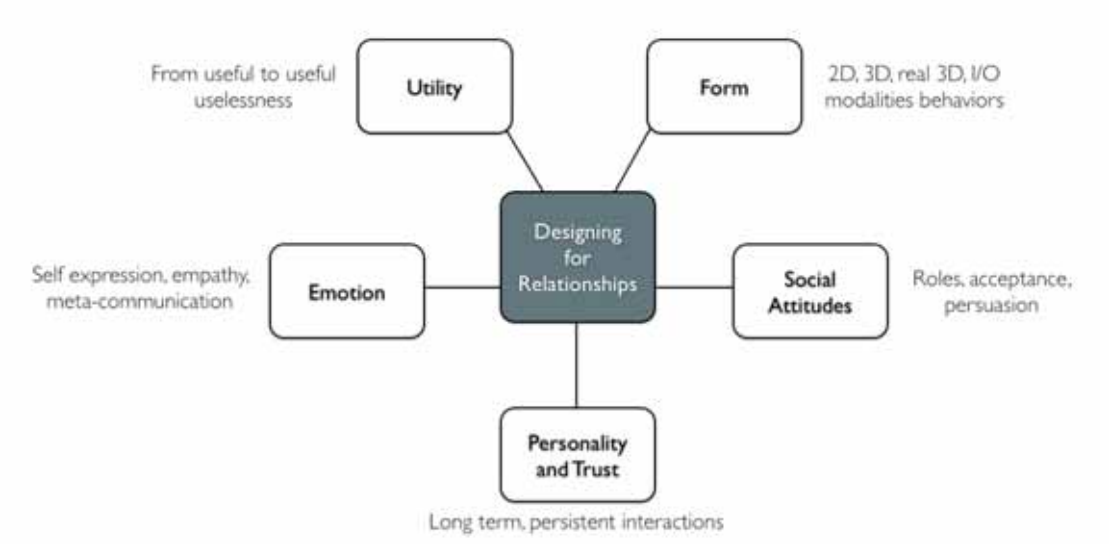



**Figure 11 The star model of designing for relationships**

Companions are an example of something we could term ‘semantic technologies’. Companions deal with meanings rather than the syntactic interactions of mouse clicks and menu selections. We are just seeing the start of semantic technologies, with semantic tagging systems as found on ‘Web 2.0’ internet sites such as Flickr and Del.icio.us. We are seeing the first attempts at interacting with these through novel interfaces such as tag clouds. Tim Berners Lee has suggested that the ‘semantic web’, based on tags will be the next development of internet technology (Berners Lee, 2001) and we envisage that Companions will be part of the new interaction with it.

However, with Companions we want to go further than simple key-word tags. We want to associate objects from a domain of application with whole conversations in natural language that have happened between a person and a Companion. These conversations will be highly domain specific, at least to start with, but will grow over time. Already we have effective spoken natural language interactions in domains characterised by structures tasks such as buying cinema tickets and train tickets.  What we do not have is ways of join-

ing up these natural language interactions, learning about individuals or engaging in less structured activities.

The dialogues (consisting of many modalities) of companions will need to embrace a whole new set of concepts if relationships are to be formed. Persuasion is one of them and pro-activity another. The dialogues will need politeness and humour. They will also need explanation, rationale, discussion, disagreement and argumentation.

Interaction design will need to understand and develop a new set of techniques that will enable people to work at this level. And interaction design must do this as the inter-networked world becomes increasingly complex. New methodologies and new attitudes to design will be needed. Designing for relationships is very different than designing for function. Interaction design has always embraced the importance of form and as well as function and now it is taking on board emotional design too (Norman, 2004). Companions demand a further step to deal with the characteristics described in Section 4 and to design for relationships.

## Scenarios for Companions

Scenarios are narratives describing what people do when engaged in particular activities (Carroll, 1995), although how scenarios are actually used varies widely. Scenarios might be based on in-depth ethnographic studies or on brief collaborative sessions with potential users. Carroll (1995) gathers together a wide range of views on scenarios; from the HCI side emphasising contextual information and from the other side of the HCI/Software Engineering divide where object-oriented methods of systems development advocate the adoption of 'Use Cases' (e.g. Jacobson, 1995). Carroll (2000) and several of his other recent writings develop the principles of scenarios and how they can be used throughout systems development.

