Putting Trajectories to Work:

Translating a HCI Framework into Design Practice

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Abstract

One major challenge for the academic Human-Computer Interaction (HCI) research community is the adoption of its findings and theoretical output by the interaction design practitioners whose work they are meant to support. To address this "research-practice gap", this thesis takes the example of *trajectories*, a HCI conceptual framework derived from studies of mixed-reality performances spanning complex spaces, timeframes, participant roles, and interface ecologies. *Trajectories'* authors have called for their work to be used to inform the design of a broader variety of experiences. This thesis explores what is required to fulfil this ambition, with a specific focus on using the framework to improve the experience of live events, and on professional design practitioners as the users of the framework. This exploration follows multiple approaches, led both by researchers and practitioners.

This thesis starts by reviewing past uses of the *trajectories framework* – including for design purposes – and by discussing work that has previously tried to bridge the research-practice gap. In a first series of studies, the thesis identifies live events – such as music festivals and running races – as a rich setting where *trajectories* may be used both to study existing experiences and to design new ones. This leads to a series of design guidelines grounded both in knowledge about the setting and in *trajectories*. The thesis then discusses multiple approaches through which HCI researchers and practitioners at a large media company have joined forces to try to use *trajectories* in industrial design and production processes. Finally, the last strand of work returns to live events, with a two-year long *Research through Design* study in which *trajectories* have been used to improve the experience of a local music festival and to develop a mobile app to support it. This last study provides first-hand insight into the integration of theoretical concerns into design.

This thesis provides three major classes of contributions. First, extensions to the original *trajectories framework*, which include refined definitions for the set of concepts that the framework comprises, as well as considerations for open-ended experiences where control is shared between stakeholders and participants. Secondly, a model describing the use of *trajectories* throughout design and production processes offers a blueprint for practitioners willing to use the framework. Finally, a discussion on the different ways *trajectories* have been translated into practice leads to proposing a model for locating translations of HCI knowledge with regards to the gap between academic research and design practice, and the gap between theoretical knowledge and design artefacts.

Acknowledgements

That's it, these four years – which I somehow hoped I'd be able to fit in slightly less time – of reading papers, visiting an industrial partner, interviewing people, designing things, coding and building apps and websites, helping the organizers of a music festival and writing about the whole experience, have come to an end.

I would like to start by thanking all the PhD students and academics I've met in Paris before coming here and who have tried to either encourage or discourage me from starting a thesis, including Bernhard, Camille, Samuel, Alexandre, Jeff.

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Glossary

Canonical Trajectory

According to Benford and Giannachi (2011), "*Canonical trajectories* express an artist's intended journey through the performance or overall narrative" (p. 260)

Critical Theory

Jeffrey Bardzell (2009), in his paper arguing for broader and deeper engagement of HCI and interaction design with criticism and aesthetics, defines "critical theory" as "an umbrella term for the theories developed in and for cultural studies [including] literary, political, linguistic, psychoanalytic, and film theories, among others" (p. 2359). Critical theory considers knowledge as a "construction" "situated in personal, social, conceptual, political, and other dynamics" (p. 2360).

Conceptual Framework

A conceptual framework is a body of academic knowledge revolving around a set of concepts. It may take many forms, between "no more than a cluster of concepts" and "full-fledged theory" (Hill and Hansen 1960, p.300).

Design

Bill Moggridge describes design as "notoriously difficult to define" (2007, p. 647). Amongst definitions provided by the Oxford English Dictionary, the most relevant for this thesis is "the process, practice, or art of devising, planning, or constructing something".

The outcome of the *design process* may be anything that can be conceived and planned by humans, but in this thesis, I consider the design of interactive computing systems, the human activities these systems support, and the experiences that these activities are part of.

Experience

Authors of the *trajectories framework* uses the word "experience" to describe the performances and games created by mixed-reality performance artists, as well as a broader range of potential use cases for *trajectories*, such as museum visits or learning experiences. This term has several implications:

- First, as analysed by Waern and Back (2017), it implies that the object of design activities is not a single interface, or series of interfaces, but also the activities that users do when interacting with them, and the whole experience that comprises them.
- This fits well with the description of *trajectories* as spanning hybrid spaces, times, roles and interface ecologies, as "experience" (just like *trajectories*) provides a word to discuss the whole rather than its parts.
- This connects with a broader trend in HCI which focuses on the qualities of technology use in everyday life and lead to considering "Technology as Experience" (McCarthy and Wright, 2004).

Experience is a very broad term that is complex to define, but Marc Hassenzahl (2013) provides three considerations that are useful in the context of HCI and of this thesis:

- Experiences are "meaningful, personally encountered events" (as opposed to another definition of "experience" as accumulated knowledge)
- They are constructed "as stories from moment-by-moment experience"
- They "emerge from the integration of perception, action, motivation, and cognition into an inseparable, meaningful whole".

Historic Trajectory

A *historic trajectory* is a synthesized story of an experience based on one or more *participant trajectories*. Benford and Giannachi (2011, p.260) propose to "achieve this through synthesis rules that select segments from among recorded participant trajectories [and] recombine them".

Human-Computer Interaction (HCI)

In this thesis, I use Human-Computer Interaction (HCI) in its definition proposed by the SIGCHI curriculum – "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett et al., 1992, p. 5) – but also to discuss the community of researchers studying HCI and their practices. There is no authoritative way of determining what or who is part of HCI and what isn't, especially given that HCI "is an interdisciplinary area" (ibid.), but HCI tends to gravitate around a number of conferences and journals, including those affiliated to the Association for Computing Machinery's Special Interest Group on Computer-Human Interaction (ACM SIGCHI), and in particular the annual Conference on Human Factors in Computing Systems (CHI).

Participant

In this thesis, "participant" may have two meanings:

- People who have voluntarily taken part in the studies described in chapters 3, 4 and 5.
- In *Interactional Trajectories*, Benford et al. (2009, p. 713) define the role of "participant" as "a member of the public who is the main target for the experience", and contrast it with "spectators" who are not "directly tak[ing] part, or are just passing through", and with "bystanders"

In uses of the *trajectory framework* outside mixed-reality performances, the word "participant" – to describe people going through *trajectories* – may not be the most adequate:

- First, as part of designers and stakeholders' choices, the relation of the target audience with the experience may not be that of *participant*, with its implications of a strong level of willingness and a prolonged involvement with an experience.
- Secondly, stakeholders may also have their own vocabulary to describe the targets for design, such as "visitors" in the case of museums, "audiences" for a TV broadcaster, or more generically "user", as commonly found in HCI and interaction design practices.

Participant Trajectory

For Benford and Giannachi (2011, p. 260), "*participant trajectories* express an individual participant's actual route through the experience". The discussion in this thesis suggests that *participant trajectories* can emerge from experience, and pre-exist the *canonical trajectories*.

Practice

In this thesis, we consider academic HCI research and professional design practice to be two "practices". Practices, which are the subject of a "practice turn" bringing together the disciplines of social science, cultural studies, science and technology studies (STS) and philosophy (Schatzki, 2001), can be described as "embodied, materially mediated arrays of human activity centrally organized around shared practical understanding" (p.11). Practices are inherently social, with practice theorists considering them to be where "the social" is (Reckwitz, 2002).

Scaffolding

In education theory, "scaffolding" describes how adults help children learn by "'controlling' [...] elements of [a] task that are initially beyond the learner's

capacity" (Wood et al., 1976, p. 90). *Scaffolding* emphasizes teaching through tutoring and guiding, rather than offering prescriptive knowledge. In Robyn Taylor's work (Taylor et al., 2014 & 2015), scaffolding is what museum facilitators do to help visitors engage with exhibitions, and is a key part of the *trajectory* through a visiting experience.

Service

I propose a definition of "service" grounded in Marketing literature. "Services", as something a business provides, are distinguished from "goods", as discussed by Parasuraman, Zeithaml and Berry (1985) when reviewing previous work, in that they are *intangible* ("they are performances rather than objects"), *heterogeneous* (as they are less open to standardization) and their "production and consumption [...] are inseparable".

More recently, Stephen Vargo and Robert Lusch (2004) have called for a "new dominant logic for marketing" in which "service provision", rather than goods production, is the basis of economic exchange. Their call for "Service-Dominant Logic" is based on a definition of services as "a process of doing something for someone" (Lusch and Vargo, 2006).

Service Design

Service design is a field of design and of design research dedicated to the design of services. The origins of *Service Design* as an activity can be traced to the work of Lynn Shostack (1984), then a senior-level executive in the banking industry.

Contemporary *service design* is structured around professional organizations, such as the Service Design Network, and academic venues such as the – originally "Nordic" – Service Design & Innovation conference (ServDes).

Temporal Trajectories

A subset of the *trajectories framework*, published as a 2008 CHI paper, one year before the full formulation of the framework.

Temporal trajectories are concerned with mappings between the actual time of an experience and the "plot" or story time, defined by the narrative participants engage with. This framework introduces the concepts of *canonical, participant* and *historic trajectory*.

Theory

This thesis follows Yvonne Rogers' (2012) review of theory in Human-Computer Interaction in its flexible and open-minded approach of the terms. After introducing the somehow stricter "scientific" definition of *theory* as "an

explanation of scientific data that follows the scientific method" (p.15), she suggests that the importation of knowledge from other disciplines has brought in "other interpretations of theory". I suggest two definitions of *theory* can apply to this thesis:

- First, a definition based on Rogers' suggested "role" for *theory*, which is knowledge "work[ing] at an abstract level, enabling understandings and generalizations to be made about specific phenomena".
- Secondly, an even broader definition, where *theory* can be *anything* that is widely recognized as such in either human-computer interaction research, design research or design practice.

Touchpoint

A central concept in Service Design. For Stefan Moritz (2005), *touchpoints* are the individual "tangibles or interactions that make up the total experience of service". For Shostack (1984), "tangibles" are the evidence of the existence and quality of service from the point of view of the customer. Miettinen (2009) suggests that touchpoints can include "spaces, objects, people or interactions".

Trajectory

"A *trajectory* describes a journey through a user experience, emphasizing its overall continuity and coherence" (Benford and Giannachi, 2011).

Trajectories

"Trajectories" or "interactional trajectories" is the title of the conceptual framework developed by Steve Benford, Gabriella Giannachi, Boriana Koleva and Tom Rodden (2009), at the centre of this thesis.

Ultimate Particular

Nelson and Stolterman dedicate a chapter of *The Design Way* (2012, pp. 27-40) to the concept of "ultimate particular". It represents the "real" and unique things that constitute the outcome of the design process, and is discussed as the philosophical horizon that designers strive towards, as opposed to other forms of knowledge that may focus on the "true" and universal.

User

The term "user" is, as described by Geoff Cooper and John Bowers (1995), central to the constitution of HCI as a "discipline" whose aim is "representing the user" (both as in describing them, and as in advocating for them). Cooper and Bowers discuss how the category of "user" has been constituted in opposition with other disciplines' description of individuals – e.g. "operators" in ergonomics – and to

distinguish them from other stakeholders, such as “designers or computer scientists or system managers or programmers”. This term has therefore been the subject of criticism, such Liam Bannon’s (1991), cited by Cooper and Bowers, who suggests “a danger in thinking of people simply as users” or, more humorously, by Edward Tufte, according to whom “only two industries refer to their customers as 'users': computer design and drug dealing” (cited by Bisbort, 1999).

User Experience

Knemeyer and Svoboda, in the Interaction Design Foundation’s glossary, provide a brief history of the term “User Experience”, and discuss both its narrower and its broader definition:

- In the narrowest sense, it is “the quality of experience a person has when interacting with a specific design” and refers to “simple interactions within computing environments”.
- In the broadest sense, it has grown to cover any “human-design interaction” as well as “various on- and offline experiences”, including “person-to-person interactions”, therefore aligning with business-oriented perspectives such as service design.

User Experience Design

User Experience Design, abbreviated as UXD, is one label given to one discipline of design. It is described by Dan Saffer (2010, p.20) as a “young field” that is “still defining itself”, and overlaps with over design disciplines, such as Information Architecture, Visual Design, Human Factors, Industrial Design and HCI.

As a community of practice, UX Design has its own professional association, the User Experience Professionals Association (UXPA), organizing a yearly conference and structured in local chapters around the world, as do its related disciplines – for example the Interaction Design Association (IxDA).

In this thesis, UX Design is discussed as the “design practice” side of the research-practice gap – although not all the practitioners I’ve encountered consider themselves as UX designers – and as one of the potential beneficiaries of HCI knowledge.

Chapter 1: Introduction

In this first chapter, I describe the motivation for this thesis and the research work it is based in. Given the central place the *trajectories conceptual framework* occupies in this thesis, I introduce this framework. I then present the research questions my thesis addresses and the contributions through which it intends to answer this question. I conclude this chapter by a brief overview of the approach I've used and the structure of this thesis.

1.1 Motivation: putting *trajectories* into practice

This thesis intends to address the "undesirable gap between HCI research aimed at influencing interaction design practice and the practitioners in question" (Goodman et al., 2011), a major concern for the discipline of *human-computer interaction*, as evidenced by the existence of an interest group dedicated to "bringing HCI practice and research closer together" (Buie et al., 2010).

To address this gap, I explore the translation of HCI theoretical knowledge for design practitioners, one of the bridging strategies advocated by the Research-Practice Interaction interest group (Buie et al., 2013). I take the example of *trajectories*, a HCI conceptual framework with generative ambitions and with, at the beginning of the work described here, no evidence of use in professional interaction design practice.

1.1.1 Why the trajectories framework?

The *trajectories framework*, described in the next section of this chapter, is a body of knowledge developed and disseminated by scholars within the disciplines of HCI and *performance studies*. One ambition for this *framework* is to support the design of user experiences (Benford et al., 2009), in line with descriptions of HCI as "a discipline concerned with [...] design" (Hewett et al., 1992).

Reasons for addressing this specific framework include the opportunity to build on the dissemination work started by Steve Benford, one of my doctoral supervisors and one of the authors of the framework. The research described here has been funded as part of a joint proposal between the University of Nottingham's Mixed Reality Lab and the British Broadcasting Corporation's Research and Development department. As part of this proposal, this thesis

explores the application of the framework to settings involving the use of media and related to BBC projects.

Another reason for using *trajectories* as the support for this exploration is that the framework is considered to be representative of broader classes of HCI knowledge, as evidenced by its citation as an example of successful contemporary theory (Rogers, 2012) and of a strong concept, i.e. a form of "intermediate-level knowledge" (Höök and Löwgren, 2012).

1.1.2 Gaps between trajectories and practice

More importantly, the use of *trajectories* in practice was still underexplored at the beginning of my doctoral research. At that time, there was no evidence that the *trajectories framework* had been involved in design processes outside the context of HCI research.

The literature review in chapter 2 unveils a second gap, as it shows that, despite academic papers discussing the use of *trajectories* for design purposes, these papers provide very little formalized *translational knowledge* that offer guidance for helping design practitioners use *trajectories*.

The original research that led to proposing the *trajectories framework* was already an example of research bridging the gap between as it intended to distil the "craft knowledge" of performance artists – the "practice" side of the gap, although artistic practices may not be equivalent to designer practices – into abstract, academic knowledge. The work documented here aims to bridge this gap in the reverse direction, looking at how this academic knowledge can better inform the practice of designers. The contributions of this thesis – the object of academic practice – crosses the gap once more, and consolidates the *translational* work described here into implications for the academic community. This logic is described in the diagram below.

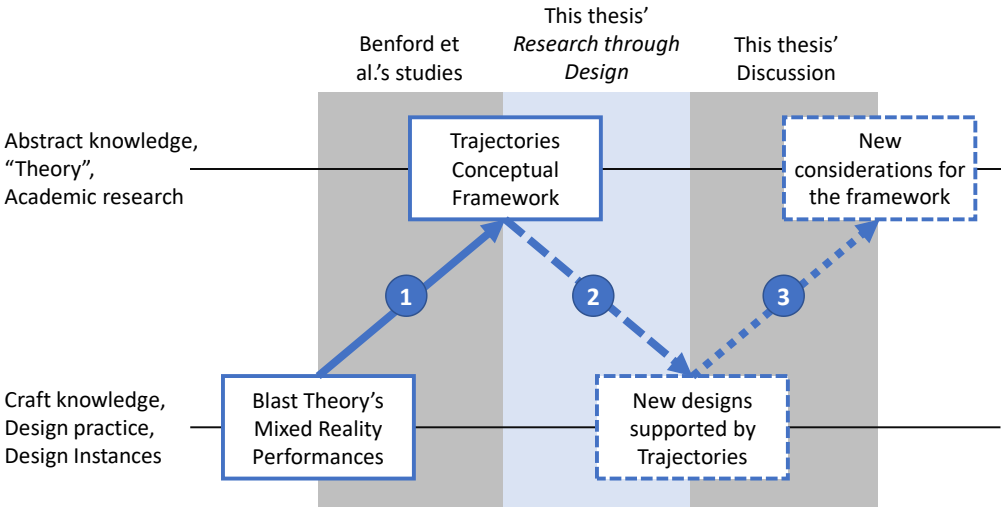

Figure 1.1: A model of this thesis across the "research-practice gap"

1.1.3 Bringing trajectories to novel design situations

Finally, one ambition of this thesis is to expand the scope of the *trajectories framework*, which was originally generated from artist-led mixed reality performances, then successfully used to support museum and exhibit visits (Fosh et al., 2013; Taylor et al., 2014; Taylor et al., 2015). Chapters 3 and 5 explore the use of *trajectories* to support media coverage of festivals and related events, while chapter 4 tries to use the framework to address the needs of a large media organization, the BBC.

The design of media experiences is expected to be a rich application field for *trajectories*, first because they belong to what Benford et al. (2009) label as "cultural experiences" and consider to be what *trajectories* are meant to address, and secondly because the framework's focus on complex narratives that span hybrid spaces and interfaces relates them to *transmedia storytelling* (Jenkins, 2006), a set of techniques for crafting and delivering content across media.

1.2 An introduction to the *trajectories* framework

In this section, I describe the nature, origin, and content of the *trajectories framework*, the piece of conceptual HCI knowledge that this thesis intends to "put into practice". This section discusses the primary sources that, from a bibliographical point of view, *are* the framework. It is complemented by the first half of the literature review in chapter 2, which discusses work that has commented on these original sources to gather a finer grained understanding of its nature. I start by introducing the original sources, briefly discuss what the nature of the framework is, present the mixed-reality performances described in these sources, list the concepts that the framework introduces. After presenting the authors' ambitions for the framework, I conclude this section by discussing the values that the framework embeds.

1.2.1 Three authoritative sources

According to conversations with Steve Benford, first author of the work described in this heading, three canonical sources can be considered to constitute the expression of the *trajectories conceptual framework*:

- "Temporal Trajectories in Shared Interactive Narratives" (Benford and Giannachi, 2008), a paper presented at the CHI conference, which

discusses a narrower version of the framework, centred on temporal mappings. In this chapter, it will be abbreviated as "TT"

- "From Interaction to Trajectories: Designing Coherent Journeys through User Experiences" (Benford at al., 2009), also presented at the CHI conference, which introduces a wider set of concepts (hereafter referred to as "Interactional Trajectories" or "IT").
- Finally, a 2011 book titled "Performing Mixed Reality" (Benford and Giannachi, 2011) covers the concepts introduced in both papers and in related research work – for example Stuart Reeves' work on spectator experiences (Reeves et al. 2005) – and illustrates them with a broader set of examples and with interviews of both practitioners and academics.

One difference between these publications is the audiences they target. Both CHI papers intend to reach the conference's typical audiences: the HCI research community and, to a smaller extent, interaction design practitioners, while the book has been written with performance scholars and artists in mind.

1.2.2 The nature of *trajectories*

The *trajectories framework* has been defined as a "conceptual framework", a somewhat ambiguous term – according to Hill and Hansen (1960), it covers anything between "no more than a cluster of concepts" to "full-fledged theory" – long used in research, and in particular in social science.

The next three sub-sections shed light on three facets of what *trajectories* are. First, they are a recension of *mixed-reality experiences* created by artists, and documented by researchers. Descriptions of this experiences, either directly in the *trajectory* sources, or through citations of previous academic papers, constitute the field data that researchers use to ground the framework. Secondly, *trajectories* are a set of concepts that have been built from discussing these design examples. They are summarized and presented in a "take-away" format in a one-column section titled "A conceptual framework for trajectories" on page 716 of IT and in a table on page 260 of Performing Mixed Reality. Finally, the last part of *trajectories* includes some guidance on how authors intend them to be used.

As discussed later on in this introductory chapter, and although all these aspects of *trajectories* may be considered to be part of the framework, I started my thesis with the assumption that their primary nature is an abstract set of concepts, and that "designing with *trajectories*" involved aligning these concepts with the features of design artefacts.

This discussion on the nature of *trajectories* is continued in chapter 2, as we introduce labels that have been given by authors commenting on *trajectories*:

Yvonne Rogers (2012) has listed it in a review of "HCI Theory" – consistent with a labelling that *trajectories* authors themselves start ascribing to the framework in *Performing Mixed Reality* – and Kia Höök and Jonas Löwgren (2012) have suggested they may constitute a "strong concept", a type of "intermediary-level knowledge" between "general theory" and "design instances".

1.2.3 A documentation of mixed-reality performances

The framework has been created by analysing mixed-reality experiences that all three sources refer to. These works include several mixed-reality games created by artist collective *Blast Theory* and spanning *physical* and *virtual* spaces

- Day of the Figurines (Flintham et al., 2007), where players use text messages to move figurines on a board.
- Desert Rain (Koleva et al., 2001), which combines the exploration of a physical space and a virtual space, with the intrusion of performers at key points in the action.
- Uncle Roy All Around You (Benford et al., 2006), involving both online and on-street players, interacting together and with performers.

All three games listed above share features that differentiate them from the types of experiences which will be discussed in the next three chapters and to which this thesis has tried to extend *trajectories*. First, they take place in a well substantiated fictional world – even if it is often inspired by real events – with many features of literary narration, such as characters, places, and story arcs. These aspects are part of what creates a "magic circle" that frames the game (Salen and Zimmerman, 2003) and engages players into suspending their disbelief – although in the case of the last performance, Benford et al. (2006) have argued that the unwitting participation of bystanders blurs the "frame of the game". Participants not only engage wilfully with these performances, in all three cases, they have bought tickets and, at least for the latter two, have had to book a time slot, and came there with some expectation that they would participate in a distinctive experience. These performances only allow limited numbers of players each time (from 6 in Desert Rain to 32 in Uncle Roy All Around You). All these elements afford authors and performers a very tight level of control over the experience. In the *trajectory* vocabulary we discuss below, this helps them *orchestrate* the experience and make *participant trajectories* converge to the *canonical trajectory*.

The last experience discussed in Interactional Trajectories, *Fairground: Thrill Laboratory* (Schnädelbach et al., 2008), created by artist Brendan Walker, augments existing amusement rides with telemetry through which a first-person

view of the ride, along with sensor data such as heart rate, was shown to prospective riders. Although this last experience lacks the fictional world and narrative set up by Blast Theory artists, it is still a self-contained experience whose framing relies on a shared understanding between authors and spectators, and on the willingness of spectators to engage in a "thrilling" experience.

1.2.4 The contents and vocabulary of the framework

Building upon an analysis of these four mixed-reality experiences, the three *trajectory* sources introduce a structured group of concepts that describe common features of these experiences. Most of these concepts and their labels were introduced in the 2009 (IT) paper. I now briefly describe this vocabulary. Some of the definitions below are duplicated in the glossary at the start of this thesis.

1 Trajectories and trajectory types

On the global level, a *trajectory* itself is a "coherent journey through [a] user experience", as introduced in IT's title. TT introduces three trajectory types: *canonical, participant* and *historic trajectories*, which in the narrower, "temporal" expression of the framework, represent three types of mapping between *story time* (the 24 hours in *Day of Figurines'* narration) and *clock time* (the time experienced by players).

a Canonical trajectory

A *canonical trajectory* represents the "ideal" experience as envisioned by its authors.

b Participant trajectory

A *participant trajectory* represents the actual journey as it has been experienced by a participant, which may diverge from the *canonical trajectory*. *Trajectory* sources attribute this divergence to the importance of interaction in mixed-reality performances, and therefore to the level of control that participants are given over their own *trajectory*.

In performances documented in *trajectory* sources, the relationship between *canonical* and *participant trajectories* follow a common pattern whereby authors first create a *canonical trajectory* which then becomes a *participant trajectory* as and when the actual experience happens. The framework authors have also hinted at the possibility that *canonical trajectories* may emerge from *participant trajectories* (IT). This reverse relation has been discussed in Flintham et al. (2011)'s analysis of *Blast Theory*'s performance "Flypad", where artists have been

continuously improving the *canonical trajectory* based on feedback and observation of *participant trajectories*.

c Historic trajectory

The third type of *trajectories*, *historic trajectories*, describes retellings of experiences. TT suggest that *historic trajectories* can be reconstituted or synthesized using traces collected during the *participant trajectory*. This part of the framework is not discussed in IT, with the consequence that – IT being the most widely quoted source in the survey below – *historic trajectories* are rarely cited in subsequent work from other authors.

2 The hybrid structure of experience

The "hybrid structure of experience" is a part of the framework that describes the nature of the experiences that *trajectories* traverse. This structure involves four "key facets" or dimensions: *time, space, roles* and *interfaces*. These dimensions are described as *hybrid* because of their heterogeneous nature, and their variability over time.

a Hybrid time

Hybrid time involves the different "types" of time discussed in TT: story time and clock time. The authors also suggest the possibility of traversing additional "layers of time", including "plot time", "schedule time", "interaction time" and "perceived time".

b Hybrid space

Hybrid spaces include *physical* and *virtual spaces*, as well as potential mappings between these spaces.

c Hybrid roles

Trajectories involve individuals taking on multiple roles over the duration of the experience and interacting with each other as part of their roles. The taxonomy of roles used in IT is based on Benford et al.'s (2006) description of roles in Uncle Roy All Around You as *audience*, *bystanders* and *performers*.

d Hybrid interfaces

The final *hybrid dimension of experience* describes the variety of *interfaces* – labelled as "interface ecologies" following Huang et al. (2006)'s work – such as computers, displays and interactive objects that support the *trajectory*

3 Transitions

The next set of concepts, listed under the generic name of *transitions*, describe local aspects of *trajectories* at "critical moments in an experience at which [...]

continuity is at risk". *Transitions* are directly linked to the *structure of experience* as they may arise from discontinuity in its dimensions. The framework introduces a typology of *transitions*, but doesn't explicitly state whether this list is exhaustive or if more *transition types* may exist. These *transitions* are:

- Beginnings.
- Endings.
- Temporal transitions between episodes.
- Role transitions.
- Interface transitions.
- Traversals between physical and virtual spaces.
- Transitions into shared physical resources, which may cause bottlenecks.
- Transitions across seams in the infrastructure, e.g. network coverage issues.

4 Managing trajectories and orchestration

The section of the framework on *managing trajectories* discusses the extent to which *trajectory* creators control *participant trajectories* when they diverge from *canonical trajectories* and make these *trajectories* converge. The process by which *trajectory* authors and performers monitor *participant trajectories* and act upon them to align them with *canonical trajectories* is labelled as "orchestration".

5 Interweaving trajectories

The last part of the framework discusses the social aspects of experiences as multiple *participant trajectories* become *interwoven*. The points where these *trajectories* intersect are discussed as *encounters*. *Trajectory* creators may need to either promote or avoid such *encounters* and use several *orchestration* techniques, such as *separating participants*, managing *pacing* or *prioritizing* parts of the journey.

1.2.5 The ambitions of the framework

After introducing the concepts listed above, IT discusses two classes of ambitions for the framework. The first one is the potential scope of the framework in terms of experience types. The second one, laid out in a section named "Putting trajectories to work", discusses potential uses for the framework.

1 Addressing cultural experiences

Trajectories intend to generalize knowledge gathered from mixed-reality performances to a broader class of experiences, labelled as "cultural experiences". These include, but are not limited to, museum tours, artistic

performances and games. Authors of the framework also suggest it could address situations "outside of the immediate domain of cultural applications, perhaps in learning, the home, or the workplace" (IT, p.716).

2 Four uses for the framework

Authors suggest four possible ways of "putting trajectories to work", the second one – compiling craft knowledge – being the one most relevant to this thesis' ambition to bring *trajectories* into design practice.

a Providing sensitizing concepts for empirical studies

The first use for *trajectories* is to act as an "analytic lens" to support future studies of experiences. An example of this type of use is found in this thesis, as both chapters 3 and 5 include sections where the *trajectories framework* is used to analyse and discuss experiences.

b As a vehicle for compiling craft knowledge

In laying out their second possible use, *trajectory* authors discuss how the abstract concepts in the framework embed practitioners' own craft knowledge and represent a potential route into transposing and disseminating this knowledge. Importantly, in IT's own words, the framework represents an early stage ("the beginning of an attempt", p.717) of doing so. This opens the scope for future work in two ways. First, the framework is open to being extended with further content – which, as I discuss later, has been done to some extent. Secondly, although the framework as such doesn't provide a well-defined, authoritative, or practitioner-centred way of being used in practice, the authors suggest future work may do so by "establish[ing] design guidelines or 'interaction design patterns' for specific aspects of the user experience" (p.717). This second aspect, to the best of my knowledge, has not been fully addressed, and is at the core of this thesis.

c Identifying requirements for new technologies

The third ambition for the *framework* is for to support "new interaction techniques, tools and platforms". To illustrate this ambition, authors suggest three aspects of the framework that may be addressed by technologies: episodic re-engagement, historic trajectories, and orchestration. Authors also suggest that this third ambition may be fulfilled by moving away from "bespoke interfaces" towards generated ones.

The review described in the next chapter doesn't identify work that address this ambition. One reason may be that most of the work citing *trajectories* addresses specific design situations by creating bespoke experiences – and generalizing

knowledge afterwards when applicable – while what *trajectory* authors call for would require starting from the generic requirements.

d Enabling a dramaturgy of interactive user experiences

The framework's final ambition is to reach out to performers and performance scholars and provide "dramaturgies" that can inform their artistic and academic practices. This last aspect mirrors *trajectories*' position with regards to the discipline HCI, into which the authors seek to import concepts from performance studies and narratology. The authors ambition *trajectories* to be a "boundary object" (Star and Griesemer, 1989) between disciplines, i.e. a shared form of knowledge between communities with some "interpretive flexibility". Although the review below shows some adoption of trajectories by performance scholars, it is hard to assess the extent to which the "cooperation without consensus" that *boundary objects* are meant to underpin has happened.

1.2.6 The values in *trajectories*

Although these may be stated more or less openly in the framework's original sources, *trajectories* include a number of "values", or underlying assumptions on what a "good" user experience is or, to use IT's terms, what "makes [it] tick" (p. 717). The major "selling point" of the framework is that it helps make complex experiences more coherent and joined up, but this is only one of multiple values.

Performing Mixed Reality, and in particular its introductory chapter, discusses these values by describing the nature of mixed-reality performances. These experiences differ from traditional theatrical performances in that they are "interactive, distributed and often deeply subjective". They invite participants to become "performers in their own right". Mixed-reality performances also offer ways for participants to make sense of their experience, both as they go, through mapping, wayfaring and perspectives, and post-hoc, through engaging with one's traces, or *historic trajectories*.

These values can be addressed in design processes at two different levels. First, they shape the scope of experiences for which we would consider *trajectories* to be a useful design tool: in the particular context of this thesis, do we want to bring these values to live events? Secondly, they shape the outcome of the design process, and suggest potential success criteria for judging in what sense *trajectories* have improved an experience.

1.3 Research question

The motivations listed in the first section help define a research question, which can be phrased as follows:

"How can the *trajectories framework* be used to inform the design of media experiences by professional designers?"

This question may be taken through two different lenses, depending on whether we start from the *trajectories framework* or from design activities, and may be rephrased as two specific research questions.

First, does the *trajectories framework* need to be modified or extended to address new design situations? Explorations of this questions are provided by selecting a specific situation, which has not been previously explored in *trajectory* literature, namely the media coverage of live events.

Secondly, taken from the practice side, this thesis questions what can designers do to integrate the *trajectories framework* with their own practice, and which design-oriented resources can support that.

Finally, the research question calls for its generalization to conceptual HCI knowledge, with the last question being: "How can HCI knowledge of a similar nature to *trajectories* inform design practice?"

1.4 Intended contributions

Three of the contributions of this thesis are articulated in detail in chapter 6. The first two correspond to the two specific sides of the research question above:

1. The first set of contributions proposes **extensions to the *trajectories framework*** and therefore answers the first specific question.
2. The next contribution is a ***process model* integrating the use of *trajectories***, including a list of methods to support that process, and answers the second specific question. This contribution constitutes a *translation* of *trajectories* into practice.
3. The third main contribution is a reflection on the translation process that led to the second contribution and proposes a **model for classifying design resources that translate HCI theory** based on how they span the gap between theoretical knowledge and design instances as well as the gap between academic research and design practice.

Given the use of live events as an example domain to explore, my thesis contributes specific knowledge regarding that domain. This fourth contribution is discussed in chapters 3 and 5, but isn't part of the main discussion of this thesis.

4. This thesis contributes a set of specific **design guidelines** to support interaction design around live events.

By reflecting upon how design, theory and other forms of knowledge have been engaged with throughout my research, the final chapter offers a final contribution:

5. This thesis intends to **inform the broader conversation around the relationship between interaction design practice and HCI theory**.

1.5 Approach

This section, describing the approach followed throughout this thesis, starts by discussing initial assumptions about its subject, then I present the actors and settings involved in my research, and finally discuss the broad methodological orientations I've followed.

1.5.1 Initial assumptions

The research work described below relied on a set of initial assumptions on my behalf about the nature of *trajectories* in particular, and of abstract design-oriented HCI knowledge in general, as well as on how this knowledge can be "put to work" in a design context.

The first assumption was that the *trajectories framework* was primarily a set of abstract concepts (as listed in section 1.2.4), with little consideration for *Blast Theory*'s works and the broader context in which the framework was introduced.

This assumption is consistent with the approach reported by Lesley Fosh and her colleagues (2013). In their example of designing a visiting experience with the *trajectories framework*, there is no mention of other mixed-reality performances, and their article is structured around a conversation between their specific design and the framework's concepts.

The second assumption, building upon Yvonne Rogers' description of the indirect role of theory in design (2004, p. 129) and upon a narrow understanding of what "intermediate-level knowledge" (Höök and Löwgren, 2012), is that there could be clearly identifiable resources that researchers could create for the intention of designers, and that is presented in a way that designers can meaningfully engage with. This assumption – also found in Colusso et al.'s model of "translational resources" (2017) described in chapter 2 – considers researchers to be in a position in which they possess knowledge and have to transfer it to third parties. It is consistent with how we, as academics, are increasingly evaluated on the "impact" of our research, but creates an imbalanced situation, as it does little to account for designers' own agency.

Chapter 7, by providing a reflection on the research described in the intervening chapters, will challenge these assumptions and provide a different point of view on the relationship between HCI abstract knowledge and design.

1.5.2 Who and what this thesis is about

To better understand the context of this thesis, I now draw upon *science and technology studies*, and in particular Bruno Latour (2005)'s articulation of Actor-Network Theory (ANT). By suggesting that social arrangements can be described and mapped as networks of human and non-human actors, ANT provides a convenient way of "setting up the scene" for this thesis and describing the situations it is about.

This thesis discusses three "practice situations" – or local contexts, or sites, to name two of the words used by Latour –, the social groups involved in these situations, and the dynamics between these three sites:

1. Academic HCI research, as a discipline. Aspects of the research community that are relevant to this thesis are the production of knowledge in the form of papers, and of the theories, frameworks and methods that are couched in these papers. As discussed in the glossary, one rough criterion for inclusion in this group is submitting papers to the ACM SIGCHI conference on human factors in computing systems.
2. Design practice, which for the sake of this thesis can be defined by the activity of designing and producing interactive artefacts and experiences, and its technological, social and economic context. Design practice is structured in several communities of practice, whose denominations depend on what individual practitioners consider their design objects, their methodological orientations, and their job descriptions to be, for example "web design", "user experience design" (UXD), "interaction design" (IxD) or "service design".
3. As discussed by Cooper and Bowers (1995), "users" as a group are constituted by the discourse of HCI and design communities as people who are distinct from designers: they are the ones who will use what designers have produced, and the ones whose use practices will be studied by researchers. They may be labelled in different ways according to workplaces and publications: BBC stakeholders consider them as audiences given the organization's broadcasting legacy, while *trajectory* literature uses terms such as "participants" or "intended audience".

These three practice situations are linked by "non-human" objects and forms of knowledge which act as bridges. I highlight two classes of such non-human actors – there may be many more – and propose a tentative model to situate

trajectories and this thesis within the sites above, which is represented by the diagram at the end of this section.

Forms of HCI knowledge that include *trajectories* and its *translations* constitute the main bridge between researchers and designers for the context of this thesis. These resources are primarily – though not only – created by researchers with the explicit intent of informing and supporting the work of designers. On the other hand, it's the design artefacts – the *ultimate particulars* in Nelson and Stolterman (2012)'s terms – that designers create and "users" interact with, that links the second and the third site.

HCI resources do not solely constitute a link between researchers and practitioners, as it strives to be "about" the artefacts, as well as about how users interact with these artefacts. A large part of HCI research is dedicated to studying what users do and therefore this diagram might be missing another bridge between research and use. However, in the context of this thesis, user studies are "mediated" by *trajectories* – as a "sensitizing concept" and an interpretive framework – and by the artefacts produced as part of *Research through Design*.

These dynamics are described in the diagram below, and suggest a "top-down" direction of knowledge transfer, from *researchers* to *designers* and from *designers* to *users*, although the contributions of this thesis will challenge that directionality.

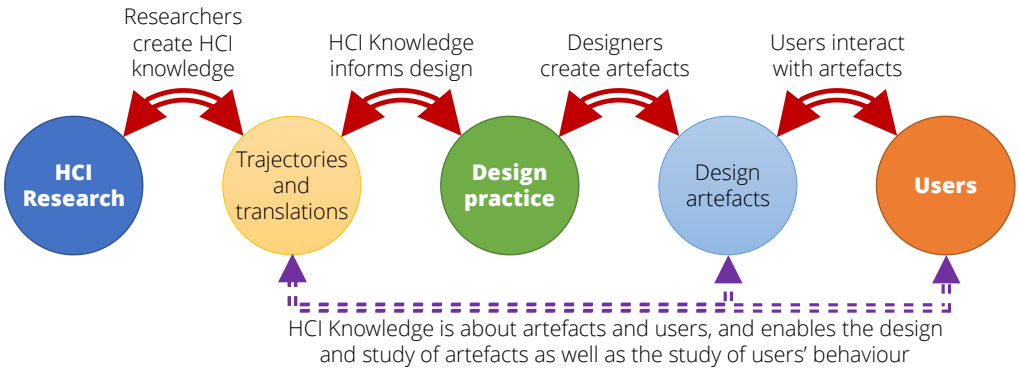

Figure 1.2: Who and what this thesis is about

1.5.3 Methods

The research work described below follows a mixed-method approach, with chapter 3 drawing mainly on ethnographic – and "design ethnography" – methods to probe the experiences of festival participants; chapter 4 relying on both observations of an organization and participatory design processes; finally, chapter 5 can be seen through two lenses: as the implementation of design methods, and as an autoethnography of the design process.

The research described here also constitutes "research in-the-wild" (Rogers, 2017), with two "wild" locations, corresponding to the second and third "practices" listed in the previous heading. It therefore follows Colin Gray et al.'s (2014) call for studies of "design in-the-wild".

Chapter 5 also extensively borrows from *Research through Design*, which is both a set of methods in which the activity of designing and making things produces knowledge, and an approach to doing HCI research informed by design research. In this thesis, the design activity in question is performed both by the researcher (chapter 5) and by professionals (chapter 4).

Chapter 2, by reviewing what constitutes *design-oriented knowledge*, and the methods through which academics can probe this knowledge, introduces the reader to the methods used in latter chapters, and grounds them in terms of epistemology and broader use within the HCI and design research communities.

1.6 The structure of this thesis

I now describe the role of each chapter in this thesis.

Chapter 2 is a literature review chapter which discusses related work, first by reviewing what has been written on *trajectories* themselves and on similar HCI constructs – namely *theory* and "strong concepts" – then by looking at works that help understand the gap between HCI academic research and UX design practice, including attempts to bridge it.

The next three chapters describe three series of studies that I have conducted as part of my doctoral research.

Chapter 3 spans two studies looking at how participants in live events interact with media and technology in general in and around these events. Following a description of the findings of both studies and their commonalities, the chapter engages with *trajectories*, both as an interpretive framework to discuss the experience of live events and as a way of defining design guidelines to support this domain. By doing so, this chapter validates the relevance of *trajectories* for live events, a new class of experiences where the framework has not been used so far.

Chapter 4 describes a series of interventions organized with an industrial partner with the intent of making designers and producers within the organization use the *trajectories framework*. It focuses on the *translational resources* that have been developed as part of this partnership, helps understand specificities of design practice at the BBC, and briefly gives examples of artefacts whose development has been to some extent influenced by *trajectories*.

Chapter 5 then describes the activity of designing a mobile app and a website for a music festival using *trajectories*. This chapter draws upon the domain knowledge elicited in chapter 3 and includes an autoethnographic reflection on my own practice of design, as well as on the process of using a theoretical framework.

Chapter 6 discusses the findings from the previous three chapters and relates them to the work reviewed in chapter 2. It conveys the three contributions described above: extensions to the *trajectories framework*, a process model for using *trajectories* as part of design practice, and a model of *translations* of HCI theory into practice.

Finally, the concluding chapter, by presenting a reflection on the whole thesis, discusses the status of *trajectories* as *theory* and how it can be related with design activities.

Chapter 2: Trajectories and Design: Related Work

In this chapter, I discuss previous work that guides my exploration of translating *trajectories* into design practice. This review is divided in three parts: first, I present how the *trajectories framework* has been used in HCI literature, in particular for design purposes; then, because of this review's limitation to specific academic uses, I try expand the review by identify concepts that are similar to, but not identified as *trajectories*; finally, I review literature about design to discuss the state of the art of how to bridge the gap between HCI academic knowledge and UX design practice.

2.1 A review of uses of *trajectories*

Referring to the three sources of *trajectories conceptual framework* presented in section 1.2, I now present a review of work citing these sources. This review, based on the state of bibliographical databases as of August 2016, was published in a conference paper (Velt et al., 2017).

I start this section by describing the methods I've used to conduct the review. I then build upon this review to discuss the nature of the framework as HCI abstract knowledge and then how it has been used by academic researchers to support design activities. I conclude by discussing the gaps identified by the review in terms of HCI academic knowledge around *trajectories*.

2.1.1 Methods for the review

I now describe the methods used to build and narrow down the corpus, then analyse it.

1 The broader corpus

I started by searching for citations of the three authoritative *trajectory* sources in four bibliographical databases:

- Google Scholar, a freely accessible search engine.
- The Association for Computing Machinery's Digital Library (ACM DL), which is the canonical repository for two of the *trajectory* sources.
- Two subscription-based commercial databases, Web of Science (then operated by Thomson Reuters, now by Clarivate Analytics) and Elsevier's Scopus.

After removing duplicates and references for which we could find no details beyond title and author, the process returned a total of 263 references. Google Scholar had the broadest coverage of all databases, and referenced all but 2 of these works. The distribution of references by paper cited and by database is shown in the table below:

Source cited	ACM Digital Library	Google Scholar	Scopus	Web of Science
Temporal Trajectories (Benford and Giannachi, 2008)	26	54	6	4
Interactional Trajectories (Benford et al., 2009)	58	150	26	16
Performing Mixed Reality (Benford and Giannachi, 2011)	37	139	Cited source not in database	Cited source not in database

Table 2.1: Results from the bibliographical search for trajectory citations

The contents of this corpus spanned a broad variety of texts, including conference and journal papers, books (monographs and book chapters), theses and dissertations, as well as adjunct proceedings (such as workshops), magazines, project reports, patents and documents whose status is less easy to determine – some, linked to authors' own websites, may be rejected papers or internal presentations. The main publication types and main venues are listed in the table below, along with their distribution across *trajectory* sources.

Publication Type	Temporal Trajectories	Interactional Trajectories	Performing Mixed Reality	Total
Conference papers (main proceedings)	20	58	26	**92**
ACM CHI	6	10	5	**18**
ACM DIS	1	5	2	**7**
Journal papers	9	28	33	**63**
Digital Creativity	—	1	8	**8**
ACM ToCHI	3	4	3	**7**
Books or chapters	2	23	22	**41**
Theses, Dissertations	8	20	17	**37**
Other publications	7	12	14	**30**
Total	**46**	**141**	**111**	**263**

Table 2.2: Main publication types for citations of trajectories

Expectedly, both CHI papers have had the most impact within the HCI community, in conferences such as CHI itself, but also ACM's CSCW (Computer-Supported Collaborative Work) and DIS (Designing Interactive Systems) and regional HCI conferences such as OzCHI, NordiCHI or British HCI, and in journals such as ACM's Transactions on Computer-Human Interaction (ToCHI). On the other hand, *Performing Mixed Reality*, in line with its own ambitions to reach out to performance scholars, is more frequently cited in arts and humanities, for example in Taylor and Francis' journals *Digital Creativity* and *International Journal of Performance Arts and Digital Media*.

2 The narrower corpus

From that large corpus, I decided to restrict content analysis to a smaller subset. The criteria for including a publication in that subset were:

- Being a paper, as their focus on a single contribution makes it easier to gauge how it engaged with the framework.
- Being published in an academic conference or journal, therefore likely to be peer-reviewed – although I didn't check each source for its acceptance procedure.
- Mentioning *trajectories* or facets of the framework, as some of these works mention *trajectory sources* either without any discussion of the sources' contents or to cite them for things that aren't the framework (for example, *Blast Theory*'s works or IT's definition of "experience")

Following these criteria, a core corpus of 60 papers was identified. 14 of these papers shared at least one author with trajectory sources. 10 of these papers cite Temporal Trajectories, 49 cite Interactional Trajectories and 14 cite Performing Mixed Reality.

This core corpus covers a range of disciplines, between traditional HCI (e.g. CHI and CSCW), design-oriented research (e.g. DIS, the Interaction Design and Architecture journal) and art-related research (e.g. Digital Creativity). It is heavily weighted towards HCI though, CHI being the most frequent venue, with 10 papers. The papers in the smaller corpus are listed below:

Papers co-authored by one or more of trajectories' originators.	**Papers not including the framework's originators**
Benford, 2010; Benford et al., 2011; Benford et al., 2013; Benford et al., 2016; Darzentas et al.,	Adams et al., 2013; Arrigoni & Zics, 2016; Barba, 2014; Barba and MacIntyre, 2011; Benyon, 2012; Benyon and Mival, 2015; Benyon et al., 2010; Benyon et al., 2012; Bonsignore et al., 2014; Bowser et al.,

Papers co-authored by one or more of trajectories' originators.	Papers not including the framework's originators
2015; Durrant et al., 2011a; Flintham et al., 2011; Fosh et al., 2013; Fosh et al., 2016; Marshall et al., 2010; Marshall et al., 2016; Rennick-Egglestone et al., 2013; Rennick-Egglestone et al., 2016a; Velt et al., 2015.	2013; Byrne et al., 2016; Calori et al., 2013; Cerratto-Pargman et al., 2014; Coughlan et al., 2010; Dalsgaard et al., 2011; Freeth et al., 2014; Friederichs-Büttner et al., 2012; Ghellal et al., 2014; Hansen et al., 2013; Höök and Löwgren, 2012; Hornecker, 2016; Huang and Stolterman, 2011; Kan et al., 2013; Leitner et al., 2010; Lindinger et al., 2013; Lundgren, 2013; Lundgren et al., 2015; Massimi et al., 2011; Maxwell et al., 2015; Mosleh et al., 2015; Nisi et al., 2016; Nissen et al., 2014; O'Keefe and Benyon, 2015; Rennick-Egglestone et al., 2016b; Rossitto et al., 2016; Stals et al., 2014; Sundström et al., 2014; Taylor et al., 2014; Taylor et al., 2014; Taylor et al., 2015; Underwood et al., 2011; van der Linden et al., 2011; van der Linden et al., 2013; Wouters et al., 2016; Yule et al., 2015; Zangouei et al., 2010.

Table 2.3: A corpus of 60 articles engaging with trajectories

3 Content analysis

Following this selection, and by iteratively coding how papers engage with *trajectories*, I developed a two-dimensional coding scheme. For each paper, I assessed the purpose of engaging with *trajectories* and which aspects of *trajectories* papers engaged with. For each dimension, I defined four non-exclusive categories. An overview of the results is presented in the table below, with details published in the CHI survey (Velt et al., 2017).

Coding category	Number of papers	Percentage of corpus
Purposes for engaging with trajectories		
1. Situating the work	31	52%
2. Analysing and describing an experience	28	47%
3. For designing experiences, including…	24	40%
3.a. For actual designs described in the paper	9	15%
3.b. For prospective designs (i.e. left as "future work")	15	25%
4. Discussing and building concepts	38	63%
Aspects of trajectories that are engaged with		
1. Trajectories as an example framework	32	53%
2. Trajectories as a global user journey	45	75%
3. Mentioning specific components of the framework	48	80%
4. Instantiations of concepts in the framework	24	40%

Table 2.4: The results of contents analysis on the corpus

The following sections build upon this analysis of uses of trajectories. First, I combine it with taxonomies of types of knowledge to discuss the nature of the framework. Then, I look at works providing extensions to the framework. Finally, I discuss uses of *trajectories* for design purposes.

2.1.2 Discussions of the nature of the trajectories framework

We now look at possible characterizations of the *trajectories framework* to move past the vagueness of its definition as a "conceptual framework". I look at two ways *trajectories* have been labelled: as "theory", and as a "strong concept". While there is enough evidence to label *trajectories* as *theory*, this analysis suggests that *trajectories*, while not a *strong concept* per se, are part of a broader category of *intermediate-level knowledge*.

1 Trajectories as theory

The first two *trajectory* sources didn't label the framework as a form of *theory*, but this characterization has been introduced in *Performing Mixed Reality*. In our review of the framework, my supervisors and I compared the framework and its uses with Yvonne Rogers' taxonomy of HCI theory (2012) which builds on previous taxonomies by herself (2004) and by Ben Shneiderman and Benjamin Bederson (2003). Comparing these characterizations of *theory* with the contents of the framework, its uses, and how users of the framework have labelled it shows that calling *trajectories* a form of *theory* is highly consistent with uses of the word *theory* in HCI.

a What type of theory are *trajectories*?

That said, this exercise raised a difficulty in identifying what *type* of theory *trajectories* are, as characterizations of *theory types* – as well as the framework itself – offer some level of interpretive flexibility. The definitions provided do not afford clear-cut assessment of *theory* and, to their authors' own accounts, are not mutually exclusive. They do not form a uniform taxonomy, as some categories describe what theory *does* (for example, being *prescriptive* or *explanatory*) and others describe the methods or intellectual traditions *theory* comes from.

Therefore, *trajectories* correspond to every type of *theory* to varying degrees. The table below lists the claims to each theory type, with sources for taxonomies abbreviated as B&S'03 (Bederson & Shneiderman, 2003), R'04 (Rogers, 2004) and R'12 (Rogers, 2012)

Theory type	Source	Justification
Descriptive	B&S'03	Trajectories "clarify terminology [...], identify key concepts [and] guide further enquiry". Trajectory

Theory type	Source	Justification
		users also frequently characterize the framework as descriptive.
Generative	B&S'03	When trajectories are used for design purposes, they "enable practitioners to invent or discover something new"
Explanatory	B&S'03	Trajectories may help practitioners identify "combinations that fail or succeed".
Prescriptive	B&S'03	Trajectories are prescriptive according to the definition, as they "convey guidance for [...] design by recording [...] known dangers". However, they are not phrased as prescriptive guidelines and the level to which academic authors citing trajectories perceive them to be prescriptive varies.
Predictive	B&S'03	Some aspects of the framework may help establish predictions of user behaviours (for example, risks of breaking the continuity of experience at transitions), but these predictions are limited in their scope and strength.
Informative	R'12	Trajectories are informative, as they seek to examine "knowledge and generalizations from another field" (specifically performance studies and narratology) and "couch understandings and designs" using a particular language.
Ethnographic	R'12	Trajectories, as discussed by Benford et al. (2013), are grounded in ethnographic studies, but they don't provide ethnographic insights (i.e. detailed descriptions of the experience of either authors or participants).
Conceptual	R'12	Trajectories are conceptual theory as a form of "high-level framework [...] for informing and articulating design and evaluation". However, unlike Rogers' definition, they do not tell researchers how design and evaluation should be done.
Critical	R'12	Although trajectories are never directly described as critical by its authors nor its users, they constitute a form of critical theory as they derive from critical, humanities-inspired analyses of mixed-reality performances. This aspect of theory is expanded upon in the next heading
Formative	R'04	Trajectories fit Rogers' definition of formative theory as "provid[ing] a lingua franca; a set of easy to use concepts for discussing design"

Table 2.5: Fitting trajectories with theory types.

b Trajectories as critically-inspired theory

I now dive into the details of *trajectories'* characterization as *critical theory*. Connections between *critical theory* and HCI have been discussed in depth by Jeffrey Bardzell (2009), in which he draws parallels between the traditional

cultural objects of criticism and aesthetics – such as film, TV, literature and arts – and interaction as a cultural product. He introduces several models for importing *critical theory* into HCI and making it useful for design, and criticizes patterns that are already common in the discipline, such as "piecemeal appropriation of a single concept" or reductionist frameworks. *Trajectories* may not constitute the type of "systematic, rigorous, expert integration of aesthetical/critical traditions and HCI" that Bardzell praises, but the framework fits another model, the "critical examination of artefacts", and it aligns well with two of his proposed "mappings of criticism and HCI": "developing theory" from "interaction design", as the framework itself and subsequent work do, and "informing the existing design process" through its generative ambitions.

Bardzell raises the question of social activism and ethical positions, which he discusses as characteristic of *critical theory*, but contrasts with HCI's orientation "towards the design and evaluation of real-world interaction". This shift is clearly visible in the *trajectories framework*: while *Blast Theory*'s works are arguably subversive and question issues such as surveillance and democracy, the major "value" which *trajectories* intend to bring to HCI and design is to maintain continuity and coherence across complex experiences.

2 Trajectories as intermediate level knowledge

I now turn to Kristina Höök and Jonas Löwgren's suggestion that *trajectories* may constitute a "strong concept", a form of knowledge which these authors list as part of a range of intermediate-level knowledge occupying the space between "design artefacts" and "theory".

Trajectories fulfil many of the criteria for being a "strong concept": they are generative, they concern "interactive behaviour rather than static appearance", and comprise "elements of potential design solutions, that can be appropriated by designers and researchers". However, it is hard to argue that *trajectories* are "potential parts of artefacts".

Strong concepts presuppose a vertical upward grounding in theory. Although there are some mentions of narrative theory for parts of the framework, *trajectories* themselves mostly come from analysing performers' work, that is from the design instances themselves, and seem to lack this vertical grounding. However, Koskinen et al. (2011) suggest that, given its epistemological grounding, most research involving the creation of design artefacts ultimately has "roots in twentieth century Continental philosophy", which may provide such a vertical grounding – with Bardzell also grounding *criticism* in continental philosophy.

Another objection to *trajectories* being labelled as a "strong concept" is the richness of the framework and the diversity of ways it is engaged with. It comprises concepts that act at different levels of genericity, from individual transitions types to the high-level idea of a global *trajectory*. Works engaging with the *framework* most often engage with a subset only of these components, and combine these with other forms of knowledge, including other frameworks, concepts, theories, or design instances to produce knowledge, again in various forms – although, given the work we've reviewed is from the HCI discipline, often on the more abstract end of the intermediate-level knowledge space.

Keeping in mind the ambitions of this thesis, it is worth noting that Höök and Löwgren explain how "strong concepts" can be built and what form they take, but they do not suggest ways for practitioners to *use* strong concepts in practice.

Our analysis of the multiple ways in which *trajectories* have been associated with, or discussed alongside other conceptual constructs, especially considering that building more theory is one of the primary uses of the framework in literature, has led us to describe the dynamic of the "intermediate knowledge space" as involving a "high churn" (Velt et al., 2017).

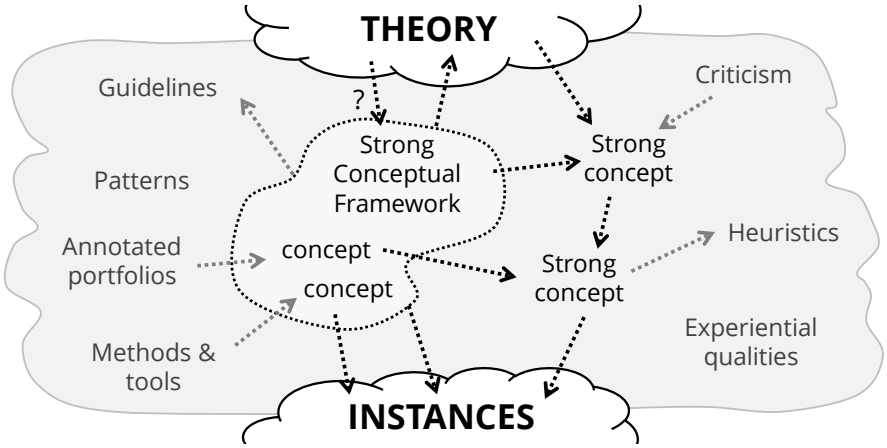

Figure 2.1: The "churn" in concept space (adapted from Velt et al., 2017)

3 Critiques and extensions of the framework

As the content analysis of *trajectory* citations shows, most uses of the *framework* lead to abstract or theoretical contributions, including commentary on the framework in the form of critiques or extension.

a Trajectories as close-ended experiences

We identified seven papers criticizing the framework and suggesting *trajectories* were not suited to certain classes of settings. These works argue that *trajectories* are too tightly structured (Huang and Stolterman, 2011; Lundgren, 2013; Rossitto et al. 2016), too close-ended (Bonsignore et al., 2014; Hansen et al. 2013), or that they give too much control to authors and too little to participants (Fosh et al.,

2016; Bonsignore et al., 2014; Hornecker, 2016). These critiques resonate with the type of tightly-controlled performances the framework is based on, and may not fully consider the possibility for *trajectories* to be extended – as its authors suggest – to cover broader classes of experiences and design settings.

b Towards open-ended trajectories

However, Robyn Taylor and her colleagues (2014) show a different interpretation of the framework and describe an example where *trajectories* have been successfully used to design "less-structured experiences". Janet van der Linden and her colleagues (2013) have also explored the applicability of *trajectories* to user-created experiences.

Several authors (Fosh et al., 2016; Taylor et al., 2014) have proposed the idea that *trajectories* could offer "scaffolding" to experiences where authors and participants share some level control.

c Extending the framework explicitly

Through their suggestion, Taylor et al. (2014) have contributed an explicit extension to the *trajectories* framework. Beside this paper, other works have considered one of their contributions to be such an extension. Except Taylor and her colleagues, all these papers include an originator of the *trajectories framework* as an author, and have their first author affiliated to the University of Nottingham's Mixed Reality Lab.

- Benford et al. (2011), in a further analysis of *Day of the Figurines*, have proposed that *trajectories* should be considered at multiple scales.
- Fosh et al. (2013) have simplified these scales into "local" and "global" *trajectories* and discussed the benefit of the framework for museum interpretation. In line with *Interactional Trajectories'* suggestion that the framework could inspire the creation of "design patterns", Lesley Fosh and her colleagues introduce distinctive interaction patterns, such as coupling a loosely structured global trajectory with a tightly controlled local one, and a five-step structure to design local *trajectories*.
- Flintham et al (2011), analysing Blast Theory's *Flypad*, have discussed feedback loops between *canonical* and *participant trajectories*, and introduced the concept of *group trajectories*.
- Darzentas et al. (2013), in their study of practices around wargaming miniatures, suggest that "things" can have *trajectories*, and that changes in ownership are forms of *transitions*.
- Finally, Marshall et al. (2010), analysing magic tricks, introduce the idea of *parallel trajectories* (one as perceived by the spectator, and one which describes what the magician really does), "knowledge" as an additional

dimension of experience, and two new types of *transitions* where *parallel trajectories* are first established – the "setup" – then converged – the "reveal".

Despite these authors contributing extensions to the *framework*, there have been few efforts to collate these extensions. Some of them, though – in particular Lesley Fosh's work – have been included in dissemination materials produced by *trajectory* authors, such as slide decks, seminar presentations, and the now-defunct trajectorize.com website.

The feedback we had from reviewers when submitting our survey for CHI 2017 suggests that other researchers may see comparatively less interest in publishing refinements and consolidations of existing frameworks than in publishing new frameworks, as some of our contributions were considered to be of interest only to current *trajectory* users rather than to the broader HCI research community.

d Implicit framework extensions

But work that can help extend the *trajectory framework* goes beyond papers who have explicitly stated it as a contribution. Evaluating which contributions may be folded into *trajectories* requires some level of subjective interpretation, but our review has identified the following "implicit extensions":

- Durrant et al.'s (2011a) description of progressive engagement with *trajectories* in a theme park as "gearing in".
- Friederichs-Büttner et al. (2012)'s discussion of fostering participation in interactive drama, which clearly contributes insight for designing *role transitions*.
- Kan et al. (2013) have suggested that *managing trajectories* can be done in a bottom-up way by voluntary synchronization rather than orchestration.
- Wouters et al. (2016) have offered a typology of ways *participant trajectories* can diverge from *canonical* ones that includes "dropout trajectories" and "activation loops".
- Nissen et al. (2014) have discussed three types of relationship between *participant* and *historic trajectories*: as a reflection upon one's experience, as an extension of if, or as a self-contained experience.
- Finally, Taylor et al. (2014, 2015) show that *orchestration* can be done as a form of "facilitation" that entices participants into engaging with artefacts and then scaffold their interaction.

Of these valuable contributions, only the first includes a *trajectory* originator and involves authors affiliated to the University of Nottingham, suggesting that there is little value for academics to contribute to a body of abstract knowledge

that has been developed outside their lab. This has been described as a "toothbrush problem" (Rogers, 2004) as *theories* are to researchers "like your toothbrush, fine for you to use but no one else is very interested in using it".

Uncovering these potential extensions has required both a detailed reading of these papers, and as a strong knowledge of the *framework* to gauge the potential implication for *trajectories* of papers' contributions.

4 Uses of trajectories for design

I now discuss instances where *trajectories* have been used to support the design of artefacts or experiences.

a Examples of trajectories used in design

Our review has identified 9 papers where *trajectories* are explicitly discussed as such. The table below lists these works, alongside the types of artefacts or experiences being built and which parts of the *framework* are engaged with.

Authors and year	**Short description of artefact or experience**	**Elements of trajectories used for design**
Arrigoni and Zics, 2016	Scenarios to guide public engagement with an existing interactive artwork, the Eye Resonator.	Global trajectory, beginnings.
Fosh et al., 2013	A mobile app to guide visitors through a sculpture garden.	Global and local trajectories, interface and role transitions, transitions into physical resources and across seams, canonical, participant and historic trajectories, managing trajectories, interweaving trajectories.
Ghellal et al., 2014	A location-based augmented reality game	Global trajectory, Hybrid spaces.
Maxwell et al., 2015	A location-based experience involving a tablet app, augmented reality, and narration.	Global trajectory as a coherent experience
Rennick-Egglestone et al., 2013	A tablet-based story supporting an exhibition visit.	Global and local trajectories, Transitions.
Taylor et al., 2014	An interactive performance installation	Canonical and participant trajectories, transitions, orchestration, encounters.
Taylor et al., 2015	A museum exhibition involving interactive artefacts.	Global trajectory, transitions, orchestration, encounters.

Authors and year	Short description of artefact or experience	Elements of trajectories used for design
Zangouei et al., 2010	A two-player game, EmRoll, using biological sensors as input mechanisms.	Trajectory as a continuous experience.

Table 2.6: Summary of uses of trajectories for design in research papers

Apart from these 9 examples, I have encountered 3 papers where the use of *trajectories* for design is unclear (Nisi et al., 2016; Stals et al., 2014; Yule et al., 2015). These works all describe the design of artefacts or experiences, introduce the *trajectories framework* before describing this design, but do not provide evidence that *trajectories* have had any role in the design process.

b Knowledge about the use of trajectories into design

I now discuss how these papers have reported their use of *trajectories*. Two types of information about this use have been provided by authors. The first shows which features of an experience or artefact map with *trajectories* and its constituent concepts, and connect with Cross' (1999, see next section) discussion of the *epistemology* of design. The second is a discussion of *how* this mapping came to be and how *trajectories* can be embedded in a design process, this time showing the *praxeology* of design.

i Trajectories as instances of design

All the papers listed above report to some extent how *trajectory* concepts map to features of artefacts or experiences. Only Lesley Fosh's work – supervised by Steve Benford and Boriana Koleva, both also co-authors of *Interactional Trajectories* – is systematic in its engagement with multiple concepts, and stands out from the rest in how explicitly concepts are mapped with features. Other papers are less detailed – for example Maxwell et al.'s (2015), who only state that the object of their design activity has been "a complex user experience" and has been successful in "maintaining a coherent narrative". It is worth noting here that the use of lower-level components of the framework, such as specific transitions, afford clearer and more specific mappings than, for example, the global *trajectory*.

Clearly presented mappings of the *trajectories framework* with instances of design are potentially useful as part of the framework's ambition to be a *vehicle for compiling craft knowledge*. I therefore highlight some examples below:

- Fosh et al. (2013) suggest that *historic trajectories* can be supported by providing authoritative content about a recent experience, for example interpretation about an artwork after it has been seen; these authors also show how headphones can isolate participants and prevent *encounters*.

- Rennick-Egglestone et al. (2013) discuss how the arrangement of exhibition space has generated queuing at a *transition point*, and how the lack of physical markers identifying content has impaired *re-engagement* – although this second example is not phrased using *trajectory* vocabulary in the paper.
- Taylor et al. (2014) build upon Sheridan et al. (2004)'s discussion of *tripartite interaction* to unpack complex *role transitions* whereby "unwitting bystanders" become "fully witting audience members" and "novice participants [transition] to skilled performers".
- Ghellal et al. (2014) have created "hybrid spaces" by matching film locations with places in real-world Stuttgart.

ii Trajectories in the design process

Although all papers describe to some extent the process that led to the design and deployment of artefacts and experiences, not all show how *trajectories* were "put to work" in this process.

Again, Lesley Fosh and her colleagues are the most comprehensive, and they describe a process in several steps:

1. Establishing a global *trajectory*
2. Designing *local trajectories*
3. Considering *key transitions* along the *trajectory*
4. Considering how participants would interact and how *encounters* should be designed

This process blueprint has been reused in BBC ideation workshops conducted in late 2013 and documented in chapter 4. Lesley Fosh's thesis (2016) also describes a second *trajectory*-based process, which consists of co-designing "gifted experiences" following a "trajectory template". This template follows the structure of *local trajectories* as defined in her 2013 paper.

Apart from Fosh et al., the integration of *trajectories* in design processes has been reportedly less extensively. Zangouei et al. (2010) have used an iterative process whereby each iteration's *participant trajectory* informs the next iteration's *canonical trajectory*. Taylor et al. (2014) list *trajectory* concepts as part of a broader range of considerations.

Other authors who have described their design processes have not necessarily discussed how *trajectories* were involved, focusing on other challenges, such as the configuration of collaboration with a museum in the case of Taylor et al. (2015). Arrigoni and Zics (2016), while not relating those with the *framework*, discuss their use of methods such as scenario-based design (Carroll, 1995) and prototyping.

Again, as with my search for extensions of the framework, identifying ways authors have used *trajectories* for design wasn't straightforward, and required detailed parsing of papers, and making judgement calls as to whether design choices were related at all to the framework, and whether these decisions derived directly from designers engaging with *trajectories*.

5 Gaps in knowledge for trajectories

Although this review shows interesting routes for using *trajectories* in design, I now argue that there is still a long way for *trajectory theory* to fully inform *professional design practice*. I now discuss the absence of reported use outside academia and obstacles to transposing current *trajectory* design to real-world situations.

Our review has only uncovered academic publications, with a few exceptions – such as patents through Google Scholar. This is due first to the contents of the bibliographical databases themselves, but also to the practice of citations within research communities – which has made this review possible but also led to the need to filter out a large number of cursory citations of the *framework* – which doesn't exist in professional design practice.

We have found several tools, methods and processes which have some currency in professional *service design* communities and resemble *trajectories* in some of their aspects – these are discussed further below – but there is no evidence that any of these concepts have been derived from the *trajectory framework*.

The only evidence of impact of *trajectories* in professional design practice we have encountered are things that my supervisors and I have actively fostered through our engagement with the BBC. These are described in chapter 4.

Lesley Fosh's work makes significant efforts to cross that gap, as she has been engaging systematically with the framework, using its components to design experiences and finally reporting on that use. However, unlike other projects – such as Stefan Rennick-Egglestone and Robyn Taylor's works with museums – it has been a researcher-led project, with no reports on constraints linked to stakeholders' requirements, resources or expectations – for example Fosh doesn't discuss coordination with the Rufford Abbey staff.

This suggests that a realistic way of "putting *trajectories* to work" that could scale up to a variety of real-world design situations would have to take into account how *trajectories* interact with a broader ecology of requirements, constraints, existing design processes, as well as designers' own sensibilities and knowledge. *Trajectories* would therefore be involved as part of *compositional judgements*, which, as Wolf et al. (2006) have discussed, are part of the craft of designers and are under-discussed in HCI literature, to the point that authors have labelled it

"the Black Art of CHI". Consistently with Wolf et al.'s diagnosis, I haven't encountered this type of knowledge when reviewing articles mentioning *trajectories*, which I would have expected to show some level of friction between *trajectories* and the practice of design.

2.2 Concepts related to *trajectories*

I now discuss another category of work, which isn't about *trajectories* themselves, but includes concepts that are similar to *trajectories* or their components. Because they are generally labelled differently, or may be linked to other disciplines than HCI, there is no direct way of identifying these through bibliographical databases. The list below is likely non-exhaustive, as there may be more concepts that I haven't identified, that discuss the same aspects of design, experience, or artefacts.

Listing these concepts may help identify similar guidelines, methods and tools that have more currency within design communities, and therefore support or inspire the development of *translations* of *trajectories*.

2.2.1 Benyon's Blended Spaces

"Blended spaces", a concept developed by David Benyon (2012), describe "spaces that mix the physical and informational, or digital". They are closely related to *trajectories*' notion of *hybrid spaces*, but also build upon other theoretical backgrounds such as the "blending theory", itself a "theory of cognition". Benyon doesn't clarify how *hybrid spaces* and *blended spaces* are conceptually related to each other, although he suggests that *blended spaces* constitute a third type of space beyond *physical* and *digital* ones, and can be traversed with *trajectories*.

More patterns of combining academic concepts and building new ones – where *trajectories* can be a building block, a simple reference, or used to define concepts in opposition to the framework – have been found throughout the review discussed above and detailed in the CHI paper where we have described the process as a "churn in concept space".

2.2.2 "Universal principles of design"

Some *trajectory* concepts correspond to some of Lidwell and his colleagues' "universal principles of design" (2003), a series of "125 ways of improving usability". For example, "consistency" (p. 56) may map to the idea of *trajectories* as "coherent journeys", "desire lines" (p. 76) to emergent *participant trajectories*, "entry points" (p. 80) to *beginnings*, "storytelling" (p.230) with the narrative aspects of *trajectories*. Although "wayfinding" (p. 260) is only mentioned in

passing in *Performing Mixed Reality*, its principles (orientation, route decision and monitoring, and destination recognition) might be complementary with *trajectory management*. Beyond their "universal" ambitions, Lidwell et al.'s principles are phrased prescriptively.

2.2.3 Service design concepts

Blended spaces and individual principles of design are each related with single concepts in *trajectories*, without the structure and relations that make them a *framework*. I now explore examples where *trajectory*-like principles are structured in a coherent whole. An important source of those is literature on the design of services, originally found in marketing and business publications. One of the earliest published methods for designing services, the *service blueprint* (Shostack, 1984), emphasizes the temporal aspects of interactions with services, presents the processes that happen behind the scenes as "orchestration" and highlights the importance of identifying "points [...] where the service may experience [...] consistency problems".

The parallel between *trajectories* and *service design* is unsurprising when comparing Parasuraman et al. (1985)'s definition of services as "performances rather than objects" with *trajectories'* grounding in *performance studies*. Other, more recent, characterizations of *Service Design* also resonate with *trajectories*. Satu Miettinen (2009) provides a glossary whose keywords may correspond to *trajectory* vocabulary: "service ecologies", although given a broader definition covering social, political and environmental environments, include *interface ecologies*. The "customer journey" mirrors the *global trajectory*.

Downe (2016)'s description of the UK Government Digital Service's approach to *service design* is about "stitching together" existing aspects of government services into "a coherent service"; the GDS intends to design services "end-to-end" (from the beginning to the end of trajectories), "front-to-back" (from the participant trajectory to the orchestration processes) and "in every channel" (across an interface ecology). In academic *service design* literature, Stefan Holmlid and Johan Blomkvist (2015) – both familiar with the CHI conference – distinguish between "expected" and "actual" journeys in ways that correspond to *canonical* and *participant trajectories*.

A central concept in *service design* literature is the "service touchpoint". *Touchpoints* (Moritz, 2005, p. 208) are the individual "interactions that make up the total experience of service". *Touchpoints* do not have a direct equivalent in *trajectory vocabulary*. The closest word is "episode of interaction", although this is a definition in terms of temporality, and not in terms of the assets involved: a single episode may involve interacting with several touchpoints (e.g. with a

digital interface and with a performer), or a single touchpoint may be reused over several interactions.

2.2.4 Transmedia storytelling

The concept of "Transmedia storytelling" was introduced by media and communication studies scholar Henry Jenkins (2003) to describe the logic of "entertainment franchises" that span multiple media – thereby corresponding to *trajectories'* idea of stories spanning "ecologies of interfaces". Jenkins offers guidelines for an "ideal form of transmedia storytelling" and suggests "a multi-layered approach" that "attracts a wider audience by pitching the content differently in the different media". This differs from *trajectories'* focus on a single overarching narrative by advocating for a balance between a coherent "franchise" and "entries" that are "self-contained enough to enable autonomous consumption".

The original presentation of *transmedia storytelling* offers no guidelines for content creators beyond this discussion on the autonomy of media. However, Christy Dena (2009) has proposed a series of "patterns in cross-media design" that may be read as a framework for designing cross-media experiences. Some of its features, such as timing considerations and "traversals" between media, correspond to considerations in the *trajectories framework*.

2.2.5 Cross-channel ecosystems

Andrea Resmini has introduced the concepts of *cross-channel ecosystems* (Resmini and Rosati, 2009; Resmini and Lindenfalk, 2016; Resmini and Lacerda, 2016) to discuss how designers can facilitate pervasive experiences. Resmini builds upon both Benyon's *blended spaces* and traditions in *service design* and in *information architecture*, i.e. a field concerned with the design of "information space". He contrasts his approach with that of *service design* by shifting from an organizational point of view – where *touchpoints* always define interactions between the service provider and its customer – to an actor-driven perspective, where actors follow their own paths across services and channel structures.

Cross-channel ecosystems are introduced alongside a rich vocabulary (Resmini and Lacerda, 2016):

- A *Channel* is an "abstract, high-level construct" and "pervasive layer". It is defined by designers and correspond to a grouping of information that it holds.
- *Touchpoints* as the support of moments of interaction.
- *Seams* are the elements that connect *touchpoints* and/or *channels*.

2.3 Knowing about design and its ways of knowing

I now turn to a second relevant body of literature, which discusses design both as an object of academic knowledge and as a site of knowledge production. The first heading will look at why this knowledge is relevant to my thesis, the second will discuss the forms design knowledge take, the third discusses methods through which researchers can address these forms of knowledge, and the final sub-section lists promising resources that may help bridge the gap between *research* and *practice*.

2.3.1 Why do we need to know about design practice? The research-practice gap and its implications

I start this review by discussing its relevance within my thesis, and within the broader concerns of the HCI community, as the gap between *trajectory theory* and *designing trajectories* mirrors a broader "gap between the demands of doing design and the way theory is conceptualized" (Rogers, 2004) that has long been a concern to academics. To address this, Erik Stolterman (2008) has suggested that "HCI research aimed at changing existing practice" should be "grounded in a well-developed understanding of design practice".

1 Some "implications for research"

Stolterman's argument is itself grounded in a succinct analysis of "the nature of design practice", from which he draws "implications for research" – named as a reference to HCI's frequent development of "implications for design" – which include new avenues for research, such as including design philosophy and theory into the "theoretical grounding" of HCI, calls for increased studies of design practice, and insight into which forms of knowledge can best support practitioners.

These suggestions have been further developed as a potential research programme by Goodman and her colleagues (2011) who have proposed the development of "theories of practice" based on studies of practice, as well as extended methodologies to support these studies, in the form of "reported practice, anecdotal descriptions, and first-person research", all of which are used in this thesis.

An example of a study of practice with strong implications for HCI research is Colin Gray and his colleagues' (2014) discussion of models of knowledge transfer

between research and practice, based on interviews of practitioners. This study has suggested that the use of theories and methods in practice is opportunistic and goes through a process of *appropriation* which involves the *translation* of concepts. Gray et al. stress the importance of individuals working as "dissemination agents" and suggest multiple routes for knowledge circulation between research and practice. The authors also call for more studies into design practice, in particular into unpacking "design judgement".

2.3.2 How do designers know? A brief introduction to design epistemologies

The works discussed above all mention that the activity of design involves specific "ways of knowing" that differ from the epistemologies of HCI. I now discuss literature that sheds a light on "designerly ways of knowing".

1 Design problems as "wicked problems"

An influential discussion of how design problems are incompatible with scientific epistemology has been offered by Horst Rittel, a design scholar, and Melvin Webber, an urban planner (1973). For them, "the search for scientific bases for confronting problems of social policy is bound to fail" because they are what they call "wicked problems". Wicked problems, unlike the "tame problems" that science is well equipped to solve, can't easily be formulated or reduced, they derive from multiple causes, and don't have a single solution. Solutions themselves – and whether and when one has been found – can't be assessed in a scientific way, as they can't be discussed in terms of "true or false", but in terms of "good or bad".

Rittel and Webber do not propose an alternative model for achieving rigour in design and social planning. However, when exploring ways of solving discrepancy resulting from the variety of possible explanations of social problem, they suggest that "the analyst's 'world view' is the strongest determining factor in [...] resolving a wicked problem", opening ways for solving design problems why may either rely on the subjective experience of practitioners, or on interpretations made possible by *critical theory*.

2 Design as a reflective practice

A way of achieving rigour in design, "reflection-in-action", has been described and advocated by Donald Schön (1983). In his book on professional practice, he criticizes previous characterizations of professional judgement based on "technical rationality" and which "consist in instrumental problem solving made rigorous by the application of scientific theory and technique". He opposes this vision by proposing instead that a professional is a "reflective practitioner". In

professional practice, knowing is tightly linked to action ("knowing-in-action") and can't necessarily be formalized through language – it includes "tacit knowledge". Developing one's skills and knowledge comes from reflecting upon one's activities within the frame of these activities, labelled as "reflection-in-action".

Schön provides examples of "reflection-in-action" for various professions. In his first case study, he describes architectural design "as a reflective conversation with the situation", which involves exploring, experimenting and discovering, shifting one's stance and reframing problems, and deploying "a language of designing which combines drawing and speaking" and involves normative knowledge about "design domains". Schön suggests that architects from varied backgrounds, although they may differ in their repertoires of styles and their way of prioritizing "domains", will have in common this reflective process.

3 Design solutions as "Ultimate particulars"

Building upon the notion of "wicked problems" and the lack of a single, "true" solution that resonates with scientific inquiry, Harold Nelson and Erik Stolterman (2012) comment on how designers address the space of potential solutions by ultimately designing a single outcome, which constitutes a "real" solution, rather than an unachievable "true" solution. Emphasizing their role as the unique endpoint of a complex design process, Nelson and Stolterman introduce the term "ultimate particulars" to name such solutions.

4 Nigel Cross' taxonomy of "ways of knowing" about design

Nigel Cross, widely considered a pioneer in design research (BIRD, in the foreword to Cross, 2007) introduced a taxonomy of design knowledge (Cross, 1999) describing it as rooted in three sources, corresponding to three types of knowledge that research about design may investigate.

- "People" as a source of knowledge drives the "epistemology" of design and research into designers' way of thinking. This aspect of design knowledge is the central focus of Cross's research around "designerly ways of knowing" (Cross, 2007).
- The "praxeology" of design, corresponds to "process" as a source of knowledge, and inquiry into the practices of design activity.
- The "phenomenology" of design, corresponds to "products" – often labelled as "artefacts" in design research literature –, and studies into their "form and configuration".

All three types of knowledge seem relevant to the transfer of knowledge about trajectories between academic researchers and design practitioners. *Epistemology* invites us to look at the shape of *trajectory* knowledge and to investigate how designers could integrate these concepts in "design thinking". *Praxeology* would look at the integration of *trajectories* within the broader context and processes of design. Finally, the *phenomenology* of design would involve looking at how interactive systems as embodiments of *trajectories* can inform future designs.

5 Design as a situated practice

The characterization of design as a "cognitive style" has underpinned popular approaches to business innovation under the umbrella term "design thinking" (Martin, 2009). Amongst critiques of this trend, Lucy Kimbell (2011) suggests that reducing design to "thinking" strips it from its social, political, economic and historical context. Kimbell (2012) later calls for design to be considered as a practice situated in the contexts through which design objects are produced, but also consumed. Influenced by Latour's *Actor-Network Theory* (2005), she suggests that design situations should be analysed as involving networks of actors – human and non-human – where designers and end-users are two categories of stakeholders which are equally central to design practice.

2.3.3 How can academics know about design? Research approaches

I now turn to ways academic HCI researchers have engaged in research that takes into account "designerly ways of knowing" and built academic knowledge through an in-depth engagement with design activities. I start by introducing classifications of relationships between research and design, then discuss approaches that have aimed to build such relationships.

1 Two taxonomies of design research

I now introduce two categorizations of design research. The first one describes the relationship of research and design activities, while the second discusses the perspectives through which design research is undertaken.

a Frayling's relationships between research and arts and design

Christopher Frayling (1993) is credited with introducing the term "research through design", which has been used to designate a set of traditions within design and HCI research communities – discussed in the next section. "Research through arts and design" is one of the three relationships between research and

design he introduced, alongside "research *into* arts and design" and "research *for* arts and design".

The research presented in this thesis covers all three of these aspects to an instance. My main goal is to empower future designers through the transfer of academic research, therefore this is research *for* design. To better achieve this goal, I look at how design is done in existing practices, for example within the context of my industrial partner, and it is to some extent research *into* design. Finally, design is also an activity *through* which my research has elicited knowledge.

b Fallman's triangle of design research activity

Daniel Fallman (2008) has introduced a taxonomy to frame research in "Interaction Design" – which he describes as a discipline related to, yet distinct from HCI in that it "fully recognizes itself as a 'design discipline'". The author introduces a "triangle" model, which suggests that design research activity lives in a continuum between three positions:

- *Design Studies*, which are "distancing and analytic" and aim to "understand" and "explain" what is "true".
- *Design Practice,* which is "context-driven, particular and synthetic" and involves the "real".
- *Design Exploration*, an "idealistic, societal and subversive" stance investigating what is "possible" or "ideal".

Work done around the *trajectories framework* on one side, and in this thesis on the other side, fit different places in this triangle. Blast Theory's work, being "subversive" and "artistic" is closest to the "Exploration" corner; *trajectories,* as an abstract set of concepts, is "distancing" and therefore fits the "Studies" corner, while the partnership with the BBC, a "design organization" (albeit not entirely "commercial"), looks at the "Practice" side. The thesis model I have described earlier can therefore be superimposed with Fallman's triangle, as shown in the figure below.

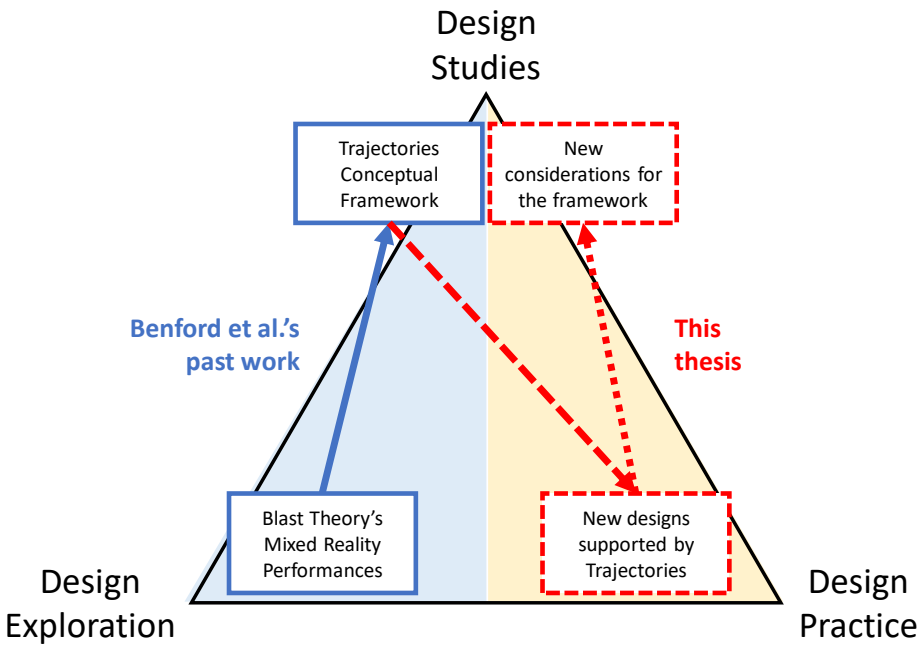

Figure 2.2: This thesis' research activity (see Figure 1.1), according to Fallman's "triangle" model.

2 Research through design (RtD)

Building upon Frayling's introduction of *Research through Design*, researchers have attempted to formalize it into a rigorous approach. I now introduce two influential approaches to *RtD* from HCI research.

a Zimmerman et al.'s model of RtD

In an essay drawing upon a review of existing models design and HCI research, interviews of designers and researchers, and examples, John Zimmerman, Jodi Forlizzi and Shelley Evenson (2007) proposed a formalized model of *RtD*, in which authors are careful to describe as not "the only way for interaction designers to perform research". In this model, "research artefacts" are put in a central position as embodying research knowledge. The authors' characterization of the research activity resonates most with Fallman's description of "design exploration", rather than "design practice" as they consider the intent not to be "to make a commercially viable product".

The authors propose a set of criteria to evaluate the quality of *RtD*: the **process** should be thoroughly documented and justified; the artefacts should exhibit significant novelty or **invention**; the impact brought about by new designs should be framed in terms of **relevance**; finally, it should provide **extensibility** by other researchers.

Zimmerman et al.'s model doesn't provide any in-depth discussion of whether and how *RtD* consumes or produces theory, beyond stating that artefacts may embody theory. A later review by Zimmerman et al. (2010) – besides calls for

further formalizing *RtD* – suggests that this approach can generate theoretical constructs either about design itself (*theory on design*) or that can inform further designs (*theory for design*). Amongst examples of the forms of theory that *RtD* can produce, Zimmerman et al. cite "conceptual frameworks" and "sensitizing concepts", two labels attached to the *trajectories framework* by its own authors.

b Gaver's expectations of RtD

Zimmerman et al.'s calls for greater accountability of RtD have been criticized by William Gaver (2012), who suggests that design research should not attempt to achieve the standards of rigour of natural sciences, and should consider the generativity – one design problem may generate multiple solutions – and performativity – design interventions change the setting in which they take place – of design. This reluctance towards excessive normalization of *RtD* mirrors Gaver's own concerns with how *Cultural Probes* – an approach to collecting insight from participants in a setting (Gaver et al., 1999) – had been "rationalized" and "appropriated as a scientific process", thereby losing its values of "uncertainty, play, exploration, and subjective interpretation".

Gaver's 2012 paper discusses a number of ways design and theory engage with each other: on the consumption of theory by designers, he quotes previous research (Rogers, 2004 and Stolterman, 2008) suggesting that design practitioners do not generally engage with HCI theory, but use "design techniques", "orienting concepts" and "existing examples of design to inform the development of their own ideas"; on the opposite direction, i.e. the generation of theory by design research, he notes examples of conceptual work arising from finding similarities in sets of designs and discussing these, or in "translating" concepts from other disciplines by using them as inspiration for designs. The argument concludes by noting that the type of theory that can be generated from design practice is "provisional, contingent, and aspirational" and offering a radical description of the place of theory in design: design artefacts are at the centre as the "definite facts of research through design", while theory is "limited to inspiration and annotation".

3 Ethnography, ethnomethodology and autoethnography

The use of ethnography and ethnomethodology in HCI originates from studies of work situations by researchers from the Computer-Supported Cooperative Work (CSCW) community with the object of designing collaborative systems (as cited by Rogers, 2004 and 2012). *Ethnography*, an approach originating from social sciences and originally applied to studying non-western cultures and then extended to marginalized groups within western society, focuses on documenting and understanding participation of individuals in a socio-cultural

setting. *Ethnomethodology* defines itself as the analysis of "everyday activities as members' [of a setting] methods for making those [...] accountable" and offers an understanding of members' "common sense knowledge of social structures" (Garfinkel, 1967, p. vii).

Although often discussed together in HCI as methods that provide insight into the social aspects of settings and technology use (Rogers gives them a single heading in her 2012 review), and sharing data collection methods based on field work, including observation and interviews of participants, they differ considerably in how they consider this data should be interpreted. Ethnomethodology rejects any external theorizing, relying instead on participants' knowledge and the ways they their work accountable to each other. Ethnography, on the other side, welcomes theoretical perspectives for interpreting and making connections between observations and field data, which has led Rogers to use the label "theory-driven ethnography" to contrast it with ethnomethodology.

Methods inspired from both ethnomethodology and ethnography have been used to support the gathering of design requirements and have made their way beyond HCI into the practice of design professionals (Fulton Suri and Howard, 2006). Turning ethnography from a social science method into a design method has involved a level of translation and appropriation, with Hughes et al. (1995) suggesting that focused studies aimed at "sensitizing" designers and being embedded in a broader design process – which they have labelled "quick and dirty ethnography" – may offer value within industrial time and budget constraints. Reacting to these appropriations, Button (2000) has suggested that designers have mistaken the data collection part, or *fieldwork* for the whole, and Dourish (2006) that such ethnographic studies, as they have focused on producing "bullet point" lists of product specifications, miss out on the true richness of ethnography, and calls for a renewed focus on the analytical and theory-driven aspects of ethnography – which this thesis involves, given its use of *trajectories* as an interpretative framework.

Ethnography traditionally involves the researcher taking the role of an '"outsider" [...] seeking to understand the lifeworld of others by participating in the research situation'" (Duncan, 2004), but also includes *autoethnography*, where the researcher reflects on their own role as a participant in the setting. Duncan suggests that designers wishing to use such methods should make sure the data they collect is not limited to their own subjective account but includes other traces of the design process, such as emails, observations of third parties and technical logs. Uses of autoethnography in HCI research has grown in recent years, from being restricted to requirements gathering and needing the support

of other methods (O'Kane et al., 2014) to being considered essential to investigate the subjectivity of design activity (Faste, 2017).

4 Koskinen's Constructive Research

Ilpo Koskinen and his colleagues (2008 and 2011) have categorized "research integrating design experiments" in the context of interaction design – included but not limited to research identified as HCI – into three main approaches, which they have labelled as "Lab", "Field" and "Gallery" and mapped to different methods and theoretical lenses. As these approaches go far beyond what is traditionally discussed as *RtD* and include a broader variety of methods, Koskinen has introduced the label of "constructive research" to discuss this class of research work.

"Lab" describes studies conducted with methods imported from experimental science – in particular psychology – with interaction happening in controlled environments where variables can be introduced independently. "Field" connects to traditions from social sciences, including *action research*, introduces design interventions in a context that "is typically ordinary people leading their ordinary lives", and its outcomes include a better understanding of the setting. Finally, the "Gallery" – or "Showroom" in later sources – is grounded in arts and design traditions, and is centred on artefacts themselves and – to use Fallman's categorization of activities – on *Design Exploration*.

This "showroom" approach is closest to characterizations of *RtD* described in the two previous headings: Koskinen cites Gaver as one of the researchers who have produced this type of research, and suggests that it has been a common approach in HCI; the centrality of artefacts is common between Koskinen's *Showroom*, Gaver's *theory as annotation* and Zimmerman et al.'s model. This doesn't mean that the two other approaches are any rarer in HCI, as they use methods that are common in the discipline – for example ethnography, *service design* methods and the deployment of prototypes in the wild in the case of "Field" – but aren't necessarily described by their authors as *RtD*.

Koskinen's paper (2008) suggest an ongoing convergence between the "Lab", "Field" and "Gallery" approaches. Although their methods, theoretical backgrounds and validity criteria made them originally "incompatible", the consolidation of design research as a discipline with its own standards means that "there is less need for honouring the standards established in other disciplines". The three approaches have in common that they "place some kind of design process and design skills at the heart of design research".

Koskinen's book includes a whole chapter around theory, which invites readers to unpick the thread linking design research approaches to theory from their

originating disciplines and onwards to their roots in continental philosophy. It suggests, not unlike Höök and Löwgren's description of a *knowledge gap* (2012), that there are intermediate levels of knowledge between theory and design instances, where elements such as *conceptual frameworks* live.

In line with the movement between *design exploration* and *design practice* discussed when mapping out this research work with Fallman's design taxonomy, the showroom and field perspectives can be used to situate this thesis. The present work seeks to import knowledge generated in the "showroom" by artists into the "field" of mainstream design objects.

Koskinen at al.'s discussion of the theoretical groundings of each approach seems at first glance to be an obstacle to this bridging. However – but this is not discussed in the text itself – the diagram of "designs, frameworks, theories, and philosophies" featured on the book's cover shows *critical theory* at the boundary of "showroom" and "field", affording it a potential role as a bridge. This would be consistent with Barzdell (2009)'s discussion of *criticism* in *interaction design*, whose analysis spans both "avant-garde" – *showroom* – and "mainstream" – *field* – productions.

5 HCI Research in the wild

Yvonne Rogers' historical account (2012) of HCI theoretical work has suggested that one of the features of "contemporary HCI" is its "turn to the wild", fuelled by the recognition that studying interactive systems in their context of use gives designers and researchers insight that studies in controlled environment cannot give them (Rogers, 2007). The *"in-the-wild HCI research"* label has originally mainly been used to describe evaluations of prototypes which have been framed as field trials instead of lab studies and draw on ethnographical methods for generating insight on systems use.

By Rogers' own account (2017), *Research-in-the-wild (RITW)* borrows heavily from the approaches listed earlier in this section, such as *RtD* and ethnographic studies, and reads more as a programme, in that it is a call for "pursuing research that strives for ecological validity" (p. 79). Mapping it onto Koskinen's taxonomy, it seeks to bring the discipline of HCI out of the "lab" and into the "field".

RITW also has theoretical ambitions, as Rogers suggested that new theory should be imported into it, and developed from it, which she labels "wild theory" (Rogers, 2012). The *trajectories framework* itself may fit that label, as it was developed through a process of "Performance-led research in the wild" (Benford et al., 2011).

2.3.4 The gap "in practice": towards translations of trajectories

After discussing the epistemological bases and the methodological approaches to the relationship between academic research and design practice, I now turn to insight into bridging the gap that may give actionable recommendations to guide this research.

1 The need for translation

In a paper suggesting strategies for bridging the "research-practice gap", Donald Norman (2010) – who has worked on both sides of the "gap" – has suggested the need for "translating research findings into the language of practical development and business", which the author suggests should be the role of "translation developers" dedicated to the task.

This need for *translation* is particularly important for forms of knowledge labelled as "theory", which Yvonne Rogers has suggested "cannot provide prescriptive guidance in the sense of telling a designer what and how to do design" and therefore can only inform design indirectly (2004, p. 130), and which William Gaver suggests "underspecifies design" (2012, p. 940).

Although Norman may not have been referring referring to that definition, *translation* is an important concept in *science and technology studies* (Callon, 1984). It describes a process in which one group of actors obtains the support, or "enrols" other groups of actors, and "represents" them – in other words, "establish[ing] oneself as a spokes[person]". Translation "is a process before being a result" and, if successful, it establishes a unifying "discourse of certainty".

In that view, developing *translational resources* for *trajectories* would require enrolling multiple sets of actors: designers, participants in *trajectories* or "end users", the originators of *trajectory theory* as well as the broader HCI research community, and finally the experiences and artefacts being produced, following Callon's approach of including non-human actors. Star and Griesemer (1989) have differed from this approach where "the story [...] is *necessarily* told from the point of view of one passage point" – which may fit well with this thesis being the account of the process from my point of view – and offer the concept of "boundary objects" which are the result of multiple translations and offer "a common coin which makes possible new kinds of joint endeavour".

2 Stolterman's forms of design support

Returning to Erik Stolterman's discussion on the "nature of design practice" (2008, see above), I now look at its most practical implication, where he suggests "forms of design support" that HCI researchers may provide and that "design

practitioners are inclined to appreciate and use". These include specific guidelines which offers routes for making *trajectories* useful for designers:

- "Precise and simple tools or techniques"
- "Frameworks that do not prescribe but that support reflection"
- "Individual concepts that are intriguing and open for interpretation and reflection"
- "High-level theoretical and/or philosophical ideas and approaches that expand design thinking but do not prescribe design action"

The last three points are arguably existing characteristics of the *trajectories framework*, but the lack of current use of the framework, and the difficulties we've had in disseminating is suggests that they may provide only partial support, and Stolterman himself suggests that this list requires further studies to be refined.

3 Höök and Löwgren's intermediate knowledge forms

Kristina Höök and Jonas Löwgren (2012)'s "intermediate knowledge space", which I already discussed when wondering whether *trajectories* constituted a strong concept, spans the gap between "theories" and "instances" in "design-oriented research". This gap is distinct from the gap between research and practice, but the authors suggest their potential in supporting design practice, and the forms of knowledge Höök and Löwgren describe as located in this space already include some of the elements highlighted by Stolterman. The authors offer the following list of intermediate knowledge forms:

- Design methods and tools
- Design guidelines – which are already forecast in *Interactional Trajectories* as future work that would help inform design.
- Heuristics, which Löwgren considers as "closely related to design guidelines but [...] evaluative [rather than] generative".
- Patterns – again forecast by Benford et al. (2009). Fosh et al. (2013)'s five-step template for *local trajectories* may constitute such a pattern.
- "Experiential qualities", of which Löwgren himself has authored an example (2009).
- William Gaver and John Bowers' "annotated portfolios" (2012), which include artefacts presented "as a systematic body of work" alongside "annotations [that] capture family resemblances". As discussed above, William Gaver (2012) considers annotated portfolios as one way to do "Research through Design".

4 Translational resources for design support

Recent work that has endeavoured to uncover such resources to support design includes Lucas Colusso and his colleagues' study based on interviews of practitioners (2017). Looking at which resources they use as part of their professional activities, the authors formulate four "recommendations for the design of translational resources to bridge the gap between theory and practice in HCI":

1. "Provid[ing] theory-driven examples", which may be visual representations, interactive examples, or vignettes that offer a glimpse into a broader data set. This resonates particularly with Benford et al. (2016)'s presentation of a "reference implementation" alongside their conceptual presentation of "accountable artefacts".
2. "Mak[ing] recommendations more actionable", which includes – as hinted at in *trajectories'* discussion of transmission of craft knowledge – developing guidelines and patterns, as well as choosing appropriate framing, vocabulary and phrasing. An example of such a rephrasing is provided in the form of a short "design implication" turned into an even shorter prescriptive guideline.
3. "Redesign[ing] scholarly search of resources", as the search practices of designers don't align well with the form of academic resources. The authors suggest aligning vocabulary, as well as embracing visual discovery. My review of *trajectories* shows that this problem is not specific to practitioners' point of view, as identifying either uses of *trajectories* or similar concepts has been made difficult by the lack of common keywords and paper structures.
4. "Integrat[ing] resources into [...] tools and workflows", for example making design pattern libraries available through design and communication software, the latter integrating with how design teams coordinate.

5 Methods and tools as resources: insight from Service Design

Building upon Höök and Löwgren's suggestion that *design methods and tools* can constitute intermediary-level knowledge between *theory* and *design instances*, and on Stolterman's suggestion of providing "simple tools and techniques", there is an opportunity for design methods and tools to showcase aspects of *trajectories* and act as *translational resources*.

There were, at the start of my thesis, only few methodological resources derived from *trajectories* – Fosh et al. (2013)'s design process, although not formalized as

a reusable method, and Anstead et al. (2013)'s heuristics, presented in chapter 4, being the exceptions. Given that, as discussed above, *service design* has similarities with trajectories, and has developed its own methodological toolkit, I now suggest that *service design methods* may guide the development of *trajectory* methods, and provide a review of *service design methods* based on Roberta Tassi (2009) and Satu Miettinen (2009)'s own reviews. These methods are diverse in type and scope, and many of them are common with, or borrowed from, HCI and other design discipline – for example surveys, ethnographic methods or heuristic evaluations.

Distinctive methods that may meaningfully support the consideration of *trajectories* include visual representations of services, for example (a) *service blueprints* (Shostack, 1984), which highlight the *global trajectory*, *orchestration processes* and "fail points", (b) *customer journey maps*, described by Tassi as a variation on the *blueprint*, and (c) *storyboards*, which, drawing on cinematographic traditions, present *customer journeys* as *coherent narratives*.

Service Design also uses prototyping methods that address a whole experience rather than its parts (Buchenau and Fulton Suri, 2000), including *bodystorming* (Oulasvirta et al., 2003) and *service walkthroughs* (Blomkvist, 2016).

6 A tension between actionability and agency

Stolterman and Carlusso's sets of "forms of design" support differ in their focus and in the agency they give to design practitioners. While Stolterman's list insists on avoiding prescriptive guidelines, Colusso et al. embrace them. Their second recommendation clearly calls for rephrasing academic knowledge into such prescriptions, while the fourth recommendation would build databases of standardized knowledge into the fabric of everyday work practices. The main rationale behind these recommendation is that they would make HCI knowledge "actionable", a word repeatedly used by Colusso and his colleagues, based on their interviewees' claim that academic knowledge is not actionable.

Connecting this back to Schön's characterization of designers as reflective practitioners and his strong opinions against "technical rationality" and "standardized knowledge", this suggests that academics who wish to design *translational resources* have to make trade-offs between *actionability* and "reflection-in-action". In Colusso et al.'s defence, their list of potential resources is backed by practitioners working in industry, the people this thesis is intending to reach. This desire for prescriptive guidelines may be driven by the contingencies of design workplace, such as time pressure – one of the interviewees is cited as saying *"people who do real-world problem-solving need design patterns to work faster"*. However, Colusso et al.'s discussion of "negative connotations" suggests that *translational resources* may be used to make aspects

of design such as “dark patterns” more acceptable by designers. Such resources, by reducing critical reflection, may therefore raise ethical concerns.

2.4 Conclusion

This chapter, reviewing mostly academic HCI literature, has explored the main research question through two perspectives. First, it has introduced the reader to the *trajectories framework* and has shown a lack of resources to help professional designers use *trajectories* in their practice. Secondly, it has looked at how design as a practice could be supported, and what methods HCI uses to engage with this practice.

In the next chapter, I pursue these two threads and identify whether the *trajectories framework* is adapted to designing experiences around live events, and what is needed to extend it to this new setting.

Chapter 3: Understanding trajectories in live events

This chapter describes two studies aimed at understanding existing experiences in a setting that hasn't yet been related to *trajectories*, that of live events. After an overview of the context and rationale that led to these studies, I review the HCI literature on live events, then describe each of the studies and draw common findings, and finally discuss the application of the *trajectories framework* to these settings.

The original goals of this chapter are to identify a mutual fit between live events and the *trajectories framework*. Although this fit is arguably successful, I present ways in which *trajectories* may be refined to better address live events. I also draw design guidelines, informed by *trajectories*, which may help designers create experiences that relate to this setting.

3.1 Context and approach

I start this chapter by discussing the rationale behind conducting these two studies. I first discuss the expected outcomes from these studies, then why live events are a good candidate setting for exploring *trajectories*, and finally explain my methodological choices.

3.1.1 Motivation

This chapter is the first step in expanding the scope of the *trajectories framework* – originally limited to mixed-reality performances, although with ambitions spanning other "cultural experiences" (Benford et al., 2009) – to the context of live events, in the same way that Lesley Fosh (2016) has expanded *trajectories* to museum visits.

To do so, this chapter is grounded in two studies of the experience of participants in live events, one around running races involving grassroots participation, and the other one around a large televised music festival.

These studies have two ambitions: gathering domain knowledge about live events, and validating the relevance of *trajectories* for that specific setting. This involves a *designerly* perspective, as some of the methods used here – specifically cultural probes – have a strong grounding in design research, and as the work

here aims to support the design work described in chapter 5 through a strong understanding of live events and prospective design guidelines.

3.1.2 Live events as a rich setting for *trajectories*

As evidenced by this chapter's literature review below, live events, and media use around live events, are rich settings in which to study human-computer interaction and design interactive artefacts.

Several aspects of live events make them both interesting and challenging. They are participatory, with mixes of amateurs, professionals and volunteers, both for running events – like the Nottingham Robin Hood Marathon, mixing occasional and elite runners, as well as professional and volunteer organisers – and for music festivals – Glastonbury has both large stages with well-established artists, and smaller ones for aspiring bands. They are spatially distributed: running races, due to their length, take over whole cities, while major festivals host multiple stages where concerts happen simultaneously. Media coverage of these events extends them over space and time, making it possible to catch up after the event. Finally, participants in these events document their experience through photos, videos, blogs and social media. In larger events, this is complemented by professional coverage from local and national media, and by the event organisers' own communication strategy.

These characteristics of live events strongly resonate with one aspect of the *trajectory framework*, the "hybrid dimensions of experience", which define the characteristics of the experiences that *trajectories* "traverse". *Hybrid time* and *hybrid spaces* fit in with the distributed nature of live events, *hybrid roles* with their participatory nature, and *hybrid interfaces* with the characteristics of media coverage.

3.1.3 Methodological approach

I now describe the global approach underpinning both studies, the specific methods used in each study being described under their respective headings.

The work described here draws upon the ethnographic tradition in HCI and in user experience design, as it seeks to use fieldwork methods to collect insight about a social setting. The two studies have been, in line with reported uses of ethnography in systems design, short and focused, which has been labelled as "quick-and-dirty ethnography" (Hughes et al., 1995). Despite the negative connotations of this term, this approach has been presented (ibid.) as "capable of providing much valuable knowledge". In the second study, I used technology probes (Hutchinson et al., 2003), a method whose goal is to inspire design, rather than produce in-depth ethnographic knowledge, which has led it to be labelled

"discount ethnography" (Dourish, 2006). However, they were combined with in-depth interviews and, more importantly, the ethnographic material is interpreted through a theoretical lens thanks to *trajectories* – which Dourish (ibid.) suggests is part of what can make HCI ethnographic studies go beyond "implications for design".

3.2 Related work: live events in HCI

The experience of live events has long been the subject of HCI research aiming at designing and prototyping better coverage services. For example, Esbjörnsson et al. (2006) and Jacucci et al. (2007a) have both conducted ethnographic studies of spectators at car races, discussing their experience as "active spectating" and highlighting its social aspects. The second study has led to the development of CoMedia (Jacucci et al. 2007b), a mobile "group media space" deployed at both a car race and a music festival. Later prototypes that also foster social interaction include "cheering" or "supporting" interfaces, for sports (Ludvigsen and Veeraswamy, 2010) or for music (Barkhuus and Jørgensen, 2008), on location or over a distance (Woźniak et al., 2015); Dezfuli et al. (2013) have designed a prototype to share videos between on-location and remote supporters.

These social considerations have led to several approaches for collaborative video production around events, from mobile live mixing (SwarmCam – Engström et al., 2008) to editing (StoryCrate – Bartindale et al., 2013), commissioning (Bootlegger – Schofield et al., 2015), and producing personalised interactive videos (Frantzis et al., 2012). *RunSpotRun* (Flintham et al., 2015) – a project which I was part of – has investigated the crowdsourcing and labelling of raw footage of races through a mobile app used by race spectators.

While the tools above imply purpose-built prototypes, the use of large-scale services available as smartphone apps, such as Twitter's Periscope[1], for covering events, has been studied by John Tang and his colleagues (2015). This study has led to two prototypes that aggregate real-time video feeds while taking into account social dynamics: Rivulet (Hamilton et al., 2016) and SocialStreamViewer (Mostafa et al., 2016).

Although these works do not directly refer to the *trajectories* framework, their emphasis on social activities and collaboration across roles – connecting spectators and performers in the case of "cheering" – resonates with the frameworks' concepts of *hybrid roles* and *encounters*. *Orchestration* is also

[1] https://www.periscope.tv/

discussed as an important consideration in some of these papers (Ludvigsen and Veeraswamy, 2010; Schofield et al., 2015).

3.3 Study 1: Marathon interviews

I now describe a small-scale study where I interviewed participants in running races – runners, spectators and race organizers.

3.3.1 Recruitment

12 participants were interviewed between February and June 2014. The first four participants were recruited in the wake of *RunSpotRun* (Flintham et al., 2015; see above for a succinct description) and were runners who had participated in the first iteration of that study by volunteering to be tracked by another set of participants who were watching and filming the race, while entering runners' bib numbers. Additional participants in the interview study included friends, university colleagues, and people referred to me by colleagues or by participants themselves – including the partner of a runner who had supported them as a spectator.

Amongst these participants, seven were primarily recruited as runners, three as spectators, as well as two who were committee members of a local club organizing a yearly race. There is overlap between these categories and three participants talked of their experience both as runners and spectators. More runners have also reported having watched races on TV.

Charities play a major role in British running and five runners reported raising funds, whereas the local club committee would donate its financial surplus to a charity.

Participant	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Participant in RunSpotRun	✓	✓	✓	✓								
Runner	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Spectator					✓	✓	✓	✓		✓		
Fundraiser	✓	✓	✓			✓	✓				✓	✓
Club member				✓							✓	✓
Club committee											✓	✓
Part of an informal group					✓		✓		✓	✓		

Table 3.1: Summary of participants in the Marathon study

3.3.2 Interview protocol

The interviews were semi-structured, with the script depending on the role each participant had held. The structure of the interviews was intended to bring out descriptions of participants' existing *trajectories*. Participants 1 to 10, recruited either as runners, spectators or both were asked first about how long, how often and how they had been engaged in running events. They would then retell the story of their participation in an event – in other words, they would narrate their *participant trajectory* – and finally discuss whether they also engaged with media around races – for example, watching marathons on TV or read running-related magazines and websites – and how this connects to their practice.

The interviews of participants 11 and 12 took a different structure, as they focused on their roles in clubs, and not on their individual practices as runners.

3.3.3 Summary of findings

I now describe a few relevant findings from the interviews.

1 A variety of profiles and motivations

Runners, who make up the majority of participants, show a wide range of profiles, ranging from occasional runners to committed club members for whom it is their primary hobby. This range of commitment also translates into a wide range of running performance – often measured by runners through their "personal best" time on a given distance –, of assiduity in entering races – from once in a lifetime to every few weeks or months – and, for the most committed runners, of preferred distance.

Runners enter races for a variety of motivations, including health-related reasons, social reasons – running with friends and colleagues –, for the sake of fulfilling an achievement or a challenge, to improve one's "personal best", to give one's day-to-day training a goal, and/or because runners enjoy either the activity itself or the atmosphere of events.

Motivations for spectating are generally social and involve either participants encouraging someone they know personally, or enjoying the general atmosphere of the race. "Spectating" has been described as a complex activity which involves identifying a location to stand at, cheering other runners, identifying the runner(s) one is looking after and taking photos of them.

2 A range of event types and participation configurations

The initial recruitment was focused on the Nottingham Robin Hood Half-Marathon, which is professionally organized amd open to both amateurs and

"elite runners", with 10,000 participants reported in 2016. Interviewees also reported participating in races of all scales, the smallest one having less than 300 runners, and the largest one – the Great North Run in Newcastle-upon-Tyne – 50,000 runners. Race lengths ranged from 3 miles (4.8 kilometres) to a full marathon of 26 miles (42 kilometres). Some were professionally organized and other community ran. Some, like the Great North Run and the London Marathon, were broadcast on national TV. Participants have also discussed other types of events, such as ultra-long runs, triathlons and mountain races.

An interesting feature of running events is that even the largest events involved volunteers, either as part of charities raising funds, as part of clubs offering specific services such as the luggage deposit point, or as race marshals, working directly for the race organizers, and generally compensated by discounted entries on other races.

3 Patterns of technology and media use

A variety of media and technologies were reported as being used by participants depending on their role and on the moment they used them.

Tracking devices – mostly GPS watches, but also mobile phone apps – were used by most runners to assess and support their performance over time, during races and/or during training sessions. Although some of these devices and apps provide features for sharing this data – including on social media – only one participant (P5) did this more than occasionally, within the context of a coaching group. Within actual races, this is complemented by RFID timing chips, provided by organizers, sent to runners in advance and returned at the end of a race. This is used by organisers to automate timing and publish results quickly, but the technology isn't commercially available for smaller races: P11 reported that groups of volunteers would note down timings on papers, and locally organized "Park Runs"[2] use barcodes that participants must print. Spectators – as well as one runner, P4, on a special occasion – have used digital cameras and camera phones to document races.

Online media were engaged with for a variety of purposes. Runners would check official race websites, either in advance to find out details of upcoming races, or just after the race, to check results, as well as the race photo website – operated by third-party commercial providers – where photos can be searched for based on a runner's race number, then purchased in either a digital or printed form.

[2] http://www.parkrun.org.uk/

All participants reported using social media, mainly to share and identify photos after races.

Other media that participants used included print magazines, which one participant (P7) subscribed to, and TV, through which several interviewees would watch running events. TV-watching motivations were varied and included watching elite runners – with sometime a focus on a single athlete, such as Mo Farah for P6 and P7 –, "the individual stories of people doing their runs for charity" (P7) or a general interest in races' atmosphere (P9). In some cases, this meant watching a race someone has participated in and being able to see the race from another point of view.

Local clubs also produce their own media, with P12 being the editor of a club newsletter, sent out by email and with a few printouts handed at club meetings.

To summarize, except for the most committed runners, technology and media use is generally opportunistic and responds to timely needs.

4 Keeping souvenirs of achievements

I systematically investigated how participants kept souvenirs of races, which all did to some extent. Souvenirs are kept in different forms, both digital and physical. Digital souvenirs include photos, automatically generated race certificates and training logs. Physical souvenirs also include photos and certificates, as well as medals given out to all finishers, commemorative T-shirts. One example of a "mixed" souvenir was a GPS watch – physical – that a runner had bought for their first race and in which the timing for that race – digital – was kept accessible and could be recalled by pressing a button.

The lifecycle of souvenirs starts by choosing whether to collect them, with trade-offs based on the significance of the souvenir. Participants' criteria included how much of an achievement they considered a run to be, cost, aesthetic qualities, and whether or not collecting a souvenir may impair performance – for example, stopping to pause for a photo or carrying a camera around. Souvenirs are then curated – for example by offloading them from cameras and building albums – and put on display – with social media profiles seen as the equivalent to walls at home or in the office.

During interviews, these souvenirs have sometimes been used by participants to support the story they were telling – some showed me photos online or on their mobile phones, or training logs. However, few of these souvenirs took the form of elaborate narratives that the work "story" may imply. One notable exception was P9's "great challenge" that took the form of a Facebook group where her friends were invited to follow her as she registered, trained and participated in a series of runs for a charity. The specificity of that story is that, rather than

starting from the retelling of event – as *historic trajectories* imply – it started from an empty frame to be filled in by an unfolding narrative over several months.

3.4 Study 2: Probing the experience of Glastonbury at Home

I now describe a study aimed at understanding the experience of engaging with a large-scale music festival through its media coverage. Unlike the marathon study described above, the Glastonbury study focused on the experience of people who were not present at an event, but followed it from home.

The original rationale behind studying the off-site experience rather than the actual festival included my thesis' initial focus on developing technology to support media coverage of live events (in line with *RunSpotRun*'s goal of crowdsourcing video footage); difficulties in accessing the festival itself; as well as BBC R&D's interest in investigating the concept of "presence", as the broadcaster was looking for new ways of delivering content and make their audiences at home feel like they are at the festival.

Two groups of participants were recruited, a large one for a short one-off survey after the festival and a smaller one for a longer-term probe and interview study over the duration of the 2014 Glastonbury Festival.

This study has been published in the proceedings of the *ACM conference on Interactive Experiences for Television* in Brussels in 2015, under the title "Towards an Extended Festival Viewing Experience" (Velt et al., 2015).

3.4.1 The Glastonbury Festival and its coverage by the BBC

The Glastonbury Festival of Contemporary Performing Arts is a music and arts festival that takes place most years in the south-west of England in late June for five days and was first organized in 1970. In 2014, when the study was conducted, 150,000 spectators had bought tickets. The festival was spread on over 80 stages, nine of which had the status of "main stage". The Glastonbury Festival enjoys a strong presence in national media in the UK, with TV viewers outnumbering on-site spectators by an order of magnitude: at its peak, according to ratings from the Broadcasters' Audience Research Board's (BARB), on Sunday 29 June 2014 at 5pm, when Dolly Parton was on stage, two million viewers had tuned into live coverage of the festival.

Six of the main stages had continuous live video coverage provided by the BBC. These feeds were available online live, with most concerts from these stages also available on iPlayer, the broadcaster's catch-up service for 30 days after the festival – unavailable sets were mostly artists who wanted to keep material exclusive to newly released albums. The BBC released 30 hours of video through its TV channels and 50 hours of audio through radio channels. Material also included edited highlights, interviews and a special edition of a magazine show recorded on location. The BBC also developed a specific portal to offer direct access to all Glastonbury-related videos – using iPlayer's technology – and articles.

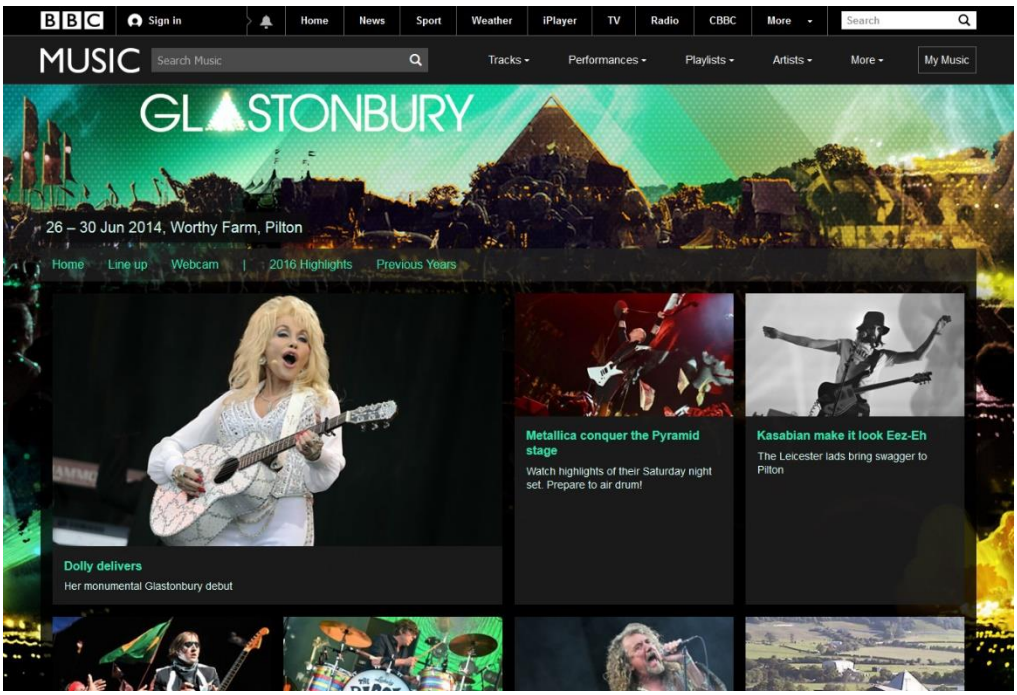

Figure 3.1: The BBC's Glastonbury portal (https://www.bbc.co.uk/events/errnc8)

3.4.2 The BBC-led survey

BBC R&D colleagues and I submitted a series of questions to a panel administered by GfK, a market research company, on behalf of BBC's Marketing & Audiences department. This panel, comprising 20,000 BBC audience members, distributed across age groups, social classes, and UK nations, takes part in daily surveys (BBC, 2013). These surveys are used primarily to calculate "appreciation indexes" for individual BBC programmes, but they can be complemented by any questions that BBC departments ask to submit.

The questions we added to the survey were taken by 1,301 respondents on the 30 June 2014, the day after the end of the festival. At that point, the probe material from the second part of the study was still being collected, and the exit interviews hadn't been yet conducted.

The first question was a screening question: participants were asked whether they had followed any BBC coverage of the festival. The 370 (28%) who had watched it on TV or listened to it on the radio would proceed to the full questionnaire, while the remaining 931 would jump to the last two questions.

The 370 remote spectators were asked who they had watched the festival with – 189 (51%) watched part or all of it alone, 46 (12%) with friends, and 172 (47%) with their partners or family.

Question 3 shows that an overwhelming majority (351, 95%) watched the festival from home, although other locations were reported, including in transportation (15, 4%).

Question 4 asked why participants watched the festival, with "listening to live music in general" being the most popular answer (189, 51%), followed by "headline artists" (140, 38%), the habit of watching it every year (74, 20%), and to discover new artists (50, 13.5%). This question also offered a choice labelled "to feel like you are at the festival", connecting with the study's original focus on presence, which was chosen by 34 responders (9%).

Question 5 enquired whether participants had done "anything special to make [their] watching of the Glastonbury festival an event", which most participants (324, 88%) responded no to. Amongst the 46 participants who did something, 18 consumed specific foods or drinks, 13 organized their weekend around specific performers, and 11 around specific sessions.

The last of coverage-related question asked viewers if there were parts of the festival they would have liked to see more, to which 230 (62%) responded no. 67 respondents (18%) were interested in "behind the scenes", 54 (15%) in non-concert entertainment, 43 (12%) in after-hours atmosphere and 33 (9%) in accommodation and facilities. 11 respondents (3%) used the "Other, specify" options, all to ask for more – or more diverse – music.

The last two questions were offered to all 1317 survey respondents. They were first asked which they though was better between going to the festival, watching it on TV, or listening to the radio, and why. The results were almost evenly split between being there (475, 37%), TV (402, 31%) and "don't know" answers (381, 29%). The most common justification for preferring being there was the "atmosphere" (224 respondents), followed by it being considered "an experience". On the other hand, over half of those who preferred TV (248) mentioned more comfortable conditions – be it due to the weather or to crowds.

The last question enquired whether respondents had been to the festival or would go in the feature. 89 (7%) had been in the past – including 5 respondents on the week before the survey – while 349 (27%) were interested in going in the

future – although 213 thought they wouldn't be able to, and 821 (63%) were not interested.

This survey paints the global picture of engagement with Glastonbury coverage as an overwhelmingly home-based experience which, for most viewers, isn't an exceptional event but part of a global media consumption routine.

3.4.3 The probe and interview study

I now describe the qualitative part of the study around Glastonbury viewers, which was conducted simultaneously with the survey above.

1 Recruitment and profiles

This study involved 17 participants (10 of whom female), aged 19 to 48 and recruited through university mailing lists in Nottingham and Swansea. The condition for participating was to follow part or all of the festival through TV, radio and/or online media, although one participant actually went to the festival and caught up with coverage later.

The study involved four steps, starting with a short questionnaire to understand their profile and their intentions for the festival, following on with a multimedia diary paired with probes for the duration of the festival, a summary questionnaire at the end of the festival and finally exit interviews.

Given the recruitment process, participants were generally highly educated and young. The demographic breakdown in the survey doesn't show strong differences between ages and social classes, but suggests that the recruited profiles correspond to viewers with broader ranges of motivations and with stronger interest in the festival than average.

The first questionnaire – which 16 out of 17 participants responded to – showed a variety of previous knowledge of the festival: 5 had been there before – including one over 10 times – and 3 had never watched or listened to any coverage of it.

2 Media diary and probes

The purpose of the diary was not to collect a fine-grained representation of participants' activity over the duration of the festival, but to support recall by interviewees and questions by the researcher during interviews, and to investigate the dynamics of collecting souvenirs and making stories of experiences. The use of a media diary follows the method proposed by Carter and Mankoff (2005), who had already investigated festivals as an example. It also follows the tradition of "cultural probes" (Gaver et al., 1999) and "technology probes" (Hutchinson et al., 2003), which often features media provided by

participants. The diary was not structured, and participants could fill it in either by sending emails or by uploading media.

The outcome therefore took very different forms: series of photos with minimal annotations, text summaries of one's experience, and word processor documents mixing text and images.

The media diary was accompanied by a series of probes to be engaged with on specific days of the festivals. These probes were:

1. Annotating a printout of the official program. This activity elicited potential strategies for selecting which acts to watch, and showed that participants would have different criteria at home – driven by bands – and on location – driven by the topography and by serendipity. This activity, being sent out on the first day, had an impact on participants' media consumption as it supported them in doing more planning than they would have done otherwise.
2. Sketching "covert reporting" devices or set ups, which has led to conversations on types of footage and coverage participants were interested in.
3. Creating an "iSpy guide" game, that is a list of things to be observed, with points to be awarded for observations, with rarer sights given the most points. For participants with previous knowledge of the festival, this elicited popular stereotypes – such as the presence of celebrities – and landmarks of the festival.
4. Taking an audio or video recording of oneself as a reporter.
5. Creating a list of awards, to be attributed to people at the festivals (performers, spectators, volunteers, etc.)
6. Designing a newspaper cover.
7. Crafting a festival-themed iPad frame to be used when watching the festival on iPlayer.
8. Summarizing the festival through either a musical playlist or by using photos from the official website.

The number of activities required more work and commitment than participants expected, therefore participants only picked a selection of these, or mostly engaged with the earlier activities. Providing clear instructions or templates made some activities, such as the list of awards, easier to engage with, and therefore more popular, while most participants felt uncomfortable with those that left the most room for creativity, such as the iPad frame.

3 Exit questionnaire and interviews

The exit questionnaire (16 respondents) aimed to elicit what type of coverage participants had engaged with. Consistently with the survey, all participants watched it from home. 11 participants also followed it from their place of work or study, and 5 while commuting. Social viewing was reported by 13 participants, mostly within the household (9), and lone viewing by 12. This main form of media accessed was video (all participants), both live and time-shifted.

Participants also engaged with various websites for festival coverage, including the festival's official website (13), the BBC's (12) and Facebook (11). Engaging with the festival involved varied ecologies of devices and included TV sets, personal video recorders (PVR), tablets, smartphones, radios and laptops. The questionnaire was also used to prompt for opinions about the coverage (almost all participants enjoyed it), and the study, which was found to be time-consuming and had made participants more aware of their engagement with the festival.

The final interviews, arguably the richest data in this study, were structured around discussing the data collected from the earlier stages of the study, and understanding use patterns, such as why and when some media would be accessed over others or how different media would be used to complement each other. Social media, fostering two-way communication with *insiders*, came up as an important part of keeping informed with what's happening on location, and participants who had been to the festival in previous years were interviewed on their own past use of social media at the festival – generally limited due to battery and network availability, as well as expectation of being cut off from the rest of the world as an important feature of the festival experience.

For all participants who had been to Glastonbury previously, knowing the festival from the inside had a strong impact on their remote engagement with the festival. Two participants reported that they had expected to feel sad about not being there. The difference between the media representation of Glastonbury as "quite a commercial thing" (P15) and the full diversity of entertainment has also made "insider knowledge" something participants value highly. For example, participants who had been there and communicated with friends on location had very specific conversations that imply such insider knowledge, for example about food options.

3.4.4 Summary of findings

This sub-section summarizes relevant findings from the Glastonbury study.

1 A diverse and composite experience

The results didn't identify a single "typical" experience, beyond characterizing the experience of Glastonbury remote audiences as centred on home, on video media, and on the most famous performers or "headliners".

Specific patterns that participants have reported include:

- A festival experience driven by "insiders" who are on location, whether they be friends who are in touch through social media, performers, or BBC presenters.
- Re-experiencing the festival through social media – as was the case with a participant who had attended Glastonbury multiple times and would post insider knowledge and photos taken in past years on their timeline.
- Accessing video coverage after returning from the festival, as a way of prolongating the experience, or sharing it with people who had stayed home.
- An experience focused on a specific band – one participant was a Metallica fan, and was thrilled that this was the first time they were headlining Glastonbury.
- A way of discovering new artists.
- A background soundtrack for other everyday activities.
- For some foreign respondents, the study constituted their first exposure to this type of music festivals, and a whole new experience.

2 A social, cultural and pervasive experience

Although some participants didn't report social interaction as part of their festival-viewing experience – especially those whose only motivation was listening to music or those who were new to the festival – others have experienced it as a social event, either because it has been shared with friends and family, because the festival found its way into conversations, or because participants have been seeking individual points of view – friends, artists, presenters – as part of their coverage of the festival.

The probes have elicited strong cultural expectations from UK-based participants, who identified and discussed iconic aspects of the festival, such as the presence of celebrities pretending to blend in, local landmarks, or muddy conditions.

The Glastonbury festival is weaved in with other aspects of British culture. It has been described as an important conversation subject; its coverage by the BBC extends beyond the frame of festival-specific formats, with mentions in news and weather programs; where BBC radio is being played, such as on car radios or in

supermarkets, it is an ongoing background coverage that audiences can tune in and out of.

It may also connect with other aspects of participants' experience: as part of one's relationship with music, helping to build musical tastes and identify artists; for committed festival-goers and volunteers, it is about being a member of a Glastonbury-centred community; for most participants, it is just part of their media consumption routine, alongside other yearly events, such as the Wimbledon tennis tournament or the football world cup, both happening at the same time as Glastonbury.

3 Immersion and presence in festival coverage

Connecting with the study's original ambitions of supporting immersive experiences, the findings can also be interpreted in the light of Carrie Heeter's (1992) dimensions of *presence* in telecommunication as a subjective phenomenon: media presence – relating to the realism of sensory stimuli, also labelled as "media richness" – social presence (through social interactions) and environmental presence (being able to interact with the remote environment).

Thanks to the high video and audio quality of the BBC's coverage, participants described the experience as being "in the front row". When compared with the actual conditions of attending a festival concert, where front rows are hard to access, remote viewers may have enjoyed richer audio and video stimuli – at least when only considering musical performances – than spectators on site. Because the broadcast experience of a festival is – as confirmed by surveys – primarily about performances, there are few incentives for the BBC to reproduce other stimuli such as background noise and views of a stage obstructed by crowds. However, this is where user-generated content may provide another form of *media richness*.

Social presence was obtained mainly through social media, although updates were rare, erratic and untimely as a result of festival-goers wishing to preserve their phones' battery life – network coverage was generally seen as a solved issue – or preferring to completely disconnect themselves from the "outside world".

The elements that could bring *environmental presence* may include the environmental conditions – including mud, cold weather, crowded facilities, tent accommodation – as well as food and drinks. These last two elements were the only ones reported by participants as something they've used to simulate the Glastonbury environment. *Environmental presence*, except maybe for a weather report on the Glastonbury portal, doesn't seem to be addressed by BBC coverage.

Participants had ambivalent feelings about presence. One participant expected that more elements of presence would make them feel more aware that they are

missing out on the real experience. Another one valued the uniqueness of being there, wanted to keep the broadcast and the on-location experiences well separate, and therefore was pleased that the BBC coverage presented what they described as a distorted image of the festival, with its focus on mainstream music.

4 Scaffolding participatory media

The probes also explored different strategies for getting participants to document their experience, which could therefore be extended to the design of systems for collecting user-generated content.

Free-form diaries, because instructions had little detail, have led to varied forms of content, depending on the effort putting into structuring media into stories. Setting up an online self-service platform has made collection of raw content easy, but it hasn't provided ways of structuring it, nor incentives to add proper descriptions to media. Two participants provided image-rich, well-structured compelling stories, both created using desktop word processing software and sent via email.

Activities which provided clear templates which participants could fill in were particularly successful. This included the "iSpy guide", where two examples had been provided in a document with blank lines, or the program annotation.

Some activities felt uncomfortable to participants, one even describing them as "childish". One participant didn't enjoy the "reporter" activity due to the self-consciousness of their own voice it brought. The iPad frame was particularly divisive, as only two participants did it, and reported it as very enjoyable. Another difficulty was that some participants found the instructions unclear or ambiguous.

Some activities led to more self-explanatory output than others, making them easier to interpret without the context of the interviews. For example, participants in the "embedded reporting device design" activity gave either well-annotated sketches or text descriptions that clearly explicated their designs; three-photo stories were accompanied by comments that made stories easy to understand. On the other hand, "playlist summaries" of the festival, when they included songs that were not directly linked to the festival program, required additional interpretation by their creators. The "iSpy guide" results often elicited either *insider knowledge* or cultural expectations (e.g. celebrities) of the festival for which, as a foreigner, I also felt I needed interpretation.

To summarize, these findings show the benefit of providing appropriate scaffolding, for example using templates to foster the generation of compelling user-generated content and shape it into stories, or building blocks for stories.

5 Televised experiences may not be souvenir worthy

As with the marathon study, I have also tried to investigate souvenir taking. Participants didn't report keeping souvenirs of their experience of following Glastonbury from home beyond material produced for the purpose of this study, except for a couple of participants keeping the video on their home recorder longer than they would normally do.

I didn't investigate in detail how participants who had attended the festival in the past had kept souvenirs of their experience at the time, although this came up in interviews. Some participants have reported using cameras, keeping photos, and posting these on social media, during or after their visit to Glastonbury. This material has been used by at least one participant to support their experience of "Glastonbury from home", who decided to reuse such images on their social media profile as a way of remembering their live experience.

3.5 Common findings: media experiences in festival events

I now discuss findings that are common to both running races and the Glastonbury Festival, highlighting first the commonality of the settings themselves, then looking at how media and technology are involved in participants' experiences

3.5.1 Live events as festive moments

The types of events described in this section revolve around "performances" by artists or athletes, with spectators watching and supporting these performances. They are complex organizations, with the largest ones being divided in simultaneous sub-events – e.g. concerts on multiple stages, races of varied lengths. The configuration of participation is also complex, involving a mix of professionals, amateurs, volunteers and fundraisers, paid or unpaid, both within organizing teams and within performers. They are celebratory and festive events, and may correspond to climactic points in individuals' practice of or engagement with arts and sports, or be an important moment in the life of a community.

Festival experiences are inherently social, and motivations for attending do involve social ones, including spending time with friends or meeting new ones with common interests. Even home-based, solitary engagement with an event involves an interest in the point of views of other participants.

Such events happen on a broad range of scales, including the few hundred participants in the local club race, the 50,000 runners in the Great North Run, or the 125,000 spectators at Glastonbury.

3.5.2 The recurrence of live events

These live events all show patterns of recurrence. Most individual events are held on a yearly basis, and therefore the organizing work happens on a year-long cycle – with, for larger events, continuous activity in between occurrences. But there are also shorter cycles involved, as spectators, artists and athletes may attend several similar events over a single season. Training programs also constitute a cyclic structure related to running events.

Repeat events have an influence on how participants experience them. For example:

- A runner may want to compare and improve their performance over races.
- A festival goer's criteria for choosing concerts to attend will change depending on their previous knowledge of the event.
- Likewise, having been there changes one experience of following a festival from home.

3.5.3 Patterns of media and technology use

Only the largest events (or the ones with the most famous participants) benefit from coverage by a national broadcaster like the BBC, but different types of coverage exist in all the events that have been studied, including community-led media such as club email lists, user-generated content posted online or local newspapers and radio.

Media consumption patterns are complex in both types of events studied and involve a range of devices (TVs, radios, phones, print media) to access the services listed above. Unlike attendance to events, most media use isn't planned for. There have been exceptions when participants have wished to follow live TV, but the importance of watching things in real-time depends on the type of events. As Glastonbury happened on the same date of high-profile sports events, one participant prioritized watching sports live over music.

Individual points of view are an important focus for media consumption around events, and participants have reported following those of friends, relatives and celebrities – including athletes and performers, but also journalists and, in the case of running races, charitable runners.

3.6 Trajectories through media in large-scale events

I now discuss the application of the *trajectories framework* to the experience of live events, showing a mutual fit between an existing framework and this new class of experience that it is applied to. I do this by systematically mapping the concepts in the framework with findings about festival experiences from the two studies described above.

1 The hybrid dimensions of experience

The four *hybrid dimensions of experience*, which describe the nature of the types of experience that *trajectories* traverse, invite us to consider whether festival experiences provide the same richness, opportunities, and challenges as mixed reality performances. When taking into account these dimensions, festival experiences seem arguably more *open-ended* than Blast Theory's work as, despite their authors' attempt to "blur the frame of the game", these tend to have clearer spatial, temporal and social boundaries.

a Time

Hybrid time is described in *trajectories* as involving different "layers" of time, with an in-depth discussion of mappings between *story time* and *clock time*. Although these events aren't structured around a story like that described by Benford and Giannachi (2009), such mappings are present when non-live content is being replayed, which has been a common way of accessing event coverage. Other temporal layers are relevant: *schedule time* describing how and when content producers make content available, whether planned or not; *interaction time* relating to frequent disengagement and re-engagement by participants; and *perceived time*, as these live events are often perceived by their participants as a break from the outside world and its pace.

An important aspect of *time* in live-events is how *trajectories* may involve the consideration of multiple timeframes, for example: a single occurrence of a festival from the moment it opens to the moment it closes, or from the moment participants or organizers start planning their event to the moment; a sub-event within the festival; the whole lifetime of the festival; a band's tour where the festival is one of the tour dates.

b Space

Hybrid spaces typically involve a mix of physical and digital spaces. This is the case with festival coverage as well: physical spaces involve the locations where festivals are organized, those where medias are consumed, generally people's

homes, but also the workplace or public spaces where either coverage is available in the background or where the event is part of the conversation, or places involved in getting to an event. Digital spaces involve those crafted and curated by stakeholders for these events, such as the BBC's Glastonbury portal, or race photography vendors' sites, but also existing social media platform, where content creation and curation is led by end users.

The spaces I've encountered are therefore not just characterized by whether they are digital or physical, but also by whether they are centred on institutions or participants. However, and this may be linked to the fragmentation of stakeholders, there are few, if any, spaces which truly show the hybrid nature of the spaces created in Blast Theory's works.

c Roles

Both studies have identified four core roles in live events:

- *Performer* or *athlete*
- *Spectator* (on location or remote)
- *Event organizer* (although this perspective is limited to two participants in the Marathon study).
- *Content producer*, including creators of "user-generated content" and local and national media.

These roles can have significant overlap, as illustrated by a Glastonbury spectator who temporarily took control of a smaller stage to perform, and published a photo of her performance on social media.

Roles may also span professional, volunteer, and amateur positions with varying levels of commitment to either the event, or to a practice corresponding to the role.

d Interfaces

Both types of live events involved a broad range of interfaces. Because of the widespread use of multi-purpose devices, in many cases, *interfaces* can be thought of as the intersection of *devices* and *services*, for example, iPlayer is a BBC *service* that is available as a *website* on *computers* or as an *app* on *phones*. *Services* themselves may take some aspects of *digital spaces*, for example *social networking sites* and their "wall" metaphor, or the Glastonbury website which is a "portal" giving access to all videos.

Unlike the performances originally described by *trajectories*, which were developed earlier than mainstream adoption of *smartphones*, the vast majority of *interfaces* encountered in festival events were accessed through participants'

own devices. Many services – a major exception being the BBC's own – involved creating accounts and giving identity details.

2 Trajectory types

I now discuss how *trajectory types* were at play in festival experiences, including cases in which there is no clear unique *canonical trajectory*, and therefore an experience led by *participant trajectories*.

a Canonical trajectories

Identifying a *canonical trajectory* in the experiences described above first requires choosing a point of view, and deciding whose plans are to be considered the *ideal experience*.

One answer could be that, this being a piece of *design research*, the work I've described here was done in preparation to actual design work – as it informs the Oxjam work described in chapter 5. In that point of view, there is no *canonical trajectory* at this stage, and this shows that *participant trajectories* may pre-exist to *canonical trajectories*.

Another answer is that participants' plans, where they exist, constitute the *canonical trajectory*. These plans may fluctuate from tightly framed to highly contingent, and the actual *participant trajectory* shows patterns of engagement, disengagement and divergence that are fully coherent with the framework. Technology is used to manage participant-led *canonical trajectories*, including pacing support in running races, or calendar alerts.

Finally, the different stakeholders involved in these events have their own plans and designs, which may be considered as *canonical trajectories*. These may be structured as coherent journeys to various extents. One of the closest example to a clearly defined *canonical trajectories* is how races organizers manage runners, sending out bibs in advance, giving clear meeting points, managing bag deposit schemes, sorting runners into starting pens depending on their performance, marshalling runners on a strict itinerary, giving out medals, then sending links to results and photos. In other cases, *stakeholders' designs* may be loose collections of signposts and calls to action rather than actual journeys rather than actual *canonical trajectories*.

b Participant trajectories

Participant trajectories are the actual journey as experienced by *participants*. As discussed above, they may be viewed as either in isolation from *canonical trajectories*, or as being guided by a series of *canonical trajectories*, led either by the participants' own plans or by stakeholders. The opportunity-driven nature of engagement with media suggests that convergence with some of the less

structured *canonical trajectories* may be transitory and loose, which offers both challenges to designers wishing to foster long-term engagement, and opportunities to engage with end-users at various points in their journey.

c Historic trajectories

The original definition of *historic trajectories* (Benford and Giannachi, 2008) is a "synthesized" retelling of the *participant trajectory*, based on data captured during the actual experience. Although the studies haven't identified examples of synthesized retellings that fit this definition in the strictest sense, participants in both have kept traces of events and retold stories. The first study elicited more cases of traces being generated, such as training logs and race results, as this data is used to support runner performance. In both event types, photos are used by participants to document their own journeys.

3 Transitions, Interleaved trajectories and Managing trajectories

I now discuss the finer-grained concepts in the *trajectory framework*, providing examples of their applicability to live events.

a Transitions

i Beginnings and endings

Beginnings and ***endings*** are moments that frame an experience. In live events, there doesn't seem to be such clear framing points, especially given the cyclical nature of these events. For example, would the beginning of a marathon experience happen when one starts engaging with running, when one registers for the race, when one travels to the starting point, or when one starts running?

ii Episodic re-engagement

Episodic re-engagement is a *transition* through time structures of events, and is very frequent in festival experiences. Examples include a spectator who travelled around town to try to identify their running partner at different points along a race, or festival remote viewers tuning in and out of TV coverage of the festival.

iii Infrastructure seams

Traditional examples of *seams in the infrastructure* discussed in *trajectory* literature, such as issues with GPS coverage – reported by a runner – or network and electricity availability – often discussed around Glastonbury – are all relevant to live events. Another example of a seam involved the *legal infrastructure*, in the case of a concert video that was available for live streaming, but not for replay.

iv Physical resources

Live events also often involve *seams* due to *simultaneous access to physical resources*. This happens when accessing concert stages and race locations, as well as the transport infrastructure around. With larger-scale events, crowd management is an important aspect of organization and also involves local authorities.

v Interface transitions

Transitions between interfaces are also a common feature of the experience of live events. Unlike original *trajectories* through *mixed reality performances*, these transitions are almost entirely managed by participants themselves. Stakeholders have offered opportunities for *interface transitions* between interfaces located within the same device, with calls for pressing the "Red Button" (BBC's own labeling of its DVB services) on TVs, links sent via email or "share buttons" towards social media. *Interface transitions* across devices do happen though, and involve for example looking for information related to a TV show on a mobile device, a behavior described in industry reports as "media stacking". More frequently, *interface* changes happen at the point of *episodic re-engagement*, where participants disengage then reengage with an event using different *interfaces*.

vi Role transitions

In recurring live events, *role transitions*, where participants take on a new role, happens both during a single event, or in between events. Examples of the first type include participants returning from an event and catching up with TV coverage, or at a more local level, switching activities, such as a runner stopping to take a photo, festival spectators walking between concerts, or remote spectators engaging with a conversation with friends on location while watching TV.

Role transitions between events are frequent and include race spectators becoming runners, runners becoming race organizers, or festival spectators going to Glastonbury one year but staying at home the next time.

b Interleaved trajectories

Interleaved trajectories, also labeled *social trajectories* discuss the *encounters* between *participant trajectories* and how stakeholders encourage or discourage them. Festival experiences being social, *encounters* are very frequent and involve all roles.

There is strong evidence that *interleaving trajectories* can support richer experiences as participants in both studies have expressed an interest in following individual points of views. Design interventions that take this into

account offer opportunities to tie *participant trajectories* together in several ways, including letting remote viewers identify people through whose eyes they want to follow the festival or making people guide each other through the experience.

c Managing trajectories

I now discuss processes for *managing and orchestrating trajectories* that I identified in both studies. The most visible side of *orchestration* is the organization of live events, and involves a broad variety of tasks, including making risk assessments, ensuring compliance to regulations, organizing logistics, publicizing the event and giving directions, recruiting volunteers and staff, and managing crowd flows.

Other stakeholders may also to an extent have their own *orchestration* processes. For example, the BBC at Glastonbury has to manage the visibility and availability of live and non-live media, as well as to organize specific shows and offer logistic support to its journalists, and communicate with its audiences through several channels, such as social media.

3.6.2 Chapter contributions

I now discuss the two main ways this chapter informs rest of the thesis. First, these two studies suggest possible extensions for the *trajectories framework*. Secondly, they suggest *design guidelines*, which support the design work described in chapter 5.

1 Extending trajectories

The studies in this chapter, as well as criticisms and suggestions around the *trajectories framework* identified through the review presented in the last chapter, point towards potential extensions for *trajectories*. I present three avenues for extensions, which will be discussed in depth in chapter 6.

First, the open-ended nature of live events and the way participants and stakeholder share control doesn't correspond to the patterns of tight authorial control observed in the original mixed-reality performance. Although the *trajectories framework* doesn't dismiss open-ended emergent experiences, it offers little guidance to address that design space, and critiques of the *framework* see it as close-ended (Bonsignore et al. 2014) and restricting the agency of participants (Hornecker, 2016). This extension has a direct consequence on definitions of *canonical* and *participant trajectories*, as the first may take loosely structured forms, and the second may emerge in the absence of, or in the presence of multiple, conflicting, *canonical trajectories*.

Secondly, the recurring nature of festivals and races support the idea of a cyclical *lifecycle* for *trajectories*, where consecutive iterations of an event can inform each other.

Finally, the varied ways in which people keep souvenirs of events suggest that there may be equally varied ways to generate, or support the creation of *historic trajectories* as memories of events, which are under-addressed in current *trajectory* literature.

2 Design guidelines for live events

Drawing upon both study findings and *trajectories*, I now give a series of guidelines to design *trajectories* around live events:

Guideline 1: Embrace the diversity of roles, which includes considering the four core roles of *spectator*, *performer* and *reporter* as well as the diversity of experiences within each role.

Guideline 2: Put encounters and social patterns at the core of design. This might be done by identifying whose *trajectories* will be interwoven and making sure technology supports it, or by making encounters happen. Stories are a great way of connecting people.

Guideline 3: Support and scaffold content creation. A few pointers or templates can help people tell and share their stories. Make content creators aware of their audience so they can choose to share *insider knowledge*.

3.7 Conclusion

In this chapter, I have studied the experience of participants in two types of live events with the dual aim of understanding the applicability of the *trajectories frameworks* and grounding further designs (which will be described in chapter 5). The findings show that these experiences map richly with the framework, although this framework may need to be extended to consider bottom-up experiences, repeated journeys, and a variety of ways of retelling stories.

Chapter 4: Using trajectories at the BBC

In this chapter, I describe the work done as part of my industrial partnership with the British Broadcasting Corporation (BBC), in which my supervisors and I have tried a variety of approaches to bring *trajectories* to an industrial design practice, and make practitioners use the framework to support their professional activities. I start by describing the context of the work, then discuss the global approach. The next sections correspond to four different approaches to bringing *trajectories* into practice and I conclude by reflecting on these approaches.

4.1 Context

My thesis is part of an industrial partnership with the BBC, the conditions and goals of which I describe here.

4.1.1 My attachment with the BBC

The conditions of EPSRC's Industrial Cooperative Awards in Science and Engineering (iCASE) involved an attachment with the User Experience and Accessibility (UX&A) team within the BBC's Research and Development (R&D) department, based in Salford, Greater Manchester. My supervisors, both at the BBC and at the University of Nottingham, and I decided early on that my attachment would not take the form of a single placement, but would be spread over the whole course of my PhD, with regular visits depending on projects in which I would be involved.

The main ambition for my attachment was to continue Steve Benford's work pre-existing work around disseminating the *trajectory framework* at the BBC. As described below, this involved reaching out to potential *trajectory* users around the organization.

4.1.2 Work predating this thesis

Trajectory dissemination at the BBC started a year before my PhD, around Steve Benford's placement at the BBC as a "Visiting professor", funded by the EPSRC's Dream Fellowships. The activities he led between October 2012 and April 2013 are described on BBC R&D's blog (Benford and Crowther 2013). They include:

- Organizing seminars, at the University of Nottingham and at the BBC, to popularize *trajectories*.

- Reframing trajectories for a specific setting: multi-screen experiences
- Facilitating workshops to "try and design trajectories through [...] hypothetical television experiences".
- Using trajectories as a way of critiquing the design of existing tablet apps used as companions to TV shows.

Steve Benford started a new series of two design workshops for BBC Knowledge & Learning around October 2013, which I describe in more detail below, as I followed the impact of these workshops within the organization.

4.1.3 Objectives

The goal of the actions described below were to accompany BBC teams in designing experiences with the help of the *trajectory framework* and document this process. BBC colleagues and myself tried to identify BBC projects that involved producing experiences where the *trajectory framework* was relevant – for example, related to multi-screen viewing. We then tried to get involved in the design and production process to ensure that *trajectory* considerations were taken into account, with the final goal being an evaluation of the value that *trajectories* brought to the end product.

This process took the form of a palette of interventions targeted at varied aspects of design processes and to different sets of stakeholders within the organization. Along the process, many challenges to the adoption and use of *trajectories* were uncovered.

4.2 Approach

I now describe the global approach for this chapter. I start by a describing the methods used in the process, then the different stakeholders I have encountered.

4.2.1 Methods

The methods used in this dissemination work can be discussed through two points of view: as a BBC intern trying to *use* and make colleagues use *trajectories*, and as an academic researcher reflecting upon that process.

Looking at the first point of view, the work in this chapter is supported by the design methods the BBC and I used to try to implement *trajectories*:

- Participatory workshops and prototyping, which are common in HCI research and UX design (as evidenced by Vines et al.'s 2013 review)

- Trajectory cards have been inspired on one hand by popular methods such as ideation cards[3] and affinity diagramming (Harboe and Huang, 2015), and on the other hand by design processes observed and reported by BBC colleagues
- Trajectory heuristics mirror usability evaluation heuristics (Nielsen and Molich, 1990).

Through the second lens, this chapter can be read as an ethnographic study, supported by stakeholder interviews, observations, informal feedback, and my immersion in a professional organization.

The design of the interventions described here was led from different sides at different times, depending on the configuration of projects. In some interventions, such as using heuristics, the work was entirely done by me or other academics, and the BBC only gave feedback at presentation time. On the other hand, the *Love Festivals* project was entirely led by the BBC based on inspiration that *trajectories* provided, and my role was only to observe and document the project. In between these two, the card-based tool was a collaborative work: the tool was designed by a colleague at BBC Research & Development and myself following a demand by BBC Knowledge & Learning.

The process has been driven mostly by opportunities found at the BBC over time, rather than on long-term planning, given the mismatch between the long-term timescale of my research and the turnover of BBC projects, and given stakeholders' varying levels of commitment and availability. The level of implication of stakeholders has been varying across approaches.

4.2.2 BBC Stakeholders

To better understand the relationships between stakeholders and their roles, I now briefly list key people I've encountered at the BBC and the departments they're part of. Understanding these roles and relationships was complicated because of the complex structure of the corporation's departments, which, as I describe below, involves transversal structures where teams can be linked to a department, and the use of company-wide titles such as "producer" and "editor", which don't necessarily correspond to descriptions of their activity. The

[3] See Richard Wetzel's thesis (2017) for both an extensive review and an example of ideation cards; Two examples of ideation cards relate directly to this work as they constitute direct translations of conceptual framework: Eva Hornecker's cards (2010) based on the "Tangible Interaction Framework" (Hornecker et al., 2006), and Mueller et al,'s cards (2014) based on the "Exertion Framework" (Mueller et al., 2011).

departments themselves have changed over the course of my thesis, following major budget cuts and highly publicized reshuffles.

The BBC stakeholders I was most involved with were within my attachment at the User Experience and Accessibility team within Research and Development. Projects that this team have been focused during my attachment included exploring new broadcasting formats – including adaptive length and interactive broadcasts, as well as virtual reality – and production processes. R&D includes other teams, both in Salford and London. Amongst these teams, I've been in contact at different points over my attachment with Internet Research & Future Services (IRFS), who focus on prototyping online services, and Connected Studio, the editors of BBC Taster, a web platform for distributing experimental video and interactive formats and collecting feedback from audiences. At the start of my work, R&D was part of the Future Media group, itself part of BBC Digital, which has now been merged into a division named BBC Design & Engineering.

I got involved early on with BBC Knowledge & Learning (K&L), which has been described in interviews as a transversal team involving BBC Learning and production teams. The remit of this department includes producing "factual" websites, such iWonder, a now discontinued series of interactive guides drawing content from multiple units within the BBC to foster learning about specific subjects. My contacts at K&L, who I first met through Steve Benford's trajectory workshops, were a team of two innovation leaders, whose role was to envision the future of this type of format.

Another department which I have been in touch with is User Experience and Design (UX&D), specialized in designing and evaluating BBC websites and applications. Employees in this group are spread amongst product teams across multiple BBC divisions, offering their expertise where it is needed. I have met the leader of UX&D, or Chief Design Officer, as well as a producer whose role was to create "pathways" – a concept inspired by *trajectories* – and designers and researchers to whom I presented my work during UX&D "Studio Days" – i.e. afternoons dedicated to internal presentations.

I also met individuals from Marketing and Audiences (M&A), a department dedicated to collecting insight about audiences. This involves gathering data from the Broadcasters' Audience Research Board, collecting extensive data on web and application use (through comScore, a commercial provider), and conducting (or sub-contracting) studies and surveys, and sharing the resulting insights with other departments.

My work within BBC R&D has also involved closely working with an employee on an internal placement program which had him leave his normal work as

conference room audio and video technician to spend eight weeks in total within R&D. His implication in organizing internal events gave him an excellent knowledge of the organization, and his help with the dissemination of trajectories has been extremely valuable.

4.3 Trajectories as high-level concepts

I now describe two instances where *trajectories* were engaged with by BBC stakeholders at their most abstract level, from presentations framed as *trajectory* seminars by Steve Benford.

The first case has led first to a reframing of *trajectories* as "pathways", then as an actual BBC project named *Love Festivals*, while the second has led to the publication of material advocating *trajectories*. The first two headings below, which describe *pathways* and *Love Festivals*, are grounded conversations with the project's producer, observations from a single project meeting, and interviews with the producer and her chief creative officer. The last section draws upon material produced by Dan Ramsden, a creative director.

4.3.1 Trajectories as pathways

This project was the first to have been commissioned as being a "pathway", and its producer (within BBC UX&D) had been given the job description of "pathways producer". BBC UX&D had started to use the word "pathways" following Steve Benford's presentations of *trajectories* to that department. This word was seen as resonating more with stakeholders' experience and as sounding "less academic". UX&D teams picked up on *trajectories* as they were seen as addressing two internal developments: First, the BBC wanted to stop being seen as a series of disjoint "services" – such as their websites and channels – and become "One Service" that could reach audiences "however, whenever and wherever". This was also seen as a way of addressing "underserved audiences", i.e. audiences who seldom access BBC services. Secondly, analysis of website use by Marketing & Audiences had shown a correlation between engaging with a variety of BBC websites and returning to BBC content over time.

Pathways were promoted internally, through presentations and at team meetings. When asked how close *trajectories* were to BBC's *pathways*, the Chief Design Officer was confident that there was a certain degree of similarity – which he estimated at around 40 %. He saw this similarity as less important than other criteria – namely "outcomes", "collaboration" and "velocity".

Although I haven't been able to obtain one of the presentations used to disseminate pathways, I did ask the *pathways producer*, who herself had to present *pathways* to her team, how she would introduce them. She described *pathways* as a "method" to design experiences, seen as related to "lean methodologies", as well as "a way of thinking", "a way of working together", a design and project management "resource", "a way of bringing mainstream audiences to online services" and "a way of fostering being 'one service'". *Pathways* therefore describe both the outcome and the process for designing and delivering an experience. She also gave a description of the process she was trying to put into place, which started by identifying the teams and assets that would be used in the pathway, continued by organizing "brainstorming" workshops which would lead to agreeing upon a scenario. This scenario would then be given to a professional illustrator who would turn it into a storyboard. Even though the producer described this step as costly, she also saw it as essential to providing a reference that would help coordinating teams, and as a distinctive feature of "using pathways".

4.3.2 A pathway in practice

The first project on which this process was tried out was meant both to serve an "underserved audience" (in that case, female audiences aged 16-34, a target demographic which was presented as a BBC-wide challenge at that time) and drive visits across BBC web assets. This project would engage with audiences at ten festivals with BBC presence over the summer. R&D and I first got involved with this project partway through the project, after the ideation phases. A storyboard had already been produced, showing how an audience member would go through the *pathway*, which involved both physical assets – a dedicated space at festivals, and balloons with the "Summer of Festivals" branding – and online assets – a Twitter account and a dedicated website.

I was invited, along with colleagues from BBC R&D, to attend a meeting for that project in London, which involved an external creative agency contracted to develop the assets needed to support the pathway, including the website, visual design elements and material to be displayed at festivals. The meeting served multiple purposes: eliciting requirements from the BBC, enlisting the support of stakeholders across the broadcasters' services, and finally obtaining clarifications on the requirements – which meant understanding to what level the storyboard was a faithful description of the client's wishes. Amongst constraints given by the Chief Creative Officer, this project had a very short deadline, a very tight budget, with little to no room for technical innovation.

The resulting product, named *Love Festivals*, revolved around a website serving as a "hub" in the user journey: Audiences were invited to access this website

through a variety of strategies, including on-location advertising (tents in 10 festivals across the UK), promotional objects (such as wristbands given out at the tents) and content, partnerships with artists and presenters, and social media. The *Love Festivals* portal would then propose links to existing content spread across a number of BBC websites, as a way of promoting these assets to audiences interested in festivals.

Conversations on evaluation elicited the complexity of measuring *trajectories*. The "key performance indicator" that was suggested was engagement with downstream content – the assets that the *Love Festivals* portal was linking to – but a member of Marketing & Audiences told us that tracing that engagement across multiple BBC assets may be complicated due to the very small uptake of logged-in services. Thanks to a launch through the *BBC Taster* portal, feedback could be obtained through user-provided ratings. BBC Taster's website indicates that 597 people have tried the portal, an arguably low number when compared with UK-wide BBC and festival audiences – but this may only include people who've engaged with *Love Festivals* through a specific link.

Beyond the metrics, the project manager considered it a success, as it showcased a new way of addressing audiences, and helped draw lessons for future projects, in particular in terms of organizing the involvement of editorial teams on in this type of project.

The images below show the Love Festivals portal and promotional material.

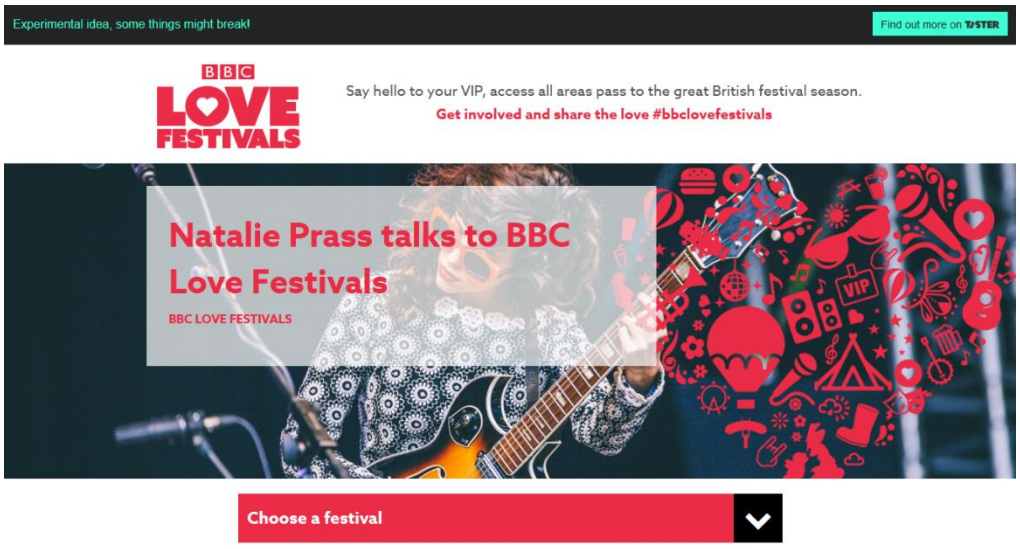

Figure 4.1: BBC Love Festivals, the homepage (retrieved 19 January 2016, now offline)

Figure 4.2: Promotional material for Love Festivals: wristbands and a foam heart held by artists and a BBC presenter

4.3.3 Trajectories as dissemination material

In this heading, I briefly discuss the dissemination material created by Dan Ramsden, a design practitioner, and targeted at other practitioners.

After attending one of Steve Benford's *trajectory* seminars in 2013, Dan Ramsden saw the framework as useful for his line of work and presented it in two main forms: a presentation at EuroIA 2015, a conference by and for Information Architecture practitioners, and a booklet (2016), distributed through his blog. Looking at the pamphlet helps understand how Ramsden translated *trajectories* into his own formulation of the framework and the value he saw in it.

The introduction to the booklet presents *trajectories* as "a design and storytelling technique that should help you design better experience by bridging gaps [...] between team members during the design process, between iterations of a design as it evolves or within individual designed experiences" (p.4). It also draws heavily on "information architecture" as the practice that he considers *trajectories* to inform, and reminds the reader of some of the principle of what he describes as a subset of User Experience design.

Ramsden introduces the three *trajectory* types, with new labels: "the designed experience" for *canonical trajectory*, "the individual trajectory" for the *participant trajectory* and "historical trajectory" for *historic trajectory*; as well as a list of *transitions: role transitions*, *interface transitions*, *beginnings*, *temporal transitions between episodes*, *real-virtual transitions* (relabelled as "switching domains"), *access to resources*, *seams*, *encounters*. The last pages describe "organizational trajectories", a translation of the *transition* taxonomy to project management.

Ramsden sees *trajectories* as a way of modelling experiences, and relates them to the *information architecture* concept of "domain modelling", i.e. an abstract

way of representing the context in which systems under design will be used (Scaled Agile Framework).

Most of the booklet stays at a very abstract level, with very few examples grounded in design instances – the "example" section just shows abstract curves symbolizing *trajectories*. The parts of the text that are closest to design guidelines are suggestions – sometimes phrased as questions – associated with concepts in the framework, for example "Consider devising a controlled vocabulary of roles that a user might inhabit during their experience" for *role transitions*, "Does the user have all the information they need to take the first required action in the experience?" for *beginnings* or "How might the isolation of a user enhance or detract from an experience?" for *encounters*.

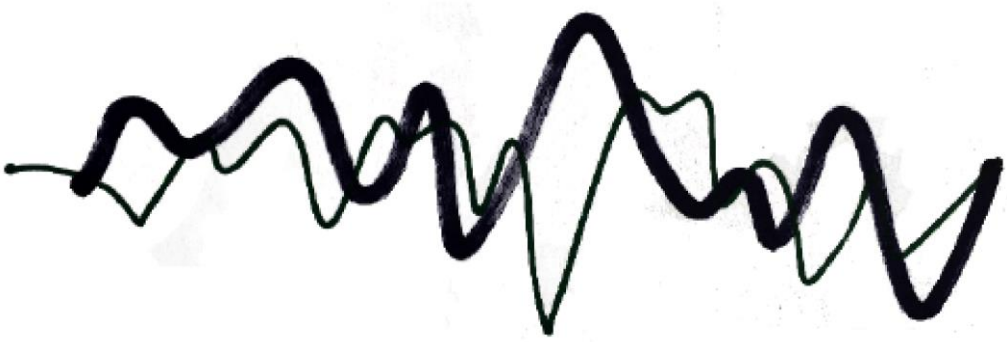

Figure 4.3: An example of a trajectory drawn by Dan Ramsden

4.4 Trajectories as scenarios and templates

I now describe another early thread of work, which started in 2013.

At the request of the two innovation leaders from BBC K&L, Steve Benford had facilitated two workshop sessions aimed at defining trajectory-based scenarios describing how audiences would interact in complex learning campaigns organized or supported by the BBC. The scenarios were chosen because they were related to existing projects – such as the "Wild-I" app described later – or to areas that K&L wanted to explore, and potentially commission, though not in the near future. Participants in the workshop included staff from K&L, UX&D and R&D.

4.4.1 Workshop outcomes

During the first session, five scenarios were developed:

- The Family Cooking Challenge, which involves learning about a recipe through a cookery show, sourcing the ingredients in a supermarket, cooking the dish and finally documenting the experience.
- The Golden Wedding trip, in which a family offers a personalized holiday to their parents, mixing on-site and BBC content.
- A Walk in the Woods, which revolves around planning, enhancing and remembering a visit at a local nature reserve.
- Community Stargazing, based on the BBC's Stargazing show, which would extend the current support the BBC provides to amateur astronomers organizing local stargazing events.
- The WWI Scout Expedition, linked to the then upcoming hundredth anniversary of the first world war, where scout groups would look for archive material about local soldiers, visit the battlefields and document the experience in the form of a "digital memorial".

Following that session, Steve Benford collated these scenarios in the form of one-page stories describing each learning campaign from the point of view of an audience member. These scenario descriptions also listed a number of BBC programs that would be involved, as well as the individuals, the locations, the devices and the timeframes involved, mirroring the *hybrid dimensions of experience* in the *trajectory framework*.

The second session, which I attended, was dedicated to address, one after another, specific elements of the *trajectory framework*, starting with drawing the global *canonical trajectory*, defining a *local trajectory* within it, and considering various concepts such as *transitions, encounters, orchestration* and looking at how to embed *historical trajectories* into the design of the *canonical trajectory*.

The image below shows a *canonical trajectory* created in the second workshop, for the "Golden Wedding" scenario:

