

Exploring a digital economy design space in theme parks

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ABSTRACT

This paper describes a creative process in which findings from a set of empirical studies were used to inspire and inform a novel design space populated with conceptual designs. Our subject of inquiry was the theme park, and we were particularly interested in exploring souvenir creation and consumption as part of the visitor experience. In presenting a rich case description of our design process and concepts, we demonstrate the potential contribution of design practice to an interdisciplinary research programme delivering understandings on human, infrastructural and innovation concerns in the digital economy.

Keywords

Service design, visitor experience, theme parks, Ubicomp

INTRODUCTION

This project forms part of a broader academic research programme to explore social and technological issues surrounding the notion of a ‘ubiquitous digital economy’ [11]. The programme has a central objective to elaborate interdisciplinary perspectives on the analysis and design of digital services, and actively engages industry partners amongst other stakeholders. The overall research agenda is structured around three key challenges previously identified for those living in a digitised world: an infrastructural challenge, whereby interactive systems and services are distributed and potentially cloud-based; an innovation challenge, to conceptualise new digital economy models and values; and a human challenge, to address associated personal, social and societal ethics and experiences.

Research also tackles key subject themes that invite empirical projects in particular domains. The work presented in this paper explored the ‘experience of cultural visiting’ as a feature of tourism and leisure in the digital economy. Whilst addressing all three challenges, the related project, engaged computer scientists, social scientists and designers. It focused on the *human* challenge and was, in disciplinary terms, ‘*design-led*’. The project aimed to open up an emerging design space for supporting visitor experience in theme parks, which included support to souvenir creation and consumption. Herein we present a

number of concepts that were generated from that exploration. These concepts were inspired and informed by empirical studies of theme park visiting and developed through imaginary use-scenarios. The work of designing, critiquing and developing such concepts constituted a reflexive design process that we found contributed significant socio-technical insights to the project. The aim of this paper is to describe this process and demonstrate the contribution of interaction design practice to an interdisciplinary research agenda. In doing this we present a case study of design practice that innovates on the use of ‘design workbooks’ [9] and delivers socio-technical understandings about life in a ubiquitous digital economy.

Empirical work on theme park visiting experiences

Discourses on human-computer interaction (HCI) and ubiquitous computing (Ubicomp) have explored forms of *visiting* for leisure and tourism in settings including museums [2, 8], zoos [14], rallies [12], cities [4] and the countryside [13]. Visiting is established as a highly social phenomenon engaging groups, and it has been suggested that successful technologies for support to visiting should be designed to resonate with the social practices in which visiting is embedded. For example, in related work considering the novel context-aware, mobile technologies for visiting, Brown and colleagues [4] have explored how visitors collaborate around electronic guidebooks and maps and negotiate on coordinational activities surrounding use.

Building on the extant literature, we recently conducted an empirical study of theme park visiting. We approached the theme park as a distinct setting, or ‘cultural ecology’ [2], for visiting, and one that has been relatively underexplored in HCI and Ubicomp to date. The theme park appealed to us as a place that people visit for thrilling and ‘out-of-the-ordinary’ experiences, and also as a technological proving ground with a rich mix of complex systems that support thrill rides and their recording for posterity. It also appealed as a commercial enterprise that exploits the provision of added value services through its dedicated infrastructure. As such the theme park provided an appropriate setting to explore design opportunities surrounding our three digital economy research challenges.

Our empirical work pursued two design-oriented lines of inquiry: to support ride experiences and souvenir making. Qualitative field research was conducted by accompanying three groups of visitors to a UK theme park, Alton Towers Resort [1]. At the time we visited, this park attracted

around 2.8 million visitors per year, and formed a resort site with flagship roller coasters set amongst gardens and other attractions. All attractions were organised around themed zones, and were distinctly branded. Our visiting groups were recruited via a snowballing method and constituted: one, a mix of friends and colleagues; the second, a mix of friends and family; and third, an extended family. Participants were self-selecting, as frequent visitors who lived locally to Alton Towers. Field research was followed up, three weeks after each visit, by an interview with the respective groups at their home or workplace. Accounts of experience were analysed and preliminary design considerations were generated. Details of the sample, procedure and analysis are comprehensively reported elsewhere [7].

DESIGN CONSIDERATIONS

Our fieldwork produced preliminary socio-technical understandings about how visitors experience a theme park, and how they orient to the technologies and souvenir generating infrastructures found therein. In the following section, we will summarise key findings, again reported fully elsewhere [ibid], and describe the insights that we took forward in our conceptual design process.

Findings on theme park visiting

We found that visiting the theme park and riding a flagship coaster was often experienced by visitors and represented afterwards as a ‘rite of passage’. Visitors of various ages found themselves – either willingly or through chaperoning – confronting their fears’ of riding a coaster for the first time, and marking the achievement afterwards. The notion of ‘rite of passage’ was commonly voiced during visits and also when later in recall. The theme was also embedded in souvenir consumption and supported by ride-branded merchandise, such as, for example, medals bearing the claim ‘I survived’. The adrenalin rush felt from conquering rides was punctuated by the consumption of food and drink during visits, and snacking became a feature of visiting.

Taking *personal* photos was an enjoyable and integral part of visiting, alongside the consumption of on-ride photography. On-ride photos were valued in cases where the scale and speed of the ride architecture made personal photos hard to take. However, visitors used personal photography, and in particular the review capabilities on their Internet-enabled camera phones, to playfully capture and share ‘Candid Camera’ moments as part of the day’s entertainment. Indeed in many cases, the on-ride cameras and associated park services didn’t capture riders as they wanted to be portrayed, and, by contrast, personal photos had greater value in allowing riders to pose for posterity.

Spectators fulfilled an important role as photographers, and as such were found to actively participate in ride experiences. Taking photos gave spectators an important activity to do when they would otherwise just be watching or waiting for others. This in-group photography, facilitated by spectators, captured more than just the ride experiences and played heavily into storytelling around visits.

The value of the on-ride photos captured by the park systems was not always known at the point of sale, which presented a barrier to purchase that was compounded by the high cost of the packaged product. Also, the window for purchase was small and *only* present upon alighting from a ride; at this point, mixed feelings were expressed within groups towards the on-ride portrayals because different members wanted to describe ride experiences in different ways; and the lasting significance of on-ride photos was not always ascertained until after the visit when they were no longer available for purchase. Also, inclusivity was an issue: in some cases due to height restrictions, children were turned away from rides they were anticipating to go on and excluded from both the experience and the on-ride photo. These various findings pointed to a broader theme, commonly voiced, of ‘getting value for money’. Using the on-ride photo consumption by example, we found visitors’ experiences and their representation through souvenirs to be greatly shaped by a perceived return on investment, in both monetary and symbolic terms. This combined with perceptions of park service delivery meeting expectations.