The power of using scenarios and personas in recognised across design methodologies and domains. They are helpful in grounding the design process and act as a shared point of reference, not only for the design team but also potential user groups. Scenarios can be both conceptual and concrete depending on their purpose of use, for example the same artefact may provide a conceptual overview of what something does to a potential user whilst providing concrete aesthetic guidelines to an interface designer or programmer. These artefacts take several forms from simple text based outlines, to mood boards, to storyboards, to short movies. The decision on the articulation of the scenario is flexible and usually based on stage of design process, potential audience and time allowances. Examples of each may be found below for three companion scenarios; a mobile companion for an older user, a health and fitness companion and a companion to help someone with their digital photos.

### 4.1.6 GoPal, a mobile companion for the older user

GoPal is a scenario (shown in Figure 12) concerning a mobile, characterful user interface supported by a cross platform software architecture. In the scenario, an older user, William (72), is reminded by Harvey whilst out and about that his favourite team is playing a football match that is on TV. GoPal asks if

William would like it recorded. After vocal or touch based confirmation, GoPal then moves to Williams home  PVR (Personal Video Recorder) and interacts with the functions on William's behalf. When William returns home GoPal moves onto the TV and reminds William that he can watch the game.

GoPal is more than a reminder service or simple interface front end. The nature of the technology is to shift what would other wise be a fairly traditional interaction into the realms of a relationship. This is achieved through the emotional investment of the user, in this case William. Much in the way that people, and older people in particular, attribute personality to their pets (for example, a cat is cool, smart and sophisticated, a dog is loyal, playful and so on) it may be possible to harness this mechanism to attribute personality and subsequent emotional investment to GoPal.

