Narratives of Blended Experience

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This paper focuses on interaction across and between the physical/digital divide. We use blending theory to design for these situations, otherwise known as conceptual integration. Initially, this paper offers a discussion of the literature around blends. From this literature, we applied Benyon's (Benyon, 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 reworking Blended Spaces into a model that novice designers could easily conceive and apply. 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.

RESEARCH HIGHLIGHTS

- This paper examines the use of conceptual integration or blending as a tool for designing applications that cross the digital/physical divide.
- The paper highlights a novel use of speculative storyboards to communicate design concepts.
- The paper concludes by highlighting the experiential nature of designing these applications and offers a model of blended experience.

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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 (Benyon, 2014, Imaz & Benyon, 2007) and blended interactions (O'Neill & Benyon, 2015), which draws from Fauconnier and Turner's (Fauconnier & Turner, 2002) work on conceptual integration also known as blending theory. Numerous approaches for creating interactions across the physical and digital inform our work.

Blended Experience (O'Keefe *et al.*, 2014) extends blended spaces to take account of the experiential. We also integrate principles from the Trajectories framework (Benford & 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 (Benyon, 2014) Blended Spaces as a means to design. Students used observation, interviews and surveys to expose opportunities

for designing novel interactions. Visitors told us 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 & Raby, 2013) and design fiction (Bleecker *et al.*, 2022, Brown, 2016, Flint, 2016, Sterling, 2005). 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.

2 Theoretical Background

Fauconnier & 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.
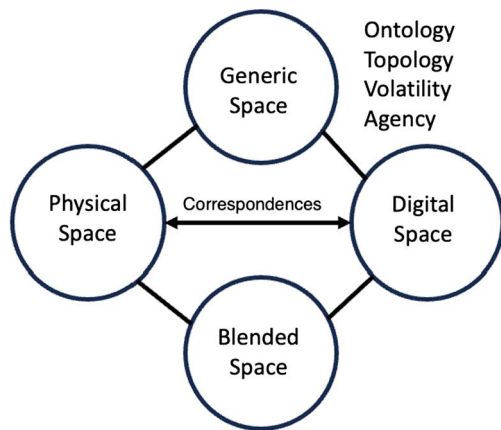

FIGURE 1. Conceptual blending in mixed reality spaces (Blended Spaces) from Benyon (2014).
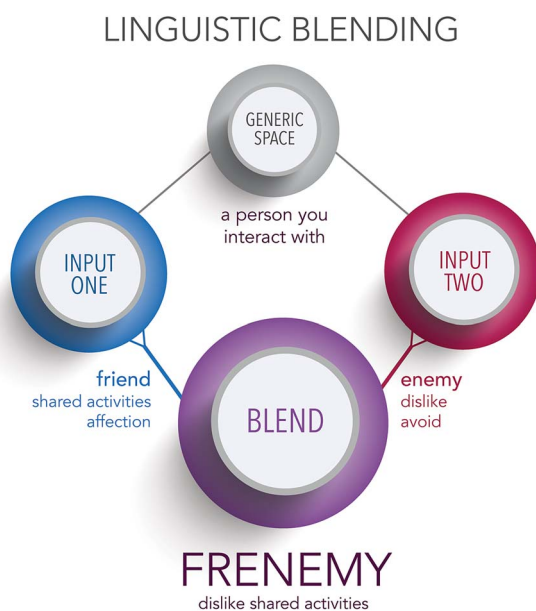