Significantly, this sense of value acquisition, balanced between park service provision and visitor activity, was extended beyond a single visit. For example, whilst the purchase of Annual Passes promised opportunities for repeat visiting at a discounted fare, social networking sites created digital platforms beyond the park for demonstrating the lasting significance of personal photos shared post-visit. Overall, we recognised a tension between the provision of added value services by the park and the opportunities provided by personal digital technologies in and beyond it.

Inspiring and informing design

From our detailed analysis of the field site [7], we elicited four opportunities for potential innovation to support theme park visiting in the digital economy. One key consideration was to *reconceptualise the materiality of souvenirs* to incorporate digital media and making physical souvenirs from digital data. Visitors’ use of smart phones was prevalent in and beyond the park, highlighting the potential for the provision of location-based services and balancing personal and professional capture. Therefore, secondly, we considered a design space for visitors and the park systems to collaborate in the capture and representation of park experiences in order to *co-create souvenirs*. By doing so we raised new economic and business implications. This was coupled with a notion that, thirdly, people’s interactions with systems and services may be captured as a digital trail of activity, or ‘*contextual data footprint*’, to be leveraged in service design. A fourth consideration was to critically explore what it might mean to conceptualise the theme park as *Data Manager*, a centralising entity and dedicated infrastructure, with discrete agency for intervening in visitor activities. Taken together, these considerations meant exploring novel forms of souvenir creation and consumption and raised interesting issues on ethics and agency, as human concerns for service design.

DESIGN PROCESS

Our design inquiry took place iteratively within our ongoing research programme. The aforementioned considerations were used as sensitising concepts for framing discussions at a participatory design workshop, held at an early stage in the design process. This workshop engaged an interdisciplinary group (c. 20 people) of academic and industry partners (including those working for existing theme park souvenir companies). Discussion of the sensitising concepts was supported by the presentation of data from the field. In sub-groups, workshop participants then iteratively developed and critiqued a series of conceptual designs for novel souvenir services utilising digital technologies. The workshop event was documented, and the output collated.

This output was subsequently utilised by the project's two interaction designers as a resource for inspiration in the course of their further sketching and ideation exercises [10], and new conceptual designs were generated.

Design picture-book

Eight of these designs were selected for inclusion in a 'design picture-book', a print-based, illustrated document comprising pictures, diagrams and written text. The selections were not intended as socio-technical solutions to 'problems' per se, but rather as a means to conceptualise and represent a set of challenges and opportunities being raised by our research. The book thus served as a reflexive tool in an ongoing process - of observation, analysis and sketching - that was grounded in the empirical findings outlined above. The book's purpose was reflected in the aesthetic decisions made about the graphical style and rendering of content.

Imagined park scenarios and characters

The conceptual designs were described in the book through character-driven scenarios of use [5, 6, 16].

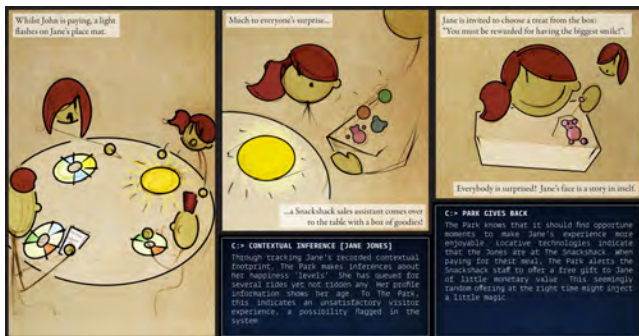


Figure 1. Example page from the design picture-book.

Other HCI researchers have critiqued scenario use in the design process, in particular suggesting that it closes down interpretation by stakeholders (including researchers and research partners) of how designs may be used, evaluated and developed [9]. In the case of this project, however, we felt that scenarios were important to our design process, and, within the scope of this paper, we go some way to explain why. We further argue herein that scenarios can

actually be used to open up rather than close down a space for interpretation and ideation.

Our scenarios were inspired by our real-world visits to Alton Towers Resort [7]. The backdrop for them is an imaginary theme park – hereafter referred to as ‘The Park’, depicted with three imaginary zones, and populated with fictional characters visiting The Park in three imaginary groups. The Park site and characters’ development, along with their social behaviours and intra-group relations, were inspired by our real-world observations.

Let us briefly introduce our characters. One nuclear family comprises Jo and John Jones, and their children Jack (aged 10 years) and Jane (aged 7). Jack is a thrill-seeker and keen park-goer, whilst his father is fearful of coasters. A second group comprises three friends, Bill, Bob and Bella. In this case, Bob is the fearful rider; coasters make him feel ill. A third group comprises an extended nuclear family, comprising Sam Smith, his father Simon, and grandfather Saul. ‘Park’ is Data Manager and an over-arching theme park system infrastructure and has considerable agency as a character, looking for opportunities to engineer happy, serendipitous moments in visitor interaction that promote Park benevolence as part of the visiting experience.

Imagined scenarios from multiple perspectives

Within the book, we adopted three perspectives to describe each of the scenarios: the visitor perspective portrays the experience; the system perspective portrays how Park interprets visitor interaction; and the ‘voice’ of the research team provides the design rationale, connecting the scenario to the original empirical insights. By creating ‘multivoicedness’ within our scenario development, we were able to weave through scenarios multiple accounts of what was happening. By doing this, we intended to convey the notion of there being multiple possible perspectives on an interaction in The Park in any given scenario [16].

We re-iterate here that the concepts developed within the scenarios were not positioned as product ideas, rather as a means to invite ideation around instances of theme park activity by stakeholders in our research. We highlight the efficacy of the imaginary space for developing and evaluating design ideas more rapidly and flexibly than may be possible with physical prototyping [5, 9]. Indeed the scenario-building exercise was carried out by our project team in complement to a physical prototype development and ‘in the wild’ deployment by the research team [7].

In the remainder of the paper, we present three of the eight picture-book concepts, and then foreground the research insights that have been generated through the process of developing them. Given space constraints herein, their presentation has been adapted to suit the two-column format; the different perspectives on the scenarios are depicted in the following ways: the ‘Park systems’ voice’ is represented through sub-headings and blue diagrams; the visitor perspective is represented through sketches and italicised descriptions; and the researchers’ voice is represented through the accompanying text.

SOUVENIR CONCEPTS

Daemon Guide

The Park presents visitors with an array of interfaces to its resident systems, such as websites, interactive maps, video displays, and handheld devices. The 'Daemon Guides' are customisable avatars that give a playful, unified face to these systems, and tailor individual visitor experiences.

C: > CREATE ACCOUNT AND PROFILE



Visitor interaction with The Park begins with accessing its system online, typically when planning a visit, and creating an account and profile.

Jo goes onto The Park's website on behalf of the Jones'. She gives a unique identifier, associated with a profile she creates.

C: > CREATE DAEMON



Jo is then invited to create an avatar, a Daemon Guide for mediating her personalised interaction with Park. Jo names her daemon Jim-Bug and gives him a top hat.

C: > BUILD ITINERARY



Jim-Bug asks Jo about her motivation to visit and who is visiting with her.

The Daemon Guide makes recommendations for visitors, helps them plan their day and build an itinerary. Jo knowingly provides personal data to 'Park', the first data it gathers to generate a contextual model of its visitor.

Daemons may be associated with individuals or groups depending on preferences set in the profile manager, and may manage and direct other daemons' activities. Visitors can make these links a permanent feature of a profile (e.g. linking daemons of a family unit) or specific to a single visit (e.g. friends linking their daemons for a shared visit).

Our fieldwork showed us that people visited theme parks in groups yet had differing motivations for visiting and wanted to do different things at the park. A key challenge when planning was to manage multiple in-group interests and capture individual experiences alongside shared ones.

C: > DAEMON LINK



Jack already has a profile on the Park system, and a daemon guide, Pirate Jack. Jo is invited to link her profile to her son's.

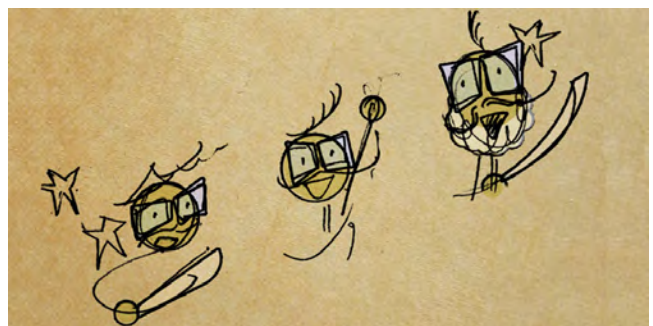
The system allows the two daemons, Jim-Bug and Pirate Jack to become linked, and for Park to make sense of both contextual data footprints when Jo and Jack visit together.

C: > DAEMON FACEPAGE NOTIFICATION

Bill is recognised as a frequent park visitor and already has a daemon guide. Bill's daemon uses Facepage, a social networking site, to notify him about a new ride that he might like, and invites him to plan a visit with those he previously visited with. The daemon makes use of the contextual data stored in Bill's Park account; in this case, information related to his previous visits. Bill proposes a visit to his friends, Bob and Bella, via Facepage.

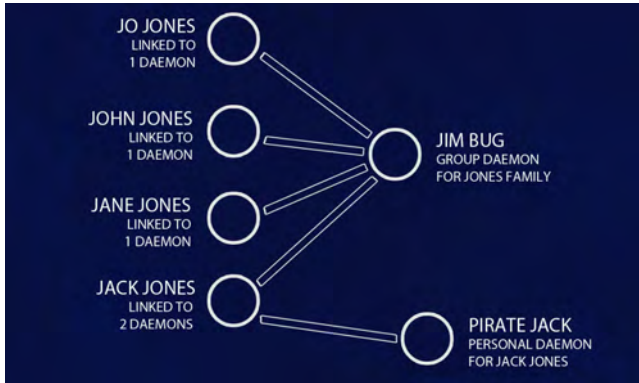
The integration of The Park's systems with social networking services leverages simple coordination mechanisms for planning visits.

C: > EDIT PROFILE



Simon is recognised as the administrator of the Smith's family account. Park enables him to create daemons for the Smiths. He envisions them as The Three Musketeers! However Saul and Sam are able to log in and edit their profile along with their daemon characteristics.

Our studies showed that some group members were more proactive than others in planning and directing a theme park visit. This finding is catered for in The Park by just two daemon guides being created within a group of four.



Park takes into account the interrelationships between the Jones' individual profiles and the two connected daemons.

Daemons afford different kinds of representation, depending upon how they are created and associated with people. As such, the concept of a daemon guide invites us to reflect on group dynamics and who manages visiting activities, and also the identities and preferences of others.

C: > LOCATION SENSING

The following week, the Smiths arrive at The Park, followed shortly after by the Jones', Bill, Bob and Bella.

Upon arrival at the entry gates, position-sensing technologies come into play to locate The Park's visitors. If Park can tell where a visitor is, it can add to the contextual data related to that visitor and also provide them with tailored information - e.g. provide estimated queue times or signpost nearby attractions.

The daemon that mediates these interactions is made available to the visitors through different applications, including a digital screen interface embedded in Park-provided wristbands (personal worn displays), and as a downloadable smart-phone application. Provision of wristbands ensures visitors do not miss out on services that older or simpler mobile phones would be unable to support.



Whilst Jo, Jack and John launch the mobile app, Jane is given a wristband because she does not own a mobile phone. Jim-bug appears on all devices except Jack's; Pirate Jack appears on his. The daemons give tips for where to go and what to do.

Park wristbands can monitor visitor location. They contain position-monitoring technologies including assisted GPS, mobile phone triangulation, Wi-Fi, Bluetooth beacons and

RFID touch-points. Different techniques work well in different situations, and the location-based features are inter-connected with The Park servers so that information on visitors' activity is synchronised across devices. Daemons may be ubiquitously present in the screen applications for the Park systems and devices throughout the site, including electronic billboards and park furniture.

C: > INITIAL ASSIGNMENT OF VISITOR TYPES

To personalise the visitor experience, Park infers what 'type' of interaction each visitor wants to entertain. In the first instance, visitors are assigned a broad category 'type' based on their responses to the questions asked by Park when creating their account and profile.