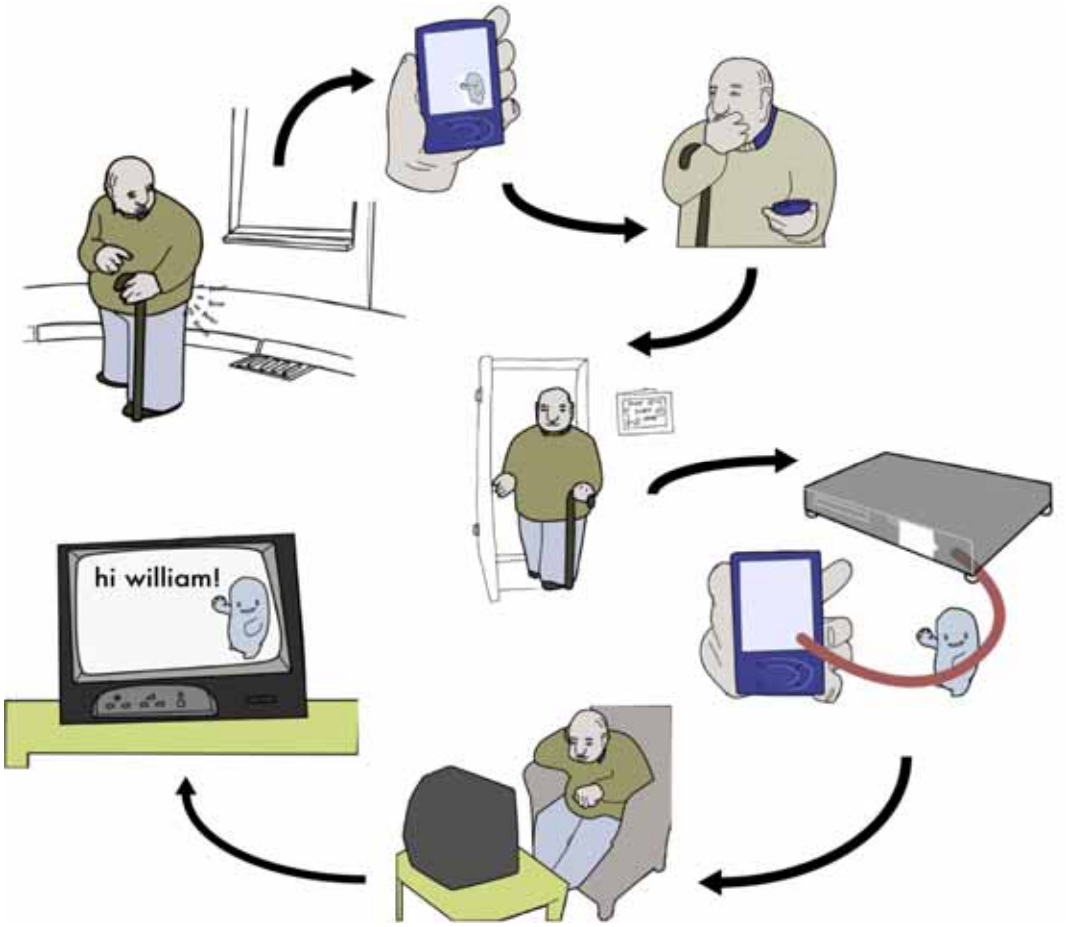



**Figure 12. The GoPal mobile companion scenario**

The intended expansion of this scenario will look at how GoPal could integrate alongside other home technologies. For example in a smart kitchen GoPal could monitor Williams blood pressure and pulse unobtrusively through a simple strip sensor on the handle of his kettle. As such, GoPal is a technology that could have a significant impact on an older persons independent living whilst providing companionship and functionality through a supportive relationship rather than an interaction.

### 4.1.7 Health and Fitness Companion

The notion of what would constitute a Health and Fitness companion (HFC), and more importantly what design considerations would differentiate it from the other companion technologies being explored was explored in a two day workshop between SICS, University of Tampere and Napier University. During and subsequent to this workshop, 3 personas were developed to explore the various needs of people with differing lifestyles, levels of fitness and exercise regimes.

One central theme of exploration was what motivational approaches are suitable to which scenarios/personas? Thus the scenarios can outline differencing motivations, for example when someone trains well their companion subscription is reduced. Alternatively, should planned training not reach a required level the companion could prevent a recorded television program from being shown until training is completed.

1. We meet Sandy in a hospital room, he's being visited by his kids.

2. They are worried about his health, he does little exercised and since his wife left him his diet has become appalling.

3. They give him a HFC (what is this!?) which will combine with his current home system. They explain that it's intended to help raise his general level of fitness, monitor his health and set and maintain a healthy balanced diet.

4. They all leave the hospital and Sandy starts the configuration.

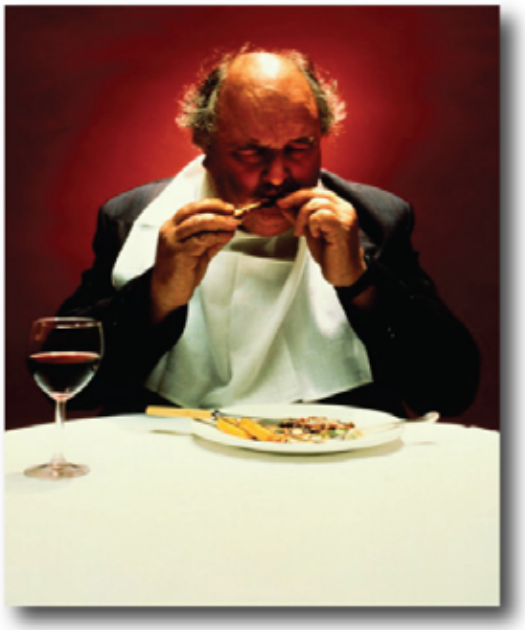
5. Being ex-army Sandy decides that a tough-love drill instructor personality would suit him best (he's on board with the fact that he needs to get healthy), so he selects Alf, a non-nonsense archetype companion character.

6. He opens his exercise regime to be accessible by his children, on their request, as he feels this will be an added incentive for him to exercise.

7. Configuration involves biometrics such as weight, height etc, allowing Alf to suggest appropriate training and diet.

8. It's aim is to understand whether the owner is in bad condition needing to get better, wanting to maintain current health or aim for high performance.

9. Alf reprimands bad behaviour (such as buying unhealthy food) nags when he doesn't exercise, but offers positive motivation when he does.



**SANDY**

*- age 46*

*- drives a lot*

*- drinks and eats too much*
*- recently divorced*

*- children in early 20's*

*- had recent health scare*
*(suspected heart attack which was actually angina)*

*- kids have bought him a HFC*

**Figure 12 The Sandy persona for HFC scenario**

These aggressively proactive stick or carrot approaches would of course not be suitable to all users, however the HFC scenario is rather unique in its potential necessity to be, at times, disliked, as anyone who has worked with a personal trainer would concede. This issue is presented in the Sandy persona (Figure 12), whilst motivation is less of an issue for the Mari persona (Figure 13) day to day and the role of the HFC is more about training analysis and advice. Thus the HFC scenario is of particular interest when exploring the impact of human-companion relationship on task and functionality success.

1. She's set up a long term schedule with her HFC to enable her to run her first marathon in under 4 hours.

2. This includes target goals such as what times she should be running distances by which stage of the regime.

3. The HFC adapts to maintain the regime when Maris social circumstance impacts her ability to train.

4. If she runs too far or too fast the companion will advice that this may have a negative impact on her training and may result in potential injury.

5. Explicit instructions in real time run ("ok, now we're gonna push hard for 2 minutes….ok, well done, let's take it easy for the next 5….etc")

6. The HFC has access to her social schedule (through social companion?) and suggests going to a party the night before a long run may not be a great idea.

7. At the actual marathon her HFC becomes a motivating force and gives her real time advice (eg, "there's a hill coming up, pace yourself", it knows this from a run plug-in she bought for the HFC).

**MARI**

- *age 23*
- *aerobics instructor*
- *training seriously for first marathon*
- *her usual training partner has moved away*
- *she leads a wild social life and tends to burn the candle at both ends*
- *she's got a targeted schedule*
- *companion is very proactive in pace making and motivation*

**Figure 13. The Mari persona for HFC scenario**

Other important areas involved in the HFC scenario are professional and social networking. For example, linking to a doctor to ensure the user remains within healthy parameters, or linking to a social networking system (such as facebook or twitter) to engage in shared exercise activity, planning and experience. This idea is used in the Bjorn Persona (Figure 14), where the social network access is configurable to allow any data to be proactively shared with any selected group, so as to facilitate social engagement.

Tangible reflection of how regime is going. For example, Nabaztag ears up when doing well, down when doing poorly, thus using disappointment and guilt

as motivational factors. It has already been demonstrated that human-companion bonds (such as the Tamagotchi) can be strong motivational factors in behaviour (Mival&Benyon, 2007).

- *Age 32*
- *Office worker (ad account manager)*
- *No children, lives alone*
- *Dog died (used to walk it for exercise)*
- *Starting to put on weight*
- *Used to play football at university, much less active now*
- *Active social life*
- *"I want to stay fit, but on my own time and fitting in to my schedule"*

# BJORN

1. Home from work, he was meant to go out the previous evening but got invited out to a dinner party instead. This evening is now free so he decides to go for a run.

2. He's in his living room and sets up his run. This involves:
   - o route choice
   - o exercise level, eg easy jog or hard run (specific pacing feedback choice, eg within PB)
   - o music choice
   - o disturbability status (eg, open to contact/running partner)
   - o weather
   - o (warm up/strectching?)

3. He get's changed and leaves the house, the handover is transparent from living room companion to mobile device based companion and is aware of all Bjorn's choices regarding run setup.