FIGURE 2. Blending Frenemy

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 a concept from the input space of a friend, someone one thinks of affectionately and seeks out their company, and a concept 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 & 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. Bødker & Klokmose (2016) link blends and metaphors. Blending and conceptual integration inform semiotic studies (Brandt, 2011) and narratology (Herman, 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 & 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 of manipulating the blend, 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 & 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. Using these constructs results in a new blended space with a unique social, conceptual feel and an altered 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 & 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 idealized 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 (Bødker & Klokmose, 2016, O'Neill & Benyon, 2015). 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, 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, 2016, Søndergaard & Hansen, 2016, Sturdee *et al.*, 2017) to prose (Blythe & 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.
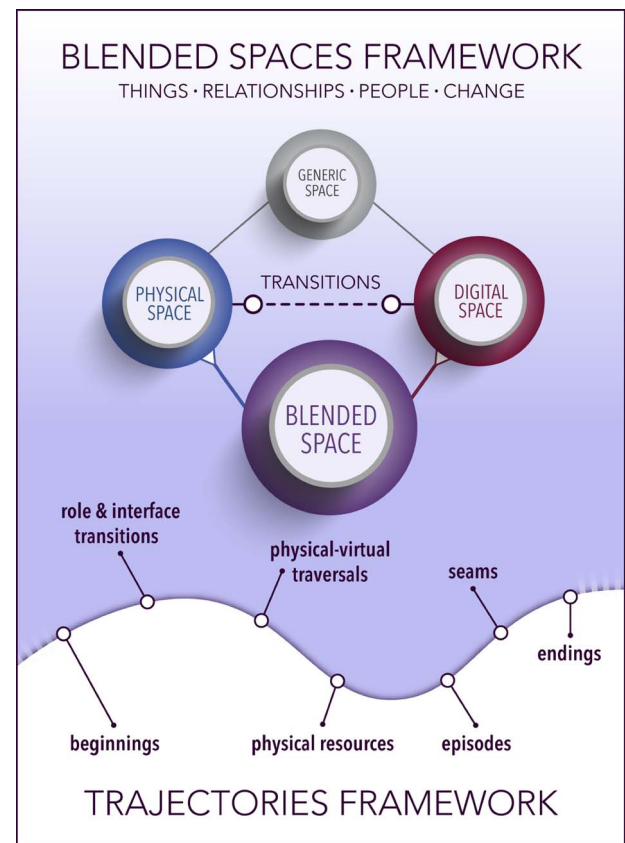

FIGURE 3. Blended Spaces Framework as presented in our workshops.

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 of 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 & Benyon (2007) initially proposed Blended Spaces to consider digital/physical interactions in the built environment. For our workshop, Blended Spaces was developed into a working framework for applied design; see Figure 3. This Blended Spaces Framework 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 (Benford & Giannachi, 2011) Trajectories Framework. We also simplified the language of ontology, topology, agency and volatility to things, relationships, people and change. Additionally, in order to prompt our students to consider trajectories, we used the term transitions rather than correspondences.

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 between physical and digital spaces and back again (O'Keefe & Benyon, 2015).

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 stadiums. 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 the Edinburgh International Festival and the Edinburgh Art Festival. Over the month of August, the population of Edinburgh doubles, and the city transforms. The festivals became the focus of our research investigation with the goal of identifying visitor, performer and promoter pain points during the month-long event. Our workshops concentrate on human-centred design practice (Benyon, 2019) and employ 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 in 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 Jupiter Artland, a local contemporary sculpture park, 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 & 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).

Thereafter, 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 produce semi-structured interviews.

FIGURE 4. Prototype for Sustainable Hobnobbing Storyboard.

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 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.

Through this process, 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 from 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 proposals; 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—200 were visitors, 102 were show promoters and 87 were performers. A total of 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 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 opinions matter.
- Would like to socialize and meet new and exciting people around them.

Promoters

- Generate a large number of leaflets and poster paper waste.
- There is 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 & 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 (Benyon *et al.*, 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, such 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. A plethora of printed posters surround them; Mike is particularly skeptical 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 skeptical as he squints at Laugh Traders on his wrist. He starts to loosen up once he realizes 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'. On the other hand, Mike's review is a resonant "Hilarious!"

As they step outside, Mike feels the smartwatch vibrate again: he has received a promotional discount to 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