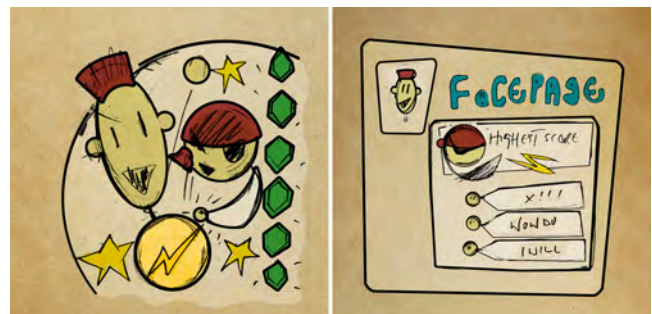
Park discerns three basic types of visitor: Trail Blazer; Trail Hunter; and Trail Finder. Trail Blazer represents visitors who want to do as many thrill rides as possible and enjoy gaming. Trail Hunter represents visitors who enjoy gaming as a social activity, like Geo-caching or doing Treasure Hunts. Trail Finder represents those who aren't interested in gaming, but wish to experience 'a bit of magic' during their visit.

When Jo set up her account, Jim-Bug assigned her a Trail Finder ID as her interests focussed on 'family time' rather than 'seeking thrill'. Jo assigned husband John a Trailblazer ID so he could chaperone Jack on 'big rides'.

C: > GAME-PLAY FOR DIGITAL TOKENS

Visitors who have expressed an interest in Game-play and assigned a suitable visitor type may also be invited by their daemons to play specific location-based games at The Park. This involves collecting digital tokens from physical locations in the Park environs ('picking-up' geo-cached information based on proximity and duration at locale). Tokens are associated with rides, Park furniture, or branded zones. Visitors are rewarded for findings tokens, scoring points for every token they collect and how.

Game-play characterises The Park as an integrated and extensible network. Park may track visitors through the site and accumulate 'contextual footprints' of activity. This affords dynamic interaction between Park, its services and visitors, leveraging opportunities to guide visitors to areas they might otherwise miss. This also engages groups of visitors in collective purposeful activity, a concern that resonated with visitors observed in our field studies.



Whilst journeying to The Park, thrill-seeker Jack had looked at his previous Game-play score on his mobile phone. Previously

he'd established himself as a Trailblazer. On this visit with his family, Jack stays in contact with his friends via Facepage as they are more interested in Game-play than his family are.

The Game-play options offer different levels of engagement. Visitors can opt in and choose how they will participate by editing their profile. Those that have gamed before at The Park will have left a data trail that invites social exchanges and competition with friends, family and even strangers, for example via Facepage groups. In this way, the results of Game-play suggest a novel form of souvenir that can be enjoyed, and shared beyond the visit.

C: > PARK AT PLAY

As Jack enters the Park, Pirate Jack invites him to 'trail-blaze' the Heavy Weather Zone. John is browbeaten into chaperoning his son, by both his family and by Jim-Bug.

Through the daemons, Park invites competitiveness and play, provoking visitors to territorialise and claim rides and zones. Park will also feed information relating to game-play to external social networking sites.

In our field studies, we observed social competitiveness about the 'most thrilling and most scary' rides people had been on. This extended beyond the group, to those absent but in remote communication. It also extended beyond the visit. We wondered how leveraging the affordances of sensor-based technologies might support this. The Park could be equipped with biosensors that detect fear or other heightened emotional states; Game-play could offer extra points for displays of fearlessness.

Jack conquers the Flame ride and gathers new tokens, adding to the ones he had collected on previous visits. John is not a Trail Blazer at heart, and is yet to gather any tokens at all - and Jim-Bug lets him know this!

C: > DISPLAY GAMEPLAY SCORE

Jack's Game-Play score for the Heavy Weather Zone is broadcast (via his daemon) to his Facepage profile and to a digital billboard display in his vicinity. Park uses available channels (internal and external) to present his Game-Play score back to him.

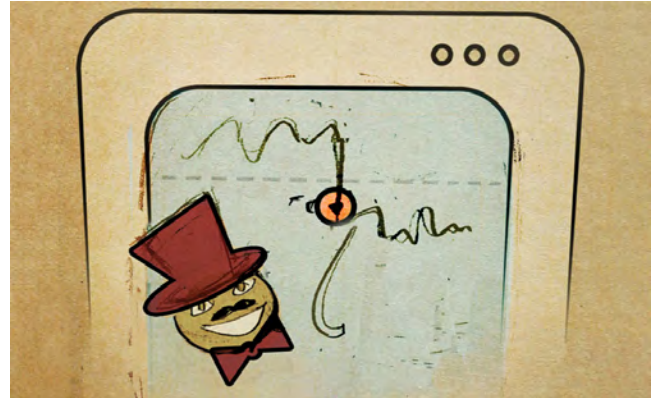
The representation of in-park experiences (collected within a contextual data footprint and mediated by the daemons), allows individuals' activities within The Park to become enmeshed in social networks both within and beyond it, inviting more socially inclusive experiences.

Snackshacks

Field findings showed how energy levels shaped visitors' experiences over the course of their visit. Sustenance was a central talking point between visitors, and taking time to eat together was key to ad hoc planning. It was also found to direct emotional states and social dynamics.

Group consumption of refreshments in a theme park provides a context for the social consumption of souvenirs. The concept of Snackshacks cater for this by providing a convenient locale for situating interactive tabletop displays. Visitors may view, share and triage park-captured media on the Snackshack tables whilst consuming food and drink.

C: > DAEMON SUSTENANCE RECOMMENDER



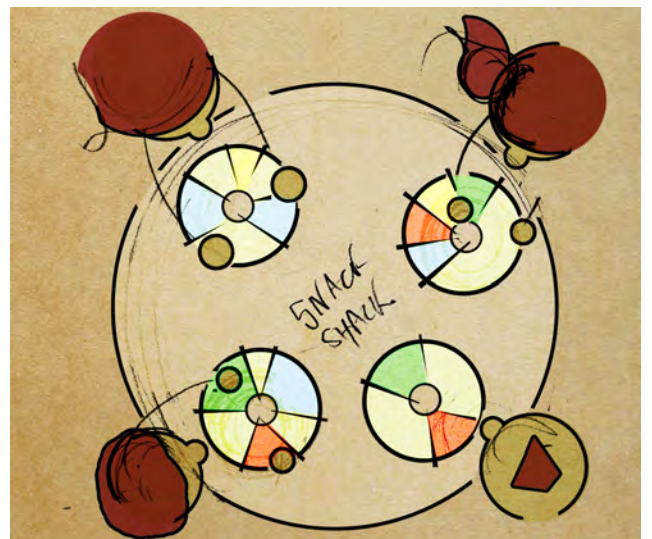
Upon leaving the Heavy Weather Zone, the Jones' family reunite. John looking pale needs something to eat. Jim-Bug suggests that the Jones' visit a nearby Park Snackshack.

