doi:10.1093/iwcomp/XXXXXX

Narratives Of Blended Experience

Tom Flint[1] Brian O'Keefe[2,] Mike Mastermaker[2,] Miriam Sturdee[3,] David Benyon[1,]

[1] *Edinburgh Napier University Merchiston Campus Colinton Road Edinburgh EH10 5DT UK*
[2] *Farmingdale State College 350 NY-110, Farmingdale, NY 11735, United States*
[3] *University of St. Andrews St Andrews KY16 9AJ UK*

This paper focuses on interaction across and between the physical/digital divide. To design for these situations we use blending theory, otherwise known as conceptual integration. Initially, this paper offers a discussion of the literature around blends. From this literature, we applied Benyon's (2014) proposition of conceptual integration in mixed reality spaces (Blended Spaces) to consider interactions with the digital that complement the physical. We investigated blended spaces in partnership with undergraduate students during a live theatre festival. Our collaborators designed applications that applied blending principles, employing techniques drawn from speculative design. Outputs consist of speculative, narrative storyboards that use data gathered directly from stakeholder interviews and over 380 festival visitors. Our work led us to propose a reworking of Blended Spaces into a model that could be easily conceived and applied by novice designers. The work we conducted highlighted the need to consider user transitions from physical to digital and back again and highlighted the experiential nature of this type of interaction.

Categories and subject descriptors: HCI theory, concepts, and models; Interaction design theory, concepts, and paradigms;

Keywords: Blended Spaces; Blended Experience; Speculative Design

Responsible Editorial Board Member: Helen Petrie

1. INTRODUCTION

Interaction between the physical and the digital has become increasingly ubiquitous and is a particularly challenging paradigm to teach to novice designers. In this paper we propose Blended Experiences as a means for designing a balanced and "seemingly natural interaction" (Jetter et al., 2012). Blended Experience builds on the proposition of blended spaces (Imaz and Benyon, 2007 Benyon, 2014) and blended interactions (O'Neill and Benyon, 2015) which draws from Fauconnier and Turner's(2002) work on conceptual integration also known as blending theory. Numerous approaches for creating interactions across the physical and digital inform our approach. Blended Experiences (O'Keefe et al., 2014)extends blended spaces to take account of the experiential. We also integrate principles from the Trajectoies framework (Benford and Giannachi, 2011) to help craft transitions from digital to physical and back again. We not only have the task of constructing a path through numerous approaches and concepts but also developing an approach to teaching them.

Our pedagogic approach was applied, tasking exchange students from our institutions to consider blends at the Edinburgh Fringe Festival. We asked our student research assistants to examine visitor, performer, and promotion problems using Benyon's (2014) Blended Spaces as a means to design. Students used observation, interviews, and surveys to expose opportunities for designing novel interactions. One thing visitors told us was that they wanted efficient, reliable methods for navigating the numerous shows available at the festival that allowed for social interaction with friends and new acquaintances.

Our applied research is through narrative storyboards. Drawing from speculative design (Dunne and Raby, 2013) and design fiction (Sterling, 2005 Bleecker et al., 2022 Flint, 2016 Brown et al., 2016) the storyboards present potential products and interactions. To envision

these speculative experiences we developed work that applied Blended Spaces to support a human-centred design process as we traversed many design considerations between physical and digital spaces.

In this paper, we present three speculative storyboards that apply Blended Spaces (Benyon, 2014 O'Keefe et al., 2014), through speculative design. Undertaking this applied investigation highlighted the experiential as opposed to space in interaction with digital applications. We also discovered a disconnect between our undergraduate's use of language and some terms used in Blended Spaces.

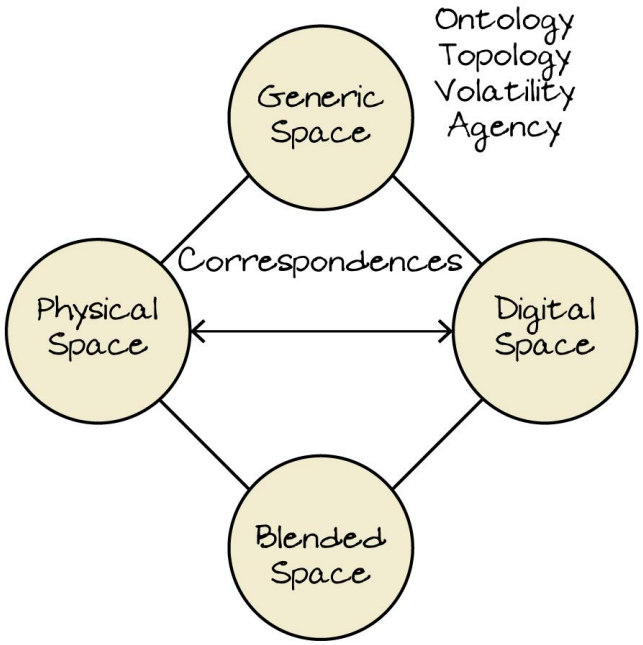

Figure 1. Conceptual blending in mixed reality spaces (Blended Spaces) from Benyon (2014).

2. THEORETICAL BACKGROUND

Fauconnier and Turner (2002) proposed Conceptual Integration as a means through which people cognitively merge two concepts. One example they use is of a linguistic blend, the word Frenemy. Most people who have English as a first language understand this word the first time they hear it. The apparent simplicity and immediate understanding of this example camouflage the conceptual complexity that drives understanding. Fauconnier and Turner argue that we take concepts from what they call input spaces. In the case of Frenemy, this is concepts from the input space of friend, someone one thinks of affectionately and seeks out their company, and concepts

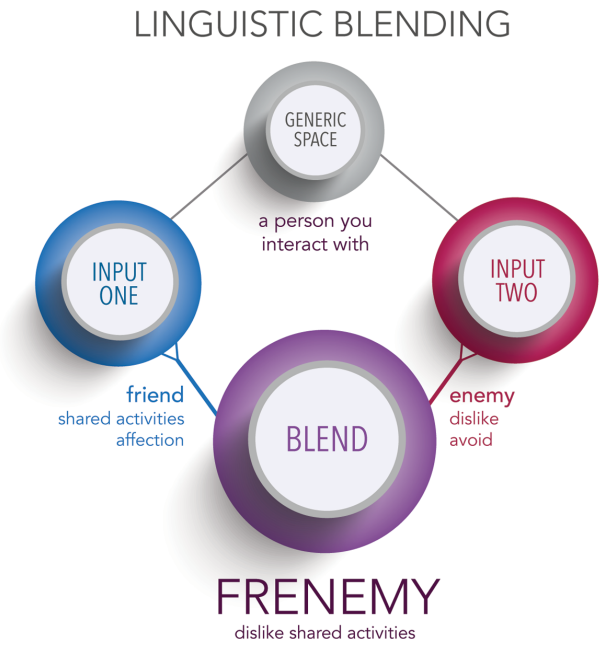

Figure 2. Blending Frenemy

from the input space of the word enemy, a person one dislikes and tries to avoid. Correspondences from these two spaces are projected into a generic space. These projections then create a blend that has features that may not be present in the original concepts. In this case, the blend is Frenemy, which can be understood as a person one dislikes but is forced to spend time with. This is illustrated in Figure 2.

The concept of blending can be a useful tool in interaction design, particularly when considering the transition from one mode to another. Schmitz and Quraischy (2009) combine a physical local store (or dorfläden) with interactive technology. Robert et al.(2010) discuss blending realities together in a mixed-reality game with robots.