4. Just as he's about to begin, the sun breaks through the clouds and Bjorn decides he'd rather go for a longer run than initially selected in his living room, this change must be facilitated through his mobile companion device. Selective rather than creative process (eg, chose run three on route 2)

5. He starts running hard.

6. Asked whether he's warmed up as he's running above a warm up rate.

7. He slows down to a more gentle jog and reaches his start point.

8. A touch of the device indicates he's starting his run.

9. Music begins

10. Pace setting tactile feedback begins.

11. Midway through run he's informed that Julie is also running in the woods and has set her DS at open to running partners (this is a closed list of pre-set social network that Bjorn belongs to).

12. He slows down and runs on the spot and sends her a greeting asking if she'd like to join him, she says yes.

13. She catches up and the companion automatically reconfigures his pacing settings to match hers.

14. After a circuit they part ways and Bjorn heads home.

15. On entering the house Bjorn warms down and stretched which induces a brief summary on his mobile device whilst the detailed data from his run is transparently transferred to his home network.

16. He walks into the kitchen to grab a glass of water and plan what to make for dinner. His home companion notes that he went for a long run today so must be hungry, and suggests some recipes based on what he has in his fridge "how bout that steak, it goes out of date tomorrow". Nothing takes his fancy so he asks the companion to search online whilst he has a shower. Takes shower, comes down and is presented with some new recipes and the fact that Julie called and asked him for a drink that night.

17. At a later time he asks for an overview of his past three months exercise, his companion notes that his heart rate is recovering quicker which suggests he's getting fitter, but for the past two weeks he's not been running for as long.

**Figure 14 The Bjorn persona for HFC scenario**

### 4.1.8 Photo Companion

The PhotoPal prototype discussed in section 3.3 stemmed from original explorations on what a Photo Companion would enable. Figure 15 illustrates a scenario in which a user has a large collection of photographs and wishes to search for a specific image to exemplify a recent trip. The user applies both speech and touch during the interaction, the choice of which is task driven. For example, it is much quicker to specify specific search parameters through speech than by typing or clicking a series of check boxes (part 2 in the scenario). However, when it comes to flicking through the search generated group or applying certain other editorial functional tasks such as scaling and cropping, touch becomes the more natural interaction. This again is due to the context of the interaction. For example, it's quicker to drag a finger or stylus back and forth to resize an image in a serendipitous or haphazard fashion than it is to say, "Make that image a little bigger…bit bigger….bit bigger…no, that's too big…bit smaller…too small" and so on. However, for specific categorical edits speech may be best, for example "make this image 4 by 6 inches and print". The true power of the interaction experience comes from the considered use of both in conjunction.

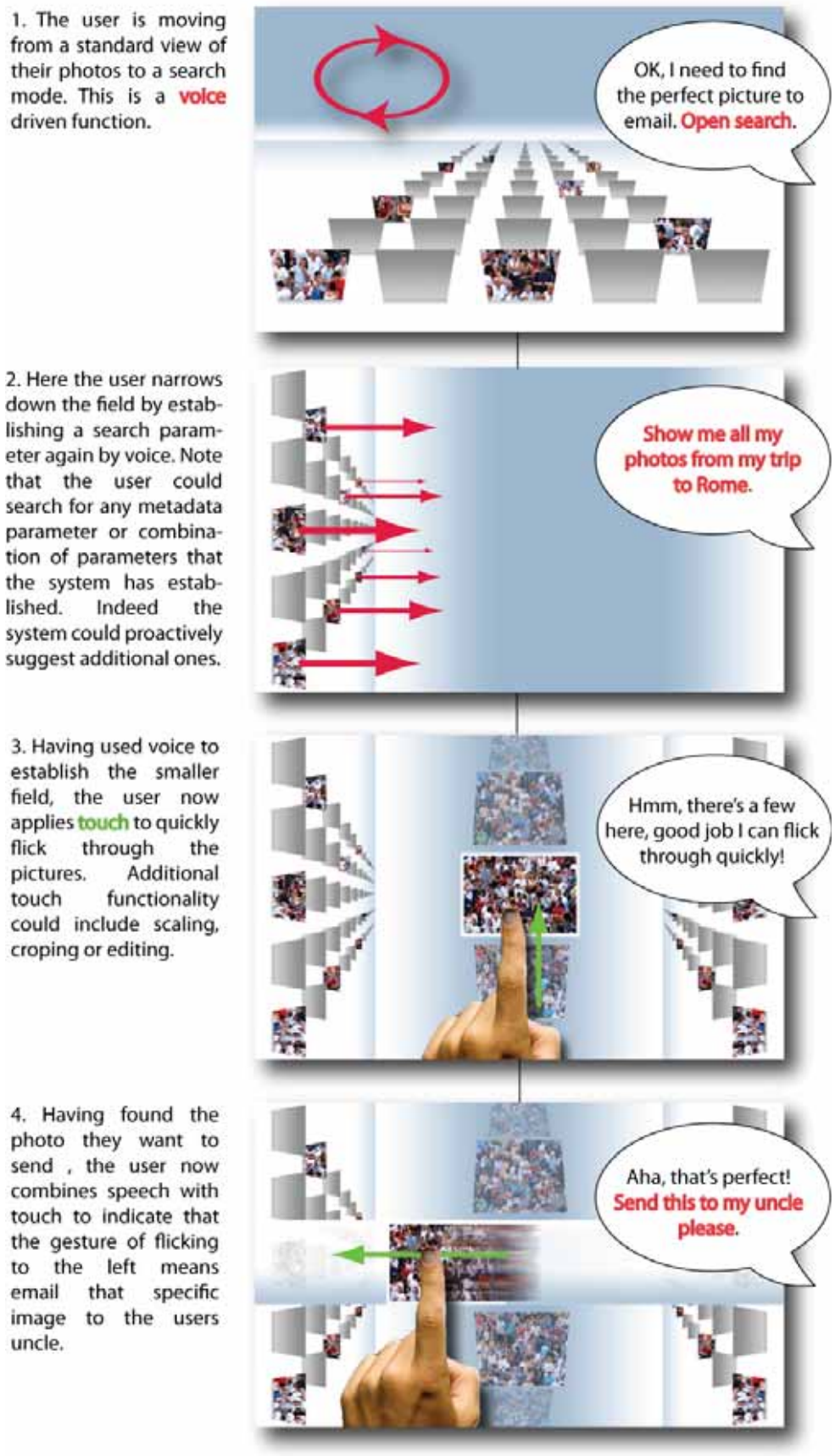



**Figure 15 An example of a multimodal interaction with a Photo Companion**

A further consideration is environmental influence. For example, Figure 16 shows the potential for moving between displays. Small displays (eg digital photoframes) have a more limited touch capability than a larger display (in the case of Figure 16, an interactive coffee table).

**Figure 16. An example of a multimodal interaction moving between displays from a digital photoframe to a smart coffee table.**

Figure 17 illustrates a further option, namely that of using a display that is simply too far from the user to be touched. This in many ways most fairly reflect the current living room environment. In such a situation physical gesture becomes an appropriate option, either by using ones hands or by wielding an object, such as is used in the Nintendo Wii games console. This allows for parameters such as speed, direction and shape of movement.

**Figure 17. An example of a gesture based multimodal interaction with a remote screen**

An alternative of course is to use two displays as is shown in Figure 18. This would actually allow for a combination of speech, touch *and* gesture.

**Figure 18. An example of a multimodal interaction using speech, touch and gesture with dual screens**

# 5 Conclusions

In this paper we have set out to explore the notion of a Companion. One such manifestation, of course, is the Virtual Butler, but we think that Companion is more general. We see Companion technologies as embracing a whole range

of experiences that are designed to encourage people to develop relationship-swith technology. Naturally there are many moral and ethical issues arising from this that must be debated and understood. There are safety, security and privacy issues. But there are also many potential benefits. Companions might help to relieve loneliness for the elderly. They might help care for the infirm. They might make interacting with the Internet and navigating through the mass of information more effective and enjoyable. Indeed we expect them to do all these things.

Companions seek to establish a sense of social presence with the people who interact with them. It is this sense of presence that allows people to form and maintain relationships. Social presence is concerned with being-with, with feeling connected to and aware of other entities. This, much richer form of interaction, will lead to quite different forms of relationships between people, technologies and information.

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