TABLE 1. Laugh Traders Storyboard

TABLE 2. Laugh Traders Storyboard
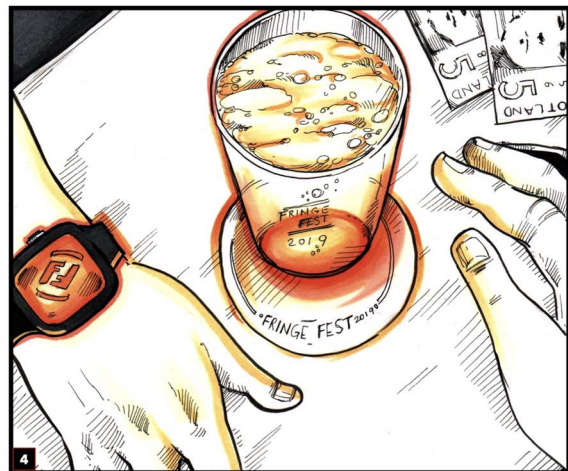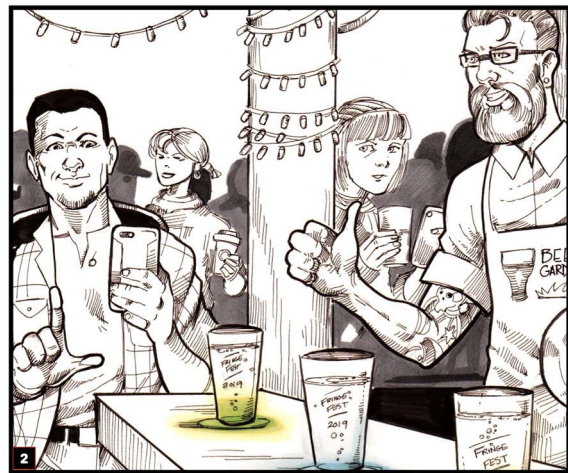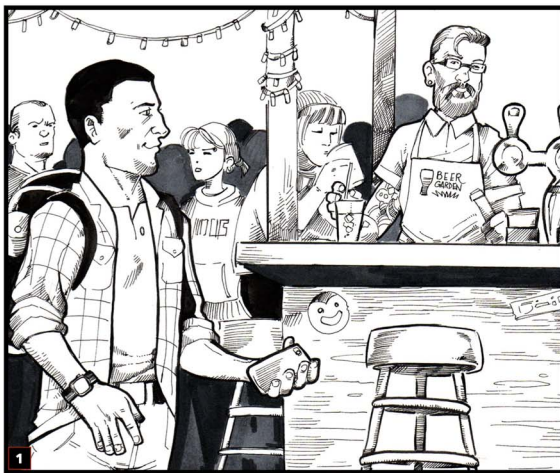
TABLE 3. Sustainable Hobnobbing Storyboard

TABLE 4. Sustainable Hobnobbing Storyboard
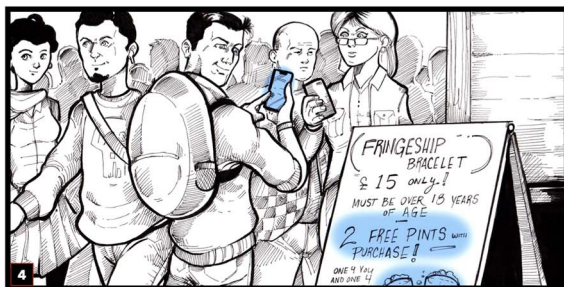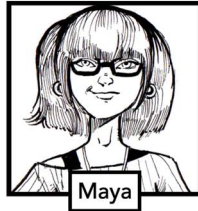
TABLE 5. Fringeship Bracelet Storyboard

TABLE 6. Fringeship Bracelet Storyboard

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-reactions 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 democratization 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 links to his watch 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 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.
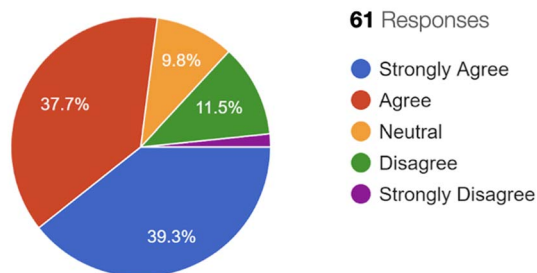

FIGURE 5. Visitors: Annoyed by flyers — 61 responses.

3.3.5 Visitor Feedback

FIGURE 6. Visitors: I talk to random people — 76 responses.
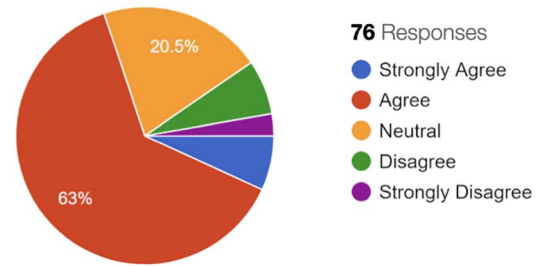
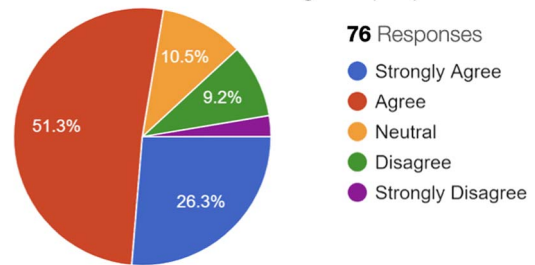**FIGURE 7.** Visitors: Want to Socialize — 76 responses.