Blending has been used in training (Saenz et al., 2015) and as a tool in interactive space. Bodker and Klokmose (2016) link blends and metaphors. Blending and conceptual integration inform semiotic studies (2011) and narratology (2013)

Our work is applied exploring blending in real world situations. The work uses storytelling and narrative with a speculative focus (Auger, 2013) using blending to explore diverse possible futures through imagined artefacts, stories, and worlds.

2.1. Conceptual Blending

Fauconnier and Turner (2002) explain conceptual integration in terms of four constitutive principles.

(i) **Composition** establishes correspondences between input spaces and brings them together into a blend.
(ii) **Relations** are established within the blend and build on the relationships between the input spaces.
(iii) **Completion** is the process whereby people's cultural and cognitive models are integrated into the blend.
(iv) **Elaboration** is the process whereby the blend is manipulated resulting in new insights.

Blends benefit from the use of 'material anchors' (Hutchins, 2005), if one input space is familiar from lived experience rather than understood on an abstract level, its impact is more powerful and improves the blend's efficacy. Hutchins provides a carefully argued contribution to this idea, drawing upon examples of his own work on Micronesian navigators and their use of rising stars and passing islands as material anchors for their approach to seafaring and navigation. Material anchors aid in binding abstract concepts to reality. We may lay out the ingredients of a meal in a specific order to aid in remembering how to cook the dish and when certain ingredients are added. Manipulating objects in the real-world aids memory and cognition. For example, when disassembling an unfamiliar piece of equipment, an engineer may use the space around them to lay the pieces out in the order in which they will be replaced. Hutchins. (ibid p. 1574). tells us:"Problems that are too complex to hold in the mind as a cultural model, and possibly some that are too complex to express at all in internal conceptual models can be expressed and manipulated in material structure"

References to input spaces can be confusing when examining Imaz and Benyon's work on blended spaces (Imaz and Benyon, 2007). Fauconnier and Turner understand input spaces to be constituent packets of cognitive understanding that exist within the mind used to navigate life and experience, whereas Benyon specifically discusses the blend of digital information with physical space and the built environment. Blended Spaces as proposed by Benyon (2014) applies conceptual integration to the design of mixed-reality spaces. The blending of spaces using these constructs results in a new blended space with unique social space, conceptual space, and sense of place.

Our work on blended experiences focuses on the transference of attention from digital to physical and back again. The point at which interaction is most at risk of breakdown (Winograd et al., 1986) is during the transition from one space to another.

A discussion of transitions and means by which to orchestrate and minimise disruption is discussed in detail by Benford and Giannachi (2011) in their trajectories framework. The trajectories framework focuses on a person's traversal through a narrative-driven mixed reality experience. There are transitions between several constructs to consider including different aspects of time, e.g times when participants can interact, time as it progresses in the real world, and the progression of time in a narrative. There are also transitions in roles, e.g. spectator to participant, and transitions concerned with physical resources. The idealised route through an experience is termed the canonical trajectory whereas the route taken is the participant trajectory. Work on integrating trajectories with blended spaces and blended experience is detailed in O'Keefe et al., 2021.

To use these theoretical concepts in our design process we adopted principles from Blended Spaces, (Benyon, 2012, 2014, 2019) for example:

(i) **Ontology:** These are those Things that make a specific space a place. Things can be physical resources or conceptual understandings.
(ii) **Topology:** This focuses on the Relationships that can occur between things, people, and places
(iii) **Agency:** The opportunities for people to interact with digital content or objects in a specific space.
(iv) **Volatility:** How Change in the physical space affects digital content and vice versa, over time.

Considering Blends enables designers to design for interaction between the physical and the digital (O'Neill and Benyon, 2015 Bødker and Klokmose, 2016) Although Blended Spaces provides a simplified view of conceptual integration and blending theory it is easier to use and apply. Regardless, conceptual blending is more nuanced than perhaps represented in this framework, and context and metaphors change over time. However, simplification is to our advantage when the focus is working with student research assistants. Using Blended Spaces provides novice designers with an effective means to maintain considerate human-centred design while avoiding a "bolt on" technology design approach (Benyon et al., 2014).

2.2. Speculative Design

Work conducted in our exchanges draws inspiration from the field of speculative design. Speculative design involves world-building where different artefacts offer views into this world (Coulton et al., 2017, Sturdee et al., 2017) We specifically employ techniques that could be described as design fiction. Design fictions (Sterling, 2005) are narratives that occupy a time frame somewhere between the near present and a possible

future. By taking possible or existing technology and extrapolating (Auger, 2013) into their potential mundane use we can make inferences about their benefits or pitfalls. Human Computer Interaction tends to be optimistic about new technology (Coulton et al., 2018) but dystopian interpretations have a great deal to teach us (Dalton et al., 2016). Design fictions employ a variety of media from prototypes with qualifying narratives in catalogues (Brown et al., 2016, Søndergaard and Hansen, 2016, Sturdee et al., 2017) to prose (Blythe and Wright, 2006) and film (Flint, 2016).

Speculative outputs broadly adopt a variety of media and there is no right or wrong way to communicate ideas. Outputs from our work are illustrated narratives in the style of graphic novels presented as storyboards. We investigate real-world scenarios and project a probable near future of interactions. Our storyboards allow us to present narratives that focus on technology (Sturdee et al., 2016) and are a means for our student research assistants to design and discuss plausible interactions (Bodker, 1999, Truong et al., 2006). What makes our storyboards speculative rather than scenarios is their focus on an imagined future with imagined products and services created specifically for the narrative, known as diegetic prototypes.

Diegetic prototypes (Sterling, 2012) adopt a position that goes beyond interactions by considering people and their daily lives with possible prototypes. Blends and speculation are a novel arena for research. The narratives we produce are an accessible empirical means within which to speculate and design blended experiences.

2.2.1. Applying Blended Spaces

One aim in this paper is to navigate a path through the various approaches and different terms used over the years. It is our hope that our assertion of Blended Experience as the activity of applying Blends and Conceptual Integration to Interaction Design in Mixed Reality is adopted going forward. Over the years this subject has been worked on and expanded significantly and there are several different approaches with different means of referring to the area. Imaz and Benyon (2007) initially proposed Blended Spaces as a means for considering digital/physical interactions in the built environment. For our workshop Blended Spaces was developed into a working framework for applied design see Figure 3. It was this Blended Spaces Framework that was applied in the workshop discussed in this paper.

The Blended Spaces Framework was discussed with students in terms of transitions between the physical and digital applying various concepts from Benford and Giannachi's (2011) Trajectories Framework. We also simplified the language of ontology, topology, agency and volatility to things, relationships, people and change. We found students found the original language difficult to navigate and using the words things, relationships, people and change provided immediate scaffolding when considering the concepts when designing.

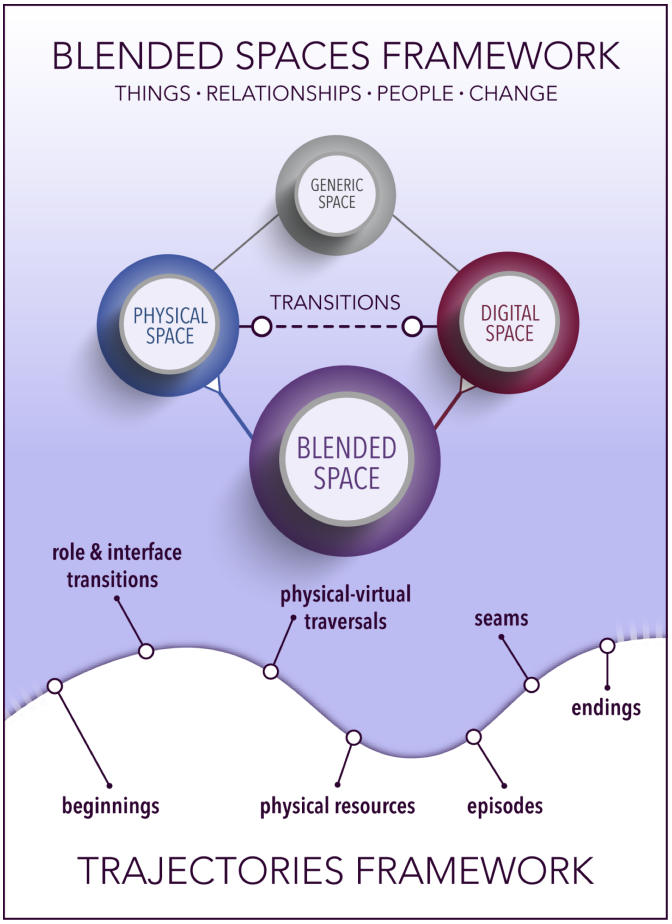

Figure 3. Blended Spaces Framework as presented in our workshops.

3. A BLENDED EXPERIENCES WORKSHOP

Our workshops explore blends in an applied manner and in real-world situations. In the past, we have worked on blends in art galleries, museums and sports stadia. For this iteration of the workshop, we decided to focus on the 2019 Edinburgh Fringe Festival. The Edinburgh Fringe Festival is the world's largest performing arts festival with over 3,500 activities and shows running annually every August. Alongside the Fringe Festival are numerous other festivals including Edinburgh International Festival, Edinburgh Art festival and more. Over the month of August, the population of Edinburgh doubles and the city transforms. The festivals became the focus of our research

investigation with a goal to identify visitor, performer, and promoter pain points during the month-long event. Our workshops concentrate on human-centred design practice (Benyon, 2019) and employed speculative storyboards and the Blended Spaces Framework as tools. The workshop culminated in an exhibition advertised as part of the Fringe Festival.

We recruited 13 undergraduate student research assistants to take part in our annual twelve day Blended Interactions Workshop. During the festival, the research assistants were given the opportunity to explore, participate and experience the festival for themselves. This meant we were able to participate in the festival as performers, promoters, and visitors affording unique insights into each role. Our show also gave us the opportunity to report our findings to fellow performers, promoters, and visitors.

3.1. Conducting the workshop

3.1.1. Week 1

Our workshops commence with field trips to visitor attractions that could be argued to be blended experiences such as "The Johnnie Walker Experience" (a visitor attraction in central Edinburgh) and a local arts institution with whom we have collaborated on mixed reality projects exploring blending for several years. Students are introduced to concepts of blending and Blended Experience from a theoretical point of view demonstrating how Fauconnier and Turner's understanding of conceptual integration was mapped onto the built environment by Imaz and Benyon (2007) and how this was expanded in later work. Students are tasked to find and present products and designed services that could be considered blended experiences.

The next session introduces the students to Benford et al's Trajectories Framework leading to a discussion of transitions and their contribution to blended experiences expanded on in O'Keefe et al.(2021) Students are then presented with a basic understanding of storytelling and the importance of story structure. We employ Field's Paradigm (Field, 2005) as a quick and easy route into structured storytelling. Our structured storytelling discussion is framed around speculation and design fiction (Flint, 2016).

After storytelling we introduce the students to sketching and art direction in the production of sequential art for highlighting blends. Our speculative storytelling outputs draw from comics and graphic novels. Sketching workshops are run by colleagues who are professional illustrators.

Throughout this first week, students are encouraged to participate in the festival as much as possible and to engage in conversations with strangers. They undertake participant observation and start to produce semi structured interviews.

3.1.2. Week 2

In week 2 students undertake participant observation in earnest and their semi structured interviews are honed into a survey using an iterative process. Once the surveys are established, students use tablets to gather as much data as possible. Students usually have a strong idea of where they want to concentrate their attention at this point, however the surveys help them establish a genuine need for their proposals and prototypes.

Regular feedback is important to ensure students are employing the guiding principles from the Blended Spaces Framework namely, Ontology, Topology, Agency, and Volatility. Drawing on the data and problem spaces established over the course of of our workshop we produce speculative solutions to meet the needs, wants, and aspirations of participating festival visitors, performers, and promoters. Over the course of week 2, we regularly examine the summative results from our surveys and ensure that our responses reflect these accurately.

It is through this process that we were able to establish the name of our exhibition as "Flyers are Rubbish" reflecting on promoters' belief that flyers are an effective advertising tool and visitors' keenness to avoid and discard flyers as soon as possible. These results are expanded on in section 3.3.

Students work iteratively on their storyboards, presenting them to their peers for critique and feedback. The storyboards are the main output displayed in the exhibition. Our workshop participants are given regular feedback not only from ourselves and their peers but also local members of the design community who are invited to come and present and discuss ideas with our workshop participants. This feedback gives students the opportunity to iterate their ideas over time.

Where possible students prototype physical manifestations of their prototypes, see Figure 4. As a school of design we are able to take advantage of numerous maker facilities and environments such as physical computing, NFC tags 3D printing etc.

3.2. Festival Research Outcomes

We sought and received institutional ethical approval to run our study. In total, we captured data from 389 festival attendees. 202 were visitors, 101 were show promoters, and 86 were performers. 57 people agreed to be interviewed, 5 were performers, 26 were promoters, and 26 were visitors. During our investigations, we encountered several situations and desires where interaction design specifically using the blended spaces framework would create opportunities for these attendees. From our

Figure 4. Prototype for Sustainable Hobnobbing Storyboard

data, we were able to make several assertions.

Performers:

- Rely on street guerrilla-style paper leaflets to promote their performances.
- Often do not have concrete nor measurable performance feedback from visitors.
- Believe that paper flyers are the best way to reach their audience.

Visitors

- Reject paper flyers because they find them annoying and overwhelming.
- Do not trust critics' performance reviews as they often do not know who they are or why their opinion matters.
- Would like to socialise and meet new and exciting people around them.

Promoters

- Generate a large number of leaflets and poster paper waste.
- Have no accurate method to measure the effectiveness of paper-based advertising.
- Have a direct stake in the success of their paper flyer advertisements.

We began to address these problems by coupling speculative storyboarding with the Blended Spaces Framework. We set out to explore and speculate how to:

- Identify a more authentic way for visitors to generate performance reviews while democratising the overall performance feedback process.
- Identify a fun and social way to streamline how beverages and tickets are used whilst exploring how people congregate around other like-minded people.
- Identify sustainable alternatives to paper advertising.

3.3. Applying the Blended Spaces Framework

The outputs from our workshop were speculative storyboards showcasing how, while using technology-driven experiences, people could:

- Feel present in physical spaces or, where possible, create an Illusion of Non-Mediation (Lombard and Ditton, 2006) when transitioning between digital and physical spaces.
- Form new relationships between visitors, performers, and promoters in a manner that felt serendipitous.
- Discover new means of occupying and interacting with space through a technology that could be navigated with a minimum of cognitive effort.

Benyon's (2014) four principles guide our work at a high level and we will take the opportunity to identify key cells that represent each guiding principle later in this paper. These lists are not exhaustive and we are aware that there are more items that could be identified however we have focused on a few examples that align with our speculative storyboards.

Things (Ontology) is an inventory of Things, People, and Places. We considered Things at the festival as beverages, posters, show tickets, mobile devices, and flyers. We identified festival People as visitors, performers, and promoters. We identified festival Places as bars, ticket booths, performance stages, streets, and queues.

Relationships (Topology) is concerned with the relationships between Things, Places, visitors, and People. For example, we investigated the relationships between visitors and paper-based advertisements. Paper-based advertisements are out of touch with festival visitors' needs and expectations of sustainability. Additionally, relationships between visitors and performers are clearly critical, however, the nuances of how people try to avoid paper flyers, coupled with performers' belief that flyers are effective, provide design opportunities for our teams.

People (Agency) As well as opportunities for people to interact, agency concentrates on opportunities for people to act on growing and maintaining relationships. For example, we investigated the relationships between visitors and performers. Performers often only get feedback from their audience based on reviews. Investigating opportunities for performers and audiences to interact provides design opportunities for our teams.

Change (Volatility) is concerned with change and how all of the above principles weave together before, during, and after an experience such as the Edinburgh Fringe Festival. Experiences with a discernible before, during, and after can happen over differing periods of time i.e meeting a new person, interacting with them and going to a show or booking, visiting and then interacting with a performer through data after the event.

To apply the four principles to the problems highlighted by the data, our teams created a total of seven storyboards. We selected three of these narratives to be professionally illustrated and these are presented in this paper. The three storyboards are *Laugh Traders, Sustainable Hobnobbing, and Fringeship Bracelet.* These three storyboards not only address problems uncovered during the festival but also showcase how these principles form what we consider to be Blended Experiences, responding to human-centered problems and affording people to feel present in physical spaces, form new relationships with each other, and discover new, personal interpretations of physical places.

The three storyboards presented consider the balance between digital and physical spaces coupling stakeholder behaviours, and biodata followed by subsequent relationships between people, places, and things. Our primary goal was to imagine products that would act on those design considerations without intruding on the pleasure of being at the festival.

Storyboard 1 *Laugh Traders* responds to visitors' lack of faith in reviews. By creating a service that generates reviews directly from audience biodata our researchers conceived a non-intrusive means for creating reliable performance reviews.

Storyboard 2 *Sustainable Hobnobbing* is a means for enabling chance encounters between strangers. This service also manages ticketless entry.

Storyboard 3 *Fringeship Bracelet* considers how people might be able to manage chance encounters for themselves. The service also enables users to avoid flyers by recommending shows to each other.

The speculative storyboards created in our workshops are meant as provocations to engage audiences in discussions around Blends. The workshops are designed for our participants to consider Blends and how to design for them in the future. The storyboards developed during the workshop are also a potential means for us to evaluate proposals for Blended Experiences. Evaluation is discussed in Section 4.1.

3.3.1. Laugh Traders Synopsis (Tables 1 and 2)

Mike and Stan are enjoying the Edinburgh Fringe Festival and meandering through the streets, a common and popular festival activity. They are surrounded by a plethora of printed posters, Mike is particularly sceptical of the reviews of Comic Isabel's shows and wonders what authority the reviewers have and how objective their point of view is.

Stan, however, is sold on the reviews which leads Stan to the box office. Tara at the ticket office encourages Stan and Mike to go paperless and to download the Laugh Traders app. The smartwatch app offers unique features: "Be an independent Festival Reviewer, Trade Your Laughs for perks, and more!" Mike is still sceptical as he squints at Laugh Traders on his wrist. He starts to loosen up once he realises Laugh Traders allows him to buy tickets and gain automatic entry to the show. Isabel takes centre stage and the show begins.

During the show, Stan chuckles a little, whereas Mike laughs hysterically. After the show, as they are leaving the venue, Mike and Stan feel vibrations in their wrists. Laugh Traders has collected their laughs and has now constructed their reviews. Stan was not as impressed: his review's recap is "A Good Chuckle". Mike's review on the other hand is a resonant "Hilarious!"

As they step outside, Mike feels the smartwatch vibrate again: he has received a promotional discount to go see and review another show. Meanwhile, Isabel steps behind the curtain, hearing the applause behind her. She taps on a push notification. Her Laugh Traders dashboard has calculated all audience laughter with a general "Laugh Score of 95 %". She quickly checks her performance's laugh data for highs and lows. Later that night she revisits her act, and makes changes to her script for tomorrow.

3.3.2. Performer and Visitor Feedback

"Who are they (the reviewers) to say what I should do based on stars? It's a stunt!" – Visitor

"Yeah sure, I have good shows, and it's great. But everyone in this biz has an off night. " – Performer

3.3.3. Laugh Traders Summary

By carefully considering the physical and digital balances as a confluence of things, relationships, people, and change over time we designed a blended experience. We employed blended spaces by carefully taking into account the interwoven interactions of its four principles. For example, we explored poster reviews, devices, tickets, etc., as things. We examined the laughter reactions or non-reaction from the audience to the performer as relationships. We additionally examined how the comic might adjust her performance based on audience feedback as Agency. We additionally examined how the audience might feel a part of the comic review democratisation process (agency) based on the fluctuation of laughter data produced over the course of the show (change).

Laugh Traders focuses on how the sharing of laugh data can strengthen relationships between a comedian and her audience. Additionally, by aggregating laugh data over time, visitors are able to discover new comics, shows, or attractions that are more meaningful to them.

3.3.4. Sustainable Hobnobbing Synopsis

Ricardo is visiting the festival by himself and relaxes in a bar. Bartender Ted encourages Ricardo to purchase a novel Smart Pint. Smart Pints link to his watch

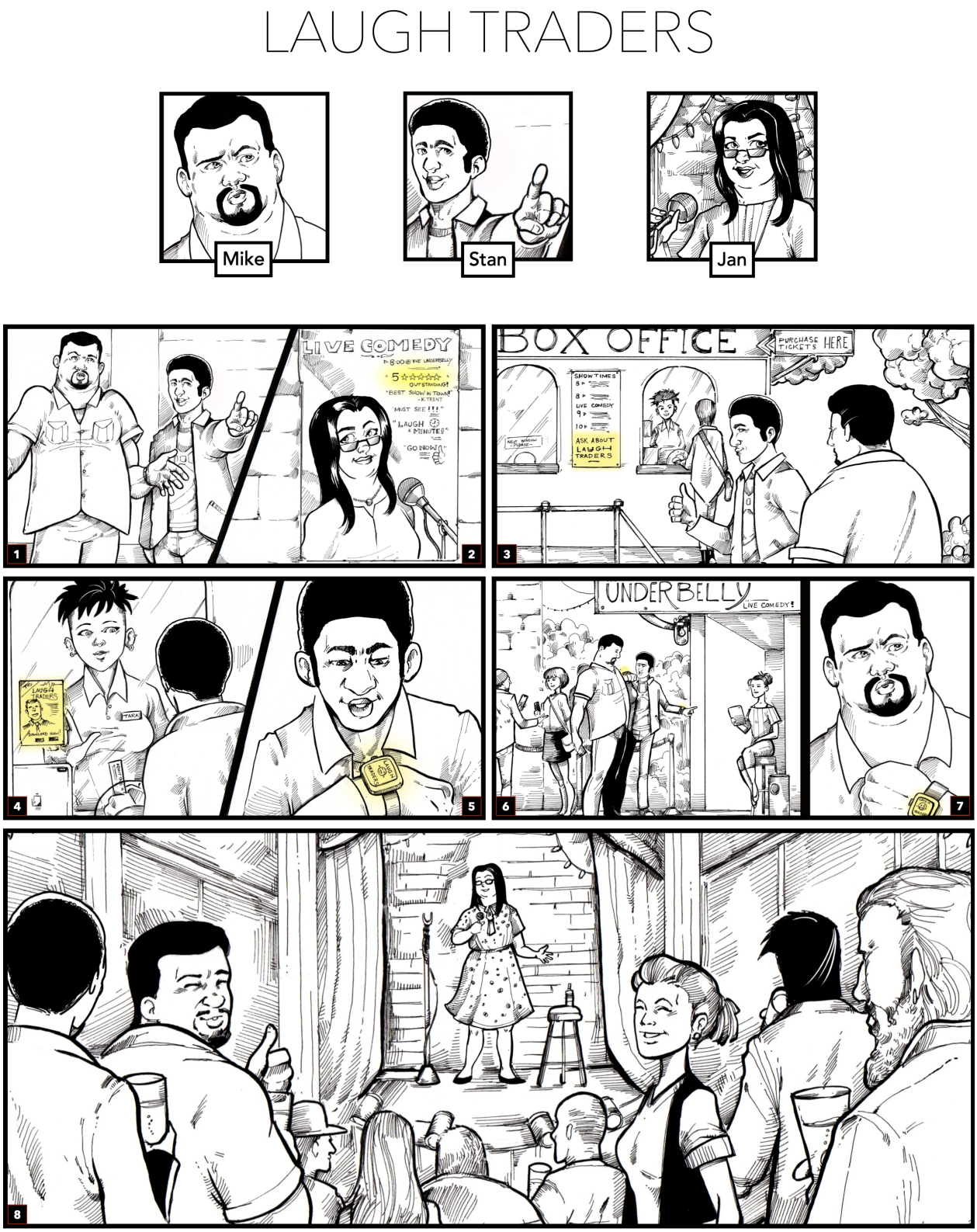

Table 1. Laugh Traders Storyboard

Table 2. Laugh Traders Storyboard

SUSTAINABLE HOBNOBBING

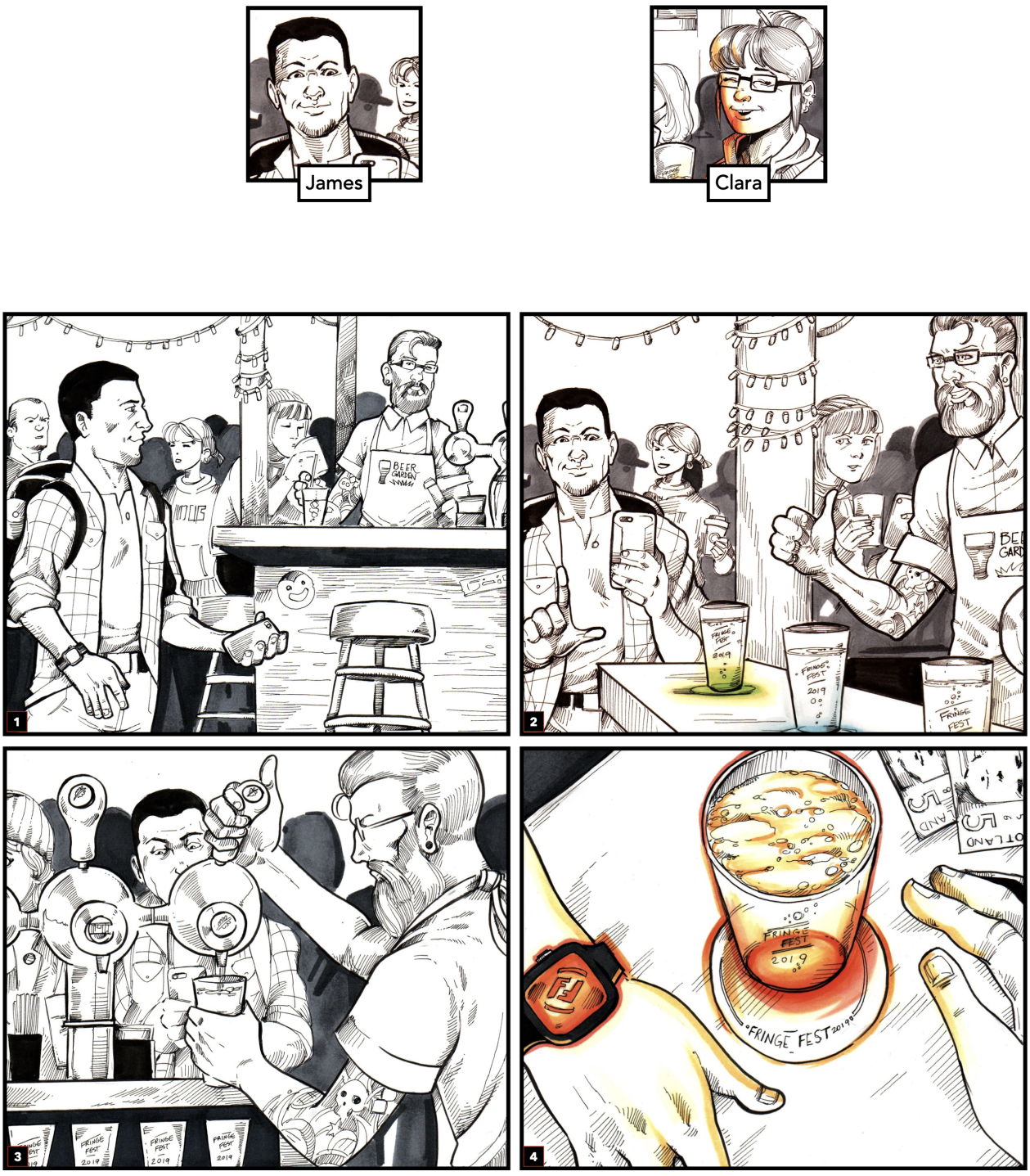

Table 3. Sustainable Hobnobbing Storyboard

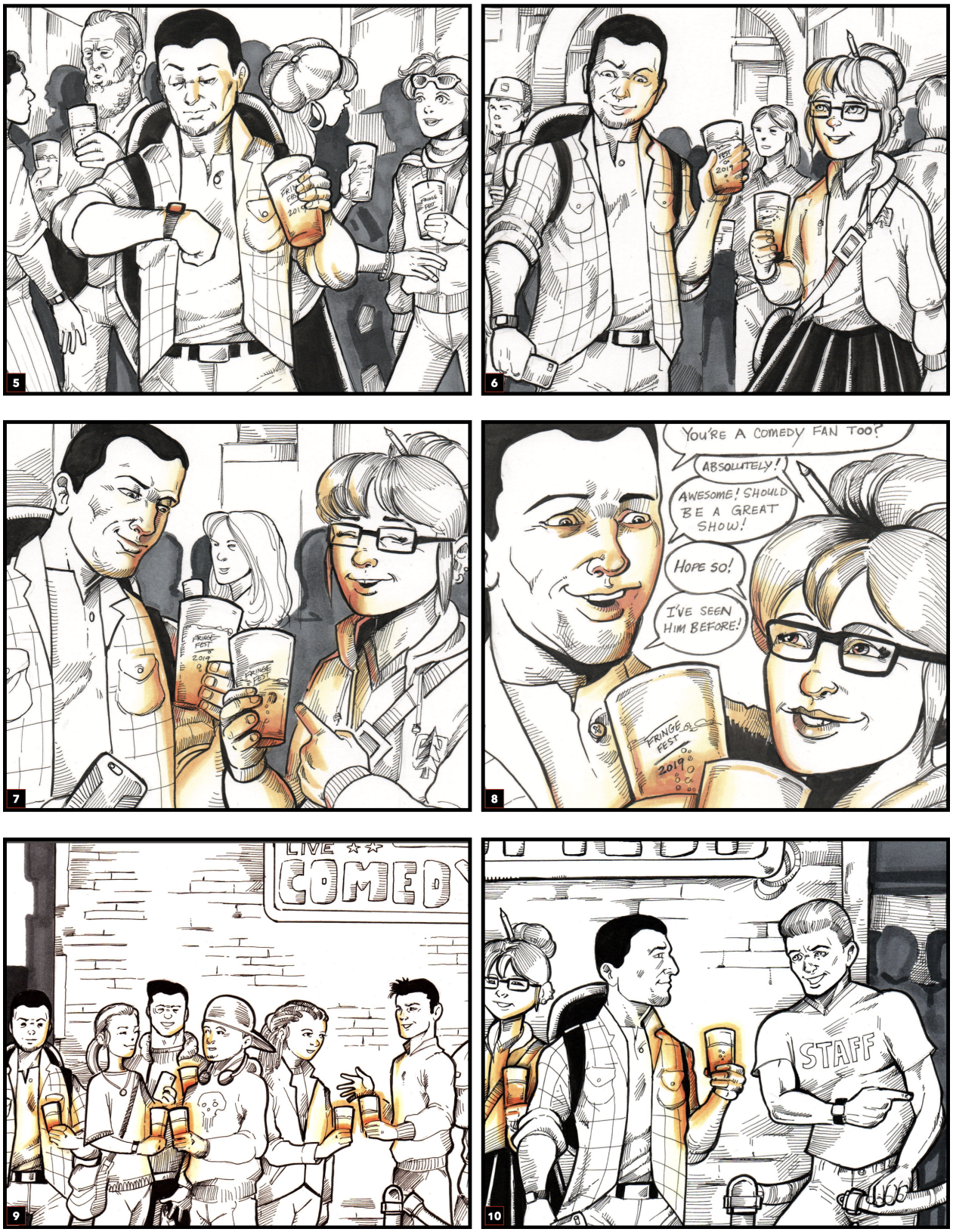

Table 4. Sustainable Hobnobbing Storyboard

Table 5. Fringeship Bracelet Storyboard

Table 6. Fringeship Bracelet Storyboard

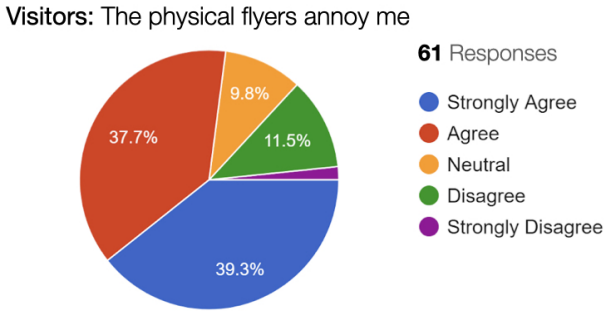

Figure 5. Visitors: Annoyed by flyers - 61 Responses

and promises to manage his tickets and manufacture serendipitous encounters with like-minded people. Ted pours Ricardo a drink into his Smart Pint and goes about linking it to his watch. Ricardo is encouraged to divulge some likes and dislikes in order to create encounters. The watch and glass also link to his current ticket purchases.

Ricardo's watch tells him it is time to leave for his next show, and he walks toward the venue. As he arrives outside the venue, Julia notices their Smart Pints are glowing the same colour. They jokingly tap drinks, and the Smart Pints glow brighter, causing Julia to laugh. They engage in conversation and discover they have many tastes in common. They easily find the queue for the venue as it is populated by people holding Smart Pints that glow the same orange colour.

Ricardo is delighted to discover that the colour of the Smart Pint acts as a ticket and he is able to enter by just showing his glass. Ricardo stops to engage in conversation with Jimmy, the door staffer. They swap numbers.

3.3.5. Visitor Feedback

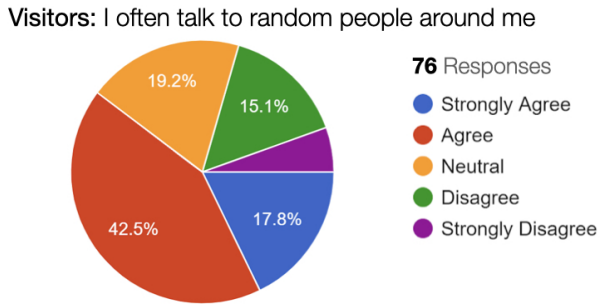

Figure 6. Visitors: I talk to random people - 76 Responses

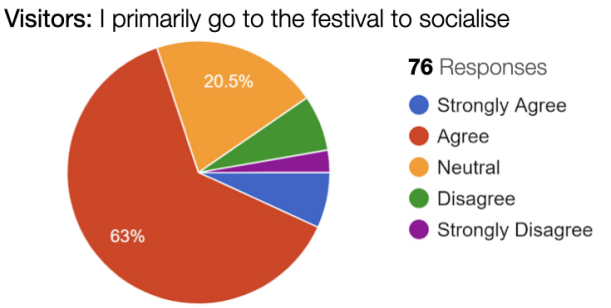

Figure 7. Visitors: Want to Socialise - 76 Responses

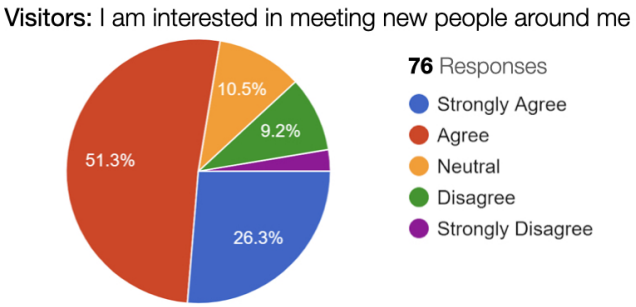

Figure 8. Visitors: Want to meet new people - 76 Responses

3.3.6. Guiding Principles for Sustainable Hobnobbing

The Sustainable Hobnobbing storyboard drew from data demonstrating that many people came to the festivals looking to socialise with others. This data point prompted the question of whether people were interested in socialising with someone new. Further data points demonstrated that not only were they interested in meeting new people who were around them at the festival but also get to know them and possibly making a connection. Data revealed that though people were keen to meet strangers they rarely acted on this, we sought to develop a solution that could close the gap between those who wanted to meet new people and those who were reticent to initiate contact.

By carefully considering the things (beverages and technology), relationships (strangers with common interests), people (interactions between visitors and event staff), and change of material anchors (colourisation of drinks as entry tickets) through blended experiences, a closely tied balance between digital and physical spaces are created.

3.3.7. Fringeship Bracelet Principles Summary

Mauro is disappointed with a large amount of waste he sees from flyers and is walking through the streets trying his best to avoid being given a flyer. He signed up for the Fringeship Bracelet when he arrived and is pleased to get

a notification from another user. The other user is Maya who has signed up for the Fringeship Bracelet App. On sign-up, she received three complimentary tickets, one for her and two for strangers. She has browsed the profiles of people registered on the app and gifted her tickets to Mauro and Alex who seem to share her interests.

Mauro makes his way to the beer garden he was invited to where Maya and Alex are already in conversation. Our protagonists easily find each other because their smart watches are glowing in colours prompted by the app. Mauro buys everyone a drink with the Fringeship Bracelet app using two complimentary offers and pays for the third. The new acquaintances enjoy each other's company and exchange contact details to allow them to arrange further activities in the fringe.

After the encounter, Maya decides she is interested in meeting with Mauro again but she is less keen on staying in contact with Alex. She deselects him in the app. Through the Fringeship Bracelet desktop app, Manager Ted now has novel data produced by the bracelets that can help him in running his bar.

3.3.8. Visitor and Promoter Feedback

"It only wastes paper and money. There are too many of them and no one really cares or really uses them. The same with lots of posters. The carbon footprint (of) all those activities is unnecessary and cannot be accepted in the long term - as we face undeniable climate change." – Visitor.

"It's bad for the environment all the leafleting and it makes me want to go to their show even less." – Visitor.

3.3.9. Guiding Principles for Fringeship Bracelet

This storyboard drew from data that demonstrated visitors found the number of flyers (things) overwhelming and had little or no desire to get more flyers. For visitors, flyers were seen as wasteful and a cause of litter. Conversely, from our data performers perceived flyers as easy and efficient though not specifically cost-effective. We also drew from the fact visitors told us they were interested in forging new relationships. The Fringeship Bracelet affords our protagonists the agency to meet and socialise. They also have the choice to continue the relationship or not.

4. DISCUSSION

The first assertion we make is to interpret interaction across the mixed reality continuum within physical space as a blended experience. Blended Experiences adopts the use of input spaces from conceptual integration and blended spaces but re-frames them as input concepts. We then align these concepts with Benyon's principles of

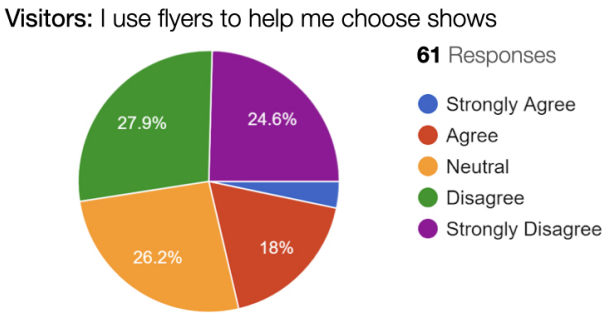

Figure 9. Visitors: Flyer effectiveness. - 61 Responses

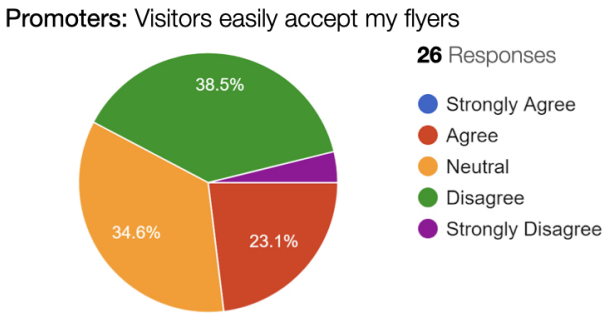

Figure 10. Promoters: Flyers Acceptance - 26 Responses

Ontology, Topology, Agency, and Volatility. In our work with students, we find that they struggle with the verbose language of these terms and have simplified them using the terms Things, Relationships, People and Change. These terms are not only more straightforward but act as scaffolding terms when applying blending tools and frameworks.

We argue the high value of considering blending theory when designing for interaction in and across space. Blending or conceptual integration is a difficult subject to navigate with a large subsection of theoretical approaches attached to it. Not least of these is the original theory's use of the word space meaning a conceptual package and Beynon's adoption of blending for space in terms of the built environment. Through running our workshops, we have developed strategies for using and considering blends as a design tool.

Approaches to design for mixed reality such as the Trajectory Framework (Benford and Giannachi, 2011)is concerned with smooth transitions through differing modes of interaction and between interfaces in the same experience. A Blended Experiences approach considers how to make these transitions seem less intrusive and simply part of the overall experience.

The built environment changes at a slow pace but the nature of its use and the context in which

it interacts can change rapidly. An example of this from The Edinburgh Fringe is the almost overnight appropriation of university spaces into temporary theatres and performance spaces for the month of August. Digital technology can change rapidly adapting to context and intent. Considering blending for the design of digital experiences in physical space ensures that designers consider the integrated context of the built environment with digital interventions. This alleviates the design of digital interactions that are simply bolted onto environments in a 'one size fits all' approach. Our approach draws from conceptual design, blending theory and concepts of trajectories. These are necessary and appropriate because the nature of many blended experiences is based on interactions with and through digital and physical objects that takes place as people move through physical space. Using our approach coupled with speculative storyboards, provided us with an approach to design for blended experiences. Speculative storyboards are critical to communicating specific blended experiences, the moment of potential breakdown and a means for evaluating the relationships between digital and physical spaces.

Traditional approaches to design often do not take these new contexts into account, focusing on the medium rather than the interaction and experience. Many systems do not consider how designers produce new digital and physical experiences that work harmoniously while supporting new interactions and relationships with people. The harmonised balance between people, relationships, and technology is vital. Our work at the Edinburgh Fringe Festival illustrated that the last thing a digital experience should do is interfere with the sensitive, and creative use of physical spaces and objects that artists, performers, and curators have crafted with their exhibits. Even where an experience is primarily focused on a location, people transition between physical and digital components to appreciate the whole experience. Having worked with our students in this and other workshops, we argue to reframe conceptual integration in interaction design as Blended Experience. We offer our approach as a means for rapidly introducing participants into an applied means of designing for experiences that transition between the physical and the digital.

4.1. Future Work

Our approach to designing for blended experiences provides us with a means for evaluating proposed interactions. Using the speculative storyboards to communicate the proposed interaction allows us to develop a means of interrogating participants framed in the notions of Ontology, Topology, Agency, and Volatility. This evaluation not only provides us with a means for interrogating each speculative evaluation in its own right; but also, a formal means for evaluating the framework itself. We are currently using the storyboards presented here in a series of factor analysis studies. We hope to report on the results from these studies in the near future. We have developed a practical approach for designing blended experiences, by adopting and adapting Blended Spaces.

This approach may be further evaluated by utilising it within student coursework assessments within higher education institutions, and further, with new user studies aimed at gathering the opinion of a wider public. We are now able to begin the process of identifying the tightness or threshold of a blended experience through our evaluations. We argue for the reinterpretation of Benyon's Blended Spaces Framework as a Blended Experiences Tool (figure 6) providing an accessible and well-grounded approach to interaction design. The tool is usable by students and novices, as well as experienced designers developing novel interactive experiences in a contemporary context.

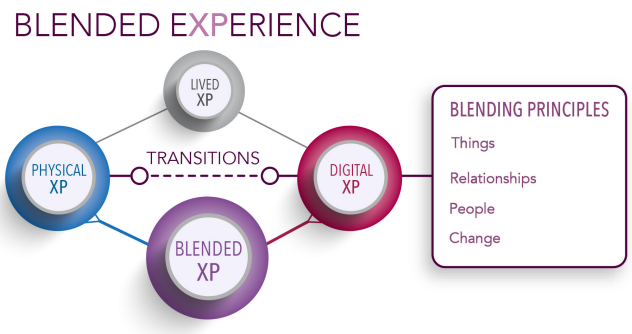

Figure 11. Blended Experience

5. CONCLUSION

We argue that Benyon's Blended Spaces be reframed as Blended Experiences . This is an accessible adaptation of Benyon's discussion of blended spaces, affording an understanding of the complexity of blending in real-world situations. Combined with storyboards, this is a useful tool for designing differing contexts for interaction within physical space. Blends can offer guidance for researchers and practitioners examining the transitions and experiences between digital and physical spaces. By creating and examining storyboards in the style of speculative narratives, set in a near-future Edinburgh Fringe Festival, we demonstrate the efficacy of the method

for identifying blended experiences. Storyboards are low-cost, easy to read and examine and enable reflection and evaluation from diverse audiences, they can support future iterations of Blended Experiences and the methods can be readily adopted in Human Computer Interaction and design settings.

Our first contribution is the practical demonstration of employing Blended Spaces in a workshop to achieve results that are of quality. Our second contribution is the reframing of blended spaces to blended experience and the adoption of the terms Things, Relationships, People and Change. A model of Blended Experience is shown in Figure 11. This model takes into account the transition from digital to physical and simplifies the language used in applying conceptual integration for interaction design.

REFERENCES

Auger, J. (2013). Speculative design: Crafting the speculation. *Digital Creativity*, *24*(1), 11–35.

Benford, S., & Giannachi, G. (2011). *Performing mixed reality*. The MIT Press.

Benyon, D. (2012). Presence in blended spaces. *Interacting with Computers*, *24*(4), 219–226.

Benyon, D. (2014). Spaces of interaction, places for experience. *Synthesis Lectures on Human-Centered Information*, *7*(2), 1–129.

Benyon, D. (2019). *Designing user experience: A guide to hci, ux and interaction design*. Pearson UK.

Benyon, D., Quigley, A., O'Keefe, B., & Riva, G. (2014). Presence and digital tourism. *AI & society*, *29*(4), 521–529.

Bleecker, J., Foster, N., Girardin, F., Nova, N., Laboratory, N. F., Frey, C., & Pittman, P. (2022). *The manual of design fiction*. Near Future Laboratory. https://books.google.co.uk/books?id=W_c7zwEACAAJ

Blythe, M. A., & Wright, P. C. (2006). Pastiche scenarios: Fiction as a resource for user centred design. *Interacting with computers*, *18*(5), 1139–1164.

Bodker, S. (1999). Scenarios in user-centred design-setting the stage for reflection and action. *Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences. 1999. HICSS-32. Abstracts and CD-ROM of Full Papers*, 11–pp.

Bødker, S., & Klokmose, C. N. (2016). Dynamics, multiplicity and conceptual blends in hci. *Proceedings of the 2016 chi conference on human factors in computing systems*, 2538–2548.

Brandt, P. A. (2011). What is cognitive semiotics? a new paradigm in the study of meaning. *Signata 2*, 49–60. http://journals.openedition.org/signata/526

Brown, B., Bleecker, J., D'adamo, M., Ferreira, P., Formo, J., Glöss, M., Holm, M., Höök, K., Johnson, E.-C. B., Kaburuan, E., et al. (2016). The ikea catalogue: Design fiction in academic and industrial collaborations. *Proceedings of the 19th International Conference on Supporting Group Work*, 335–344.

Coulton, P., Lindley, J., & Cooper, R. (2018). The little book of design fiction for the internet of things.

Coulton, P., Lindley, J. G., Sturdee, M., & Stead, M. (2017). Design fiction as world building.

Dalton, N. S., Moreau, R., & Adams, R. K. (2016). Resistance is fertile: Design fictions in dystopian worlds. *Proceedings of the 2016 CHI conference extended abstracts on human factors in computing systems*, 365–374.

Dunne, A., & Raby, F. (2013). *Speculative everything design thinking and social dreaming*. MIT Press.

Fauconnier, G., & Turner, M. (2002). The way we think. conceptual blending and the mind's hidden complexities. *New York: Basic Books*, *2*(4), 6–4.

Field, S. (2005). *Screenplay: The foundations of screenwriting*. Delta Trade Paperbacks.

Flint, T. (2016). Fiction for design: Appropriating hollywood techniques for design fictions. In *Digital make-believe* (pp. 49–66). Springer.

Herman, D. (2013). Cognitive narratology (revised version; uploaded 22 september 2013). http://www.lhn.uni-hamburg.de/article/cognitive-narratology-revised-version-uploaded-22-september-2013

Hutchins, E. (2005). Material anchors for conceptual blends. *Journal of pragmatics*, *37*(10), 1555–1577.

Imaz, M., & Benyon, D. (2007). *Designing with blends: Conceptual foundations of human-computer interaction and software engineering*. MIT Press.

Jetter, H.-C., Geyer, F., Schwarz, T., & Reiterer, H. (2012). Blended interaction: Toward a framework for the design of interactive spaces. *AVI 2012: International Working Conference on Advanced Visual Interfaces*.

Lombard, M., & Ditton, T. (2006). At the heart of it all: The concept of presence. *Journal of Computer-mediated Communication*, *3*.

O'Keefe, B., Flint, T., Mastermaker, M., Sturdee, M., & Benyon., D. (2021). Designing blended experiences. *Proceedings of Designing Interactive Systems Conference 2021 (Virtual Event, USA) (DIS '21)*.

O'Keefe, B., Benyon, D., Chandwani, G., Menon, M., & Duke, R. (2014). A blended space for heritage storytelling. *Proceedings of the 28th International BCS Human Computer Interaction Conference (HCI 2014) 28*, 90–99.

O'Neill, S., & Benyon, D. (2015). Extending the semiotics of embodied interaction to blended spaces. *Human Technology*.

Robert, D., Wistorrt, R., Gray, J., & Breazeal, C. (2010). Exploring mixed reality robot gaming. *Proceedings of the fifth international conference on tangible, embedded, and embodied interaction*, 125–128.

Saenz, M., Strunk, J., Chu, S. L., & Seo, J. H. (2015). Touch wire: Interactive tangible electricty game for kids. *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction*, 655–659.

Schmitz, M., & Quraischy, H. (2009). Tangible interaction with real and virtual products: Designing a shopping assistant for rural communities. *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction*, 209–212.

Søndergaard, M. L. J., & Hansen, L. K. (2016). Periodshare: A bloody design fiction. *Proceedings of the 9th Nordic Conference on Human-Computer Interaction*, 1–6.

Sterling, B. (2005). *Shaping things*. MIT Press. https://books.google.co.uk/books?id=fluqQgAACAAJ

Sterling, B. (2012). *Bruce sterling explains the intriguing new concept of design fiction (interview by torie bosch)*. Retrieved December 14, 2023, from http://www.slate.com/blogs/future_tense/2012/03/02/bruce_sterling_on_design_%20fictions_.html

Sturdee, M., Coulton, P., & Alexander, J. (2017). Using design fiction to inform shape-changing interface design and use. *The Design Journal*, *20*(sup1), S4146–S4157.

Sturdee, M., Coulton, P., Lindley, J. G., Stead, M., Ali, H., & Hudson-Smith, A. (2016). Design fiction: How to build a voight-kampff machine. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, 375–386.

Truong, K. N., Hayes, G. R., & Abowd, G. D. (2006). Storyboarding: An empirical determination of best practices and effective guidelines. *Proceedings of the 6th conference on Designing Interactive systems*, 12–21.

Winograd, T., Flores, F., & Flores, F. F. (1986). *Understanding computers and cognition: A new foundation for design*. Intellect Books.