Prompts for sustenance are expressed through the daemons. Bio-sensed data informs daemons' recommendations and itinerary planning. The Park's biosensors include non-invasive glucose monitoring that detects low sugar levels and indicates a visitor's 'need' for food. This is triangulated with contextual data on time passed since the last food purchase. Daemons recommend nearby restaurants.



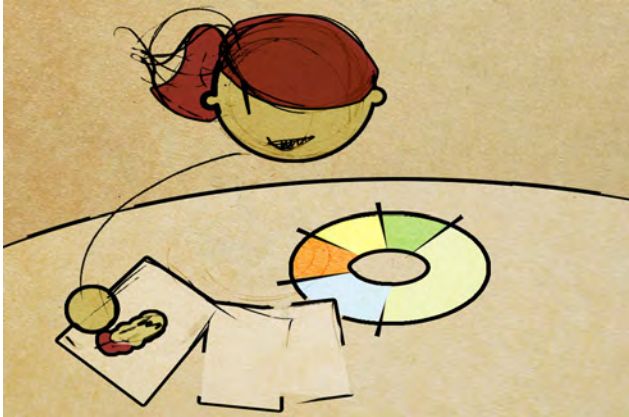
The Jones' follow Jim-Bug to a nearby Snackshack.

C: > SNACKSHACK PLACEMATS

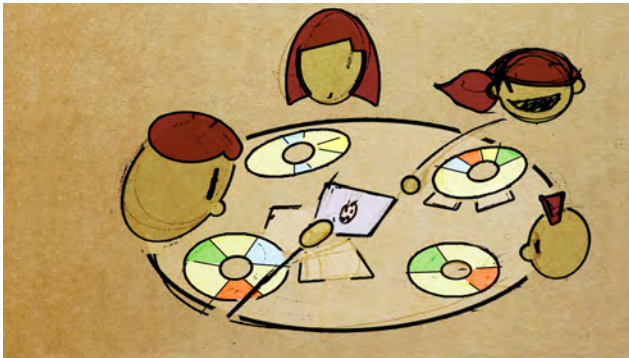


The Jones' sit at a Snackshack table. Virtual placemats magically appear in front of each person.

Each visitor's activity up to the present time is depicted on a tabletop display. Each 'placemat' resembles a pie chart, the size of each portion representing the relative portion of time spent with a colour-branded attraction from Park entry up to the present. The Snackshack placemats make visible to the Jones' the different activities they have experienced during the visit, and how these have been shared.



The tabletop is interactive. When Jane presses one of her placemat portions, media captured around the associated attraction fans out on the table.



Jane laughs at the fearful expression on her father's face, from being in the Heavy Weather Zone. She adds one of his photos to her personal collection. John tries to change the subject of conversation by calling up a virtual menu.

The Snackshack concept opens up a rich design space that facilitates the real-time consumption of souvenir media co-created by Park and its visitors in a playful manner. Embodied, tangible interaction is suggested as a means to enhance the sociality and playfulness of the interaction, core components of media sharing observed in the field.

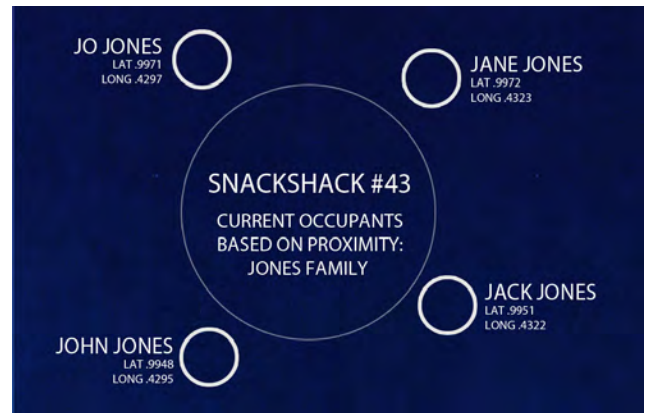
C: > CENTRALISED MEDIA MANAGER

The Jones' generate a lot of photos, videos, and other media at The Park using Internet-enabled devices, which can be automatically uploaded and stored on Park servers. Their media content, along with Park-generated media can then be viewed and managed through a variety of touch-interactive displays including the Snackshack placemats.

In the field, visitors voiced the desire to review and share media captured by the park services, with mind to creating souvenirs. They also wanted to retain access to 'all' the

media that was captured from the 'whole' visit, to retain the option to make editorial decisions later on.

C: > CONTEXTUAL INFERENCE [JANE JONES]



Through tracking Jane's recorded contextual data footprint, Park makes inferences about her happiness 'levels'.

C: > PARK GIVES BACK



Park knows that it should find opportune moments to make Jane's experience more enjoyable. Jane has queued for several rides yet not ridden any. Her profile information shows her age. To Park, this indicates an unsatisfactory visitor experience, a possibility flagged in the system. Whilst John is paying for lunch, Jane's placemat lights up. Park alerts the Snackshack staff to offer her a free gift, much to everyone's surprise! Jane is rewarded 'for having the biggest smile'!

Park locates the Jones' at The Snackshack. Combined with inferences being made about its visitors' relative enjoyment and activity levels, an opportunity for delivery of a just-in-time, value-added service, is identified. The gift given to a child could be of small monetary value, but the seemingly random offering at the right time might inject enough magic to dramatically lift a visitor's mood. In our field studies, we observed moments where younger members of groups were inadvertently excluded from park activities because of age and height restrictions; these moments seemed to impact negatively on their visiting experiences.

Magic Cam

Magic Cam is an integrated in-park photography system that leverages an extensible network of locative technologies and resident cameras distributed across the park site. It consists of a handheld viewfinder, a camera selection dial, and a shutter button. Magic Cam users can frame and capture photos from a number of the distributed cameras, including those located in inaccessible places to visitors such as on rides. It also ensures that the views provided feature the members of a designated group.

C: > ID FLAME RIDERS IN QUEUE



Bill, Bob and Bella approach the Flame ride in the Heavy Weather Zone. Bill and Bella start queuing, but Bob doesn't want to. Through use of the locative wristbands, Park can tell that Bill and Bella have entered the Flame queue and flags them as 'Riders in a Queue'. Bob, although he is in the same group and same general vicinity as Bill and Bella, is not in the queue. Park flags him as a spectator.

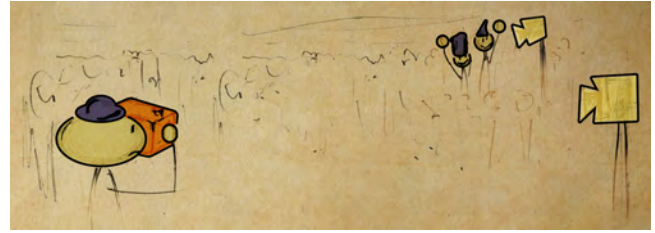
In our fieldwork we found that visitors were frustrated when they couldn't see their friends on the ride, and share in the spectacle as it unfolded. This also meant that they couldn't capture the riders at a particular moment during the ride, using their own cameras.



Bill gives Bob a Park Magic Cam that he hired upon Park entry, and asks Bob to take on-ride photos on his behalf.

In our fieldwork, we identified a central design consideration, to cater for shared engagement and shared group capture of park activities whilst catering for different preferences for rides and attractions. In these cases, a non-rider might take on the role of photographer on behalf of the others, especially since the automated capture services didn't always produce the desired shot, or produced low quality images. The Magic Cam allows spectators to engage with their friends' ride experiences in real time, and it captures high quality images.

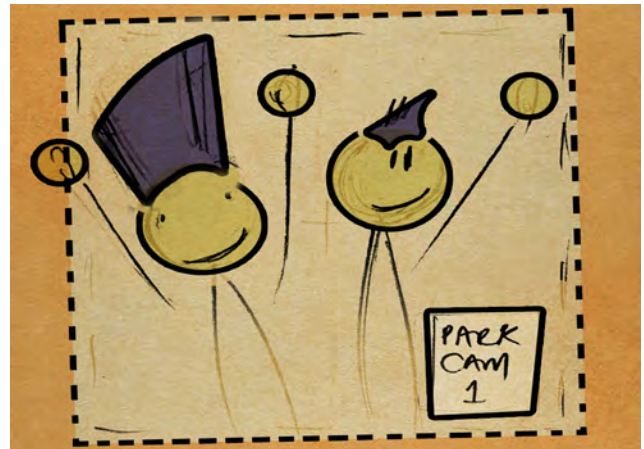
C: > NETWORKED CAMERA ACCESS



Bob obliges as 'Magic Cam Photographer', whilst Bill and Bella join the queue for the Flame ride. Whilst in the queue, they look into one of the Park Cams and wave to Bob.

Magic Cam enables its user to view live video feeds from an integrated wireless network of cameras installed in queues and on ride cars and throughout The Park. Magic Cam enables visitors to operate these 'Park Cams'.

C: > PROXIMITY CAMERA VIEWS



Bob sees the Park Cam 1 view through the Magic Cam.

Magic Cam also enables the real-time capture of photos from these feeds. Upon hire, the Magic Cam ID is associated with the visiting group. Magic Cam senses the Park Cam proximal to group members, in this case, Bill and Bella. It also senses and excludes the photographer, Bob. An alternative application for Magic Cam functionality is a software package for camera-phones.



Bill sits in Flame Car 1 and Bella in Flame Car 3. Park knows that Bob is in a group with Bill and Bella, allowing his Magic Cam to access their camera feeds whilst riding Flame.

Location sensors let Park know which car each rider is occupying. We found that spectators wanted the means to engage with riders' experiences in real time and be

proactive in capturing something of those experiences on the riders' behalf.



By turning the dial on the side of the Magic Cam, Bob can switch between the different views of Bob and Bella. Bob finds these views pretty exciting.

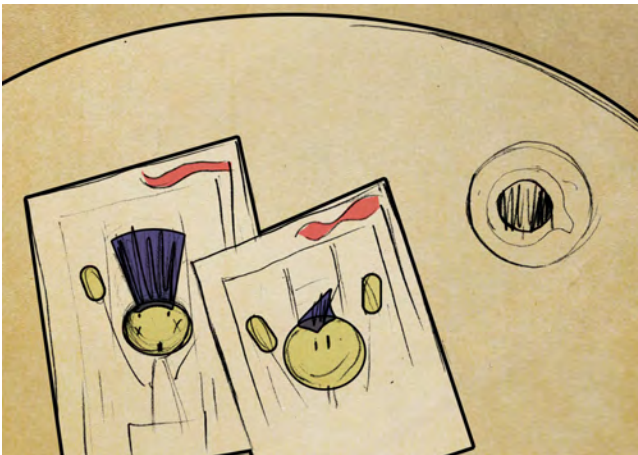
C: > MAGIC CAM CAPTURE



At Flame's scary part, Bob presses the Magic Cam shutter.

When Bob presses the shutter, Flame Cams One and Three simultaneously capture photos of Bill and Bella and send them to the Park servers.

C: > MULTIPLE DISPLAYS



Later on, Bill, Bob and Bella stop for Shackshack refreshments. They look over the Flame photos. Bob feels jealous of Bill because Bill gets to spend more time with Bella than he does. This is emphasised in the group's souvenirs.

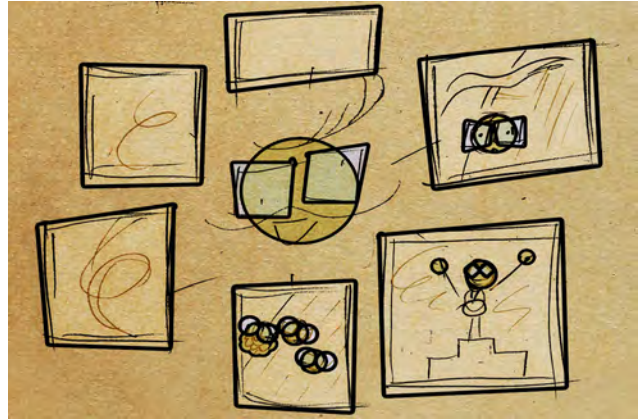
We found our real-world visiting groups wanted to review, edit and exchange media captured within them over the course of their park visit. Working together, the Magic Cam and Snackshack tables afford this collaborative photowork. The Snackshack table makes visible the negotiated use of Magic Cam within the group.

C: > MEDIA ARCHIVING

The Smiths head home after a special day out as The Three Musketeers. This family had opted to use Park wristbands for their daemon guides and returned these at the exit.

Data is not kept on the wristbands, but on The Park servers. Park takes note when visitors leave through its gates. At that point, their status changes from 'current' to 'past'.

C: > CUSTOM SOUVENIRS POST VISIT



When he gets home, Sam looks through all the media from his day at The Park, on his family's Internet-enabled PC. His media is organised by his Musketeer daemon via The Park's web-service. He deletes some photos he doesn't like and selects others for Facepage.

Park archives image metadata and cross-references it with contextual visit data, so that images can be explored via where and when during a visit they were taken. So-called 'deleted' files are actually archived by Park for later re-use.

Game-play scores can be combined with stored media and can be used to fashion bespoke souvenirs using online services post-visit. Contextual tags can be used by daemons to auto-generate media stories from one or multiple visits.

Sam's father Simon later logs on and can view Sam's edits. With help from his daemon, Simon creates a personalised, map-based poster of The Park for Sam, to give him on his birthday. Si also compiles a DVD for Saul, intended to entertain by highlighting Game-play scores. Both gifts draw on media captured by The Park, and by the Smiths, and by other Park visitors that Simon doesn't know.

The Musketeer daemon supports the construction of two media stories for Simon that depict the unfolding of the Smith's Park activities. The provocations of Park, mediated by the daemon in Game-play, help dramatise this story.

Altogether, media gathered using Park systems, Magic Cams, personal cameras, and any Game-play tokens are managed on the visitors' behalf, and organised around attractions into a personal record that may be rendered in both a digital and physical form. As well as collating one's own media, there is the option to draw upon a 'pool' of media (created by both other visitors and the park) in online public domains (e.g. social networking sites).

The notion of archiving and sharing co-created media presents interesting design challenges. In our fieldwork and interviews, visitors voiced concerns about whether or not photos captured by the resident cameras were actually deleted or could be used by the park for publicity. We also identified an apparent concern that, in the throes of using a complex system with many actors, an individual user may lose control over the capture and display of their experience, with potentially significant social ramifications.

When Bella was looking through her media archive, she came across only two photos of Bob. In one of the photos he was captured pulling a weird face at her behind her back. This must've been taken on accident by one of the Park Cams. Viewing this photo made Bella angry and, as a result, she hasn't spoken to Bob since.

Sam receives the poster for his birthday, but does not like it as much as his father thought he would because, by coincidence, it depicts photos from The Park Archive of his friends riding flagship coasters that he hadn't been tall enough to ride.

The scenarios presented in this section represent three of the eight picture-book concepts that we developed, and serve in this paper to highlight some of the most significant issues at play in potential theme park environments.

DISCUSSION

The concepts that we've depicted broadly explore a novel design space for souvenir consumption in a technologically enhanced theme park setting. In this section, we describe how our process of concept development and, in particular, the embedding of designs in imagined, character-driven scenarios, have prompted reflection on the human, infrastructural, and innovation challenges presented by leisure and touristic visiting in the ubiquitous digital economy. Our discussion orients around higher-level design considerations and socio-technical insights that have been refined through reflecting on the picture-book content.

Souvenir Co-creation

In the scenarios above we have explored the notion that theme park souvenirs could be co-created by The Park and by its visiting groups, including known *and* unknown visitors and other entities. To re-cap, our empirical findings revealed the proliferation of smart-phones amongst visitors at Alton Towers, and their heavy use as being integral to the day's entertainment, contributing alongside the on-ride photos to a media portfolio treasured for its Candid Camera quality. Set against this, we observed mixed visitor feelings towards park-provision of media due to barriers of packaging cost and availability to purchase.

In our design response we embraced the idea to configure theme park systems for balancing personal *and* professional photography in novel ways. These systems and their associated services could afford visitors greater access to the park-provided ride photos that are hard for them to take, whilst also supporting them in taking their own photos, an activity they apparently enjoy. The Magic Cam design reflects this response, establishing a novel arrangement of capture and display devices for doing photography. In our

empirical cases, the entertainment value of the *park-provided* photos stemmed from catching people off guard, rather than 'posing for posterity'. Magic Cam reinforces this quality by affording the spectator control over on-ride capture. What was valued about the *personal* photos in the field was the intentionality that came with taking them. The Magic Cam scenario aims to address the apparent shortcomings of the real-world system: Bob is actively involved in his friends' ride experience, in real-time.

Souvenir co-creation for leveraging added value

The Magic Cam concept raises interesting socio-economic implications for the theme park as a commercial enterprise and also for the visitor as being *enterprising*. The design highlights a rich innovation space for sharing *workflow* to co-create souvenirs between visitors and the park. This opportunity centres on ways in which both the park *and* its visitors may leverage added value from the personal and professional technologies made available for them to consume, rather than vie for competing value in terms of visitor versus park activities.

This opportunity is opened up more broadly in the delivery of location-based services to visitors, which utilise the information and media that *they* create and provide on their own mobile devices. We also use our design concepts to highlight the potential for leveraging value from the 'digital trail of activity' that visitors generate as they interact with both their own devices and the park. This trail can be fed back to support the park-provided services, a concept illustrated with Daemon Guides and Snackshacks.

Again, interesting socio-economic implications follow from this. First, the park may afford visitors a personalised experience that is coupled with a sense of autonomy. Also, we posit here that assuming some control over the work of souvenir production would reduce the barriers to purchase presented by the high cost of packaged products in our original field observations; the park may promote a sense of 'value for money' by offering visitors flexibility in the extent to which its media is produced and productised.

These implications may be elaborated with reference to the scenarios. For example, the Snackshacks, as part of the dedicated Park infrastructure, would provide an expanded window of opportunity for visitors to review and consume the media captured from their day. At the same time, the café creates a new commercial context for The Park to capitalise on, by offering up additional services and other 'consumables', including itinerary information provided by an agent akin to the Daemon Guide, the purchase of a meal, or the packaging of personalised mementoes.

The Park as Data Manager

We now turn to discuss ways in which our character 'Park' has allowed us to further our design thinking in the theme park setting. To reiterate, the theme park already exists as a distinct cultural ecology with a dedicated infrastructure: it is a place that offers a uniquely branded experience. With 'The Park' as a backdrop, our scenarios foreground the unique potential of this infrastructure to afford centralised

management of visitor activities. Our designs propose that all data captured about a visitor and their experiences is centrally collated and archived.

Dedicated infrastructure for service delivery

The Daemon Guide scenario introduces an interface to various Park services, enabling both active personalisation of visitor experience and the ability for designers to engender a sense of unification between the visitor-facing technologies. The Magic Cam scenario points to the suitability of Park infrastructure for distributed media creation and consumption.

Furthermore, the Park accounts and associated Daemon Guides facilitate a new form of distributed service design, catering for visitor interaction in and beyond the Park site. This is demonstrated in the scenarios with Jack and his ongoing Game-play across multiple Park visits. Jack's Game-play score and trail blazing, provoked by his daemon prompts repeat Park visiting. The Park's contextually derived inferences also address potential areas of visitor dissatisfaction, as in the Snackshack gift scenario, and promotes models of 'just in time' service delivery. Significantly, what emerges from the imagined infrastructure is a reconceptualisation of 'Souvenir' from a single, stable memento to an assemblage of multiple linked media elements that may be distributed across multiple platforms and made manifest in various forms of service.

To re-iterate, we embraced the concept of Park as Data Manager with a critical mindset, and connected it to the notion of balancing of agency between 'Park-as-entity' and its visitors. This raises a number of social and ethical challenges for design. The individual characters only have partial control over *how* the media that is captured by them or of them is to be used by others, with potentially negative consequences. This is reflected in the case of Bob and Bella and the negative emotions conjured up between them post-visit, and in Simon's use of media captured by strangers to create his two gifts for Sam and Saul; the latter scenario invites speculation on the negative potential for the reappropriation of media associated with 'other' strangers.

With the concept of Data Manager, we also explored the park as a place where visitors *trust* the management, where people can 'let go of their inhibitions' and feel reassured of their physical safety. Our designs build on this notion by inviting speculation on how the 'safety' of personal *data* may be treated in a similar way. Explicitly volunteered personal information via profile generation, combined with data implicitly volunteered (e.g. through Snackshack payments) or gathered via location sensors, may be used to model a relatively detailed portrait of a visitor's activity. By cross-referencing this data, greater levels of detail might be inferred, with interesting ethical implications.

The possibility for contextual inference reveals a key design implication: the need to mask the potential fallibility of any underlying inferred behaviour, leading to an action taken on the part of the park. In the Snackshack gift-giving scenario, Park infers that Jane is having a bad day. The

Jones' are *not* presented with this inference, but instead given an unrelated reason (Jane's big smile). If the Park systems had been incorrect in this inference, this may be viewed as an error, with trust implications. Thus, the visitor experience was improved without the potential for the visitor to view The Park systems as being in error. This speaks to a broader need to design for the apparent 'felt' relationship between the visitors and The Park.

Using Picture-book scenarios

As a final part of the discussion, we reflect on the methods we've adopted in our design process and address the paper's proposed contribution. The use of visual storytelling has previously been described as an efficacious tool for user-centred design [5, 6]. Our development of the picture-book contributes to a broader investigation within HCI and Ubicomp into the use of the sequential art format for visual storytelling [15]. Within this paper's scope, the picture-book content and structure is only partially represented (see figure 1). Our central motivation herein has been to describe a set of design concepts and communicate their efficacy in pursuing an interdisciplinary research agenda that spans human, technological and economic concerns. We now turn to discuss the development of the book as a *means* for embedding our designs in character-driven scenarios. We also discuss the methodological insights we have generated from it.

Character-driven scenarios for user-centred design

There is a growing literature in HCI that reports the use of imagined worlds and characters by designers to help engage with experiential aspects of interaction [3, 5, 16]. The use of character-driven scenarios is reported to help designers focus not just on usability goals but also *user experience* goals [16]. Character-driven scenarios enable a shift from conceiving of users as passive and living in a closed world of action, and towards imagined agents that are not governed by any particular course of action but are nevertheless relatable, observable and manipulable [ibid]. Consequently, scenario use may open up a space for interpretation, whilst affording an analytic focus on particular instances of interaction and sense making that evoke an emotional, felt response.

In our research, the picture-book format has provided a platform for *reflexive* ideation within the research team, for enabling our project's stakeholders to foster empathetic engagement around the scenarios - relating the characters' experiences to their own. The process of developing the scenarios has helped our designers evaluate the efficacy of interfaces at play in the unfolding use of the designs; the storyboards have become tools for exploring our empirical findings in ways that are rooted in user-centred design and the qualitative analysis of experience. In turn, the empirical findings have served as a means for *evaluating* and informing the designs' feasibility in the course of their development.

It has previously been suggested that scenarios may close down the play of possibilities for interpreting conceptual

designs in a research project [9]. Contrary to this, we suggest that the picture-book format and character-driven scenarios can have significant utility when opening up a design space. By harnessing the visual juxtaposition and narrative of sequential art, multiple concepts may be presented and multiple perspectives on use explored, along multiple concurrent timelines. In our project, we have developed at least three perspectives on a potential theme park environment: the visitors' (our imagined users); the Park systems'; and the researchers'. We argue that there is value in using the picture-book format to explore multiple perspectives on how designs may be experienced and interpreted in specific ways by different users or entities.

The scenarios have served to make the designs relatable to real-world *instances of use*, and to interlink the designs within a broader potential *infrastructure of service delivery*. The imaginary Park setting has framed speculative engagement with the design space: it may invite character interactions within and beyond its landscape that are not articulated in the scenario narratives or pictures, (e.g. the Park character is not visually depicted and we have invited the reader to imagine its form); it offers up the potential for the designs that populate it to be developed, or to interact with other designs, without the constraints presented by physical prototyping (e.g. barriers to resources or commitment to form). What is revealed as a result is the complexity at play in the design space of the theme park.

CONCLUSION

In this paper we have described how a creative design process has informed an interdisciplinary programme of research. We have presented three design concepts in character-driven scenarios and explained how they were developed from empirical insights and used by the project team to further design thinking, delivering socio-technical insights to the broader research programme. Taken together, the scenarios have informed the articulation of design implications for shaping socio-economic, infrastructural and human concerns in the contemporary theme park setting. By presenting the concepts, we've demonstrated a rich, emerging design space for novel forms of souvenir creation and consumption. We've also hoped to demonstrate the efficacy of working with conceptual designs in conjunction with empirical data.

We have further hoped to demonstrate the utility of character-driven scenarios in an interaction design process. Specifically, we've suggested that a 'multi-voice', picture-book format enables the use of multiple perspectives to visually convey the ubiquity of a novel theme park infrastructure in use. Further to embedding our designs in this way, we suggest that the *imagined* users bring as much to the shaping of a design space as the real-world participants do. We plan to use the book and its content in our ongoing research, and continue to critically evaluate its efficacy as an ideation tool in appropriate research contexts such as stakeholder workshops and public exhibitions.

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