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 socialize with others. This data point prompted the question of whether people were interested in socialising with someone new. Further data points demonstrated that they were interested in meeting new people around them at the festival, getting 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 (colorization 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 the large amount of waste he sees from flyers and 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.

Visitors: I use flyers to help me choose shows
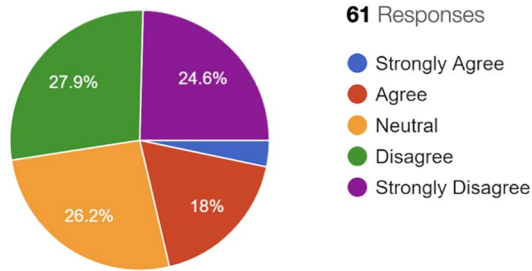
FIGURE 9. Visitors: Flyer effectiveness — 61 responses.

Promoters: Visitors easily accept my flyers
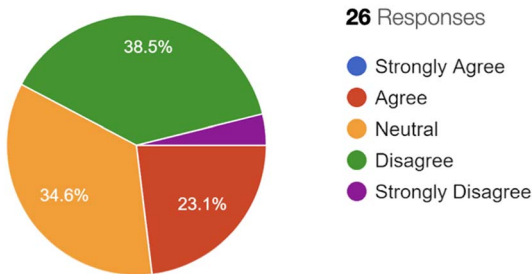
FIGURE 10. Promoters: Flyers Acceptance — 26 responses.

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 for or uses them. The same goes for 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, our data shows 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 socialize. 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 Ontology, Topology, Agency and Volatility.

In our work with students, we find that students struggle with the verbose language of these terms and have simplified them

BLENDED EXPERIENCE
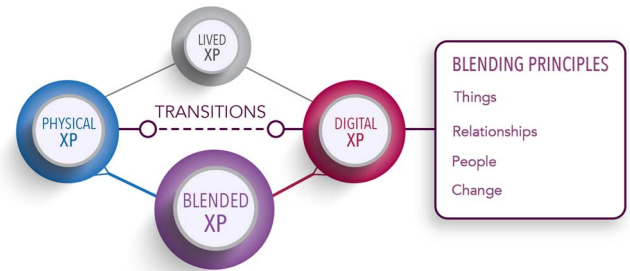
FIGURE 11. Blended Experience

using the terms Things, Relationships, People and Change. These terms are more straightforward and act as scaffolding when applying blending tools and frameworks.

We argue for the high value of considering blending theory when designing for interaction in and across physical and digital spaces. Blending or conceptual integration is difficult 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 Trajectories Framework (Benford & Giannachi, 2011), are 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. Therein, the product is the experience, not the system or device. This consideration led us to consider transitions as opposed to correspondences, as originally proposed by Benyon (see Figure 1) to transitions.

Architecture and 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 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 take place as people move through physical space. Using our approach coupled with speculative storyboards provided us with an approach to designing 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 relation-ships with people. The harmonized 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.

Our evaluations provide us with a means for interrogating each speculative evaluation in its own right, but also a formal means for evaluating the framework itself. For example, we are currently using the storyboards presented here in a series of factor analysis studies.

This approach may be further evaluated by utilizing 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 Blended Experience (Figure 6) providing an accessible and well-grounded approach to interaction design. Blended Experience is appropriate for students and novices, as well as experienced designers developing novel interactive experiences in a contemporary context.

5 Conclusion

We have developed a practical approach for designing blended experiences by making Blended Experience a valuable tool for students and practitioners. This paper offers three contributions.

Our first contribution is an evolution of Benyon's Blended Spaces reframing it as Blended Experience. This method is an accessible adaptation of Benyon's discussion of blended spaces, affording an understanding of the complexity of blending in real-world situations. Reframing blended spaces to blended experiences and translating the principles of Ontology, Topology, Agency and Volatility to Things, Relationships, People and Change simplifies the language used in applying conceptual integration for interaction design.

The second contribution is a combination of Blended Experiences, narrative storyboarding and Speculation. This combination integrated into the traditional human-centered design process is of value for students and practitioners. Our results provide three effective narrative examples when designing different contexts for interaction within and across physical and digital spaces. 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 the Human–Computer Interaction community.

In our third contribution, we demonstrate that Blended Experience can contribute to real-world problems and scenarios. By creating and examining potential interactions through speculative narratives set in a near-future Edinburgh Fringe Festival, we demonstrate the method's efficacy for identifying novel interactions across and between the physical and the digital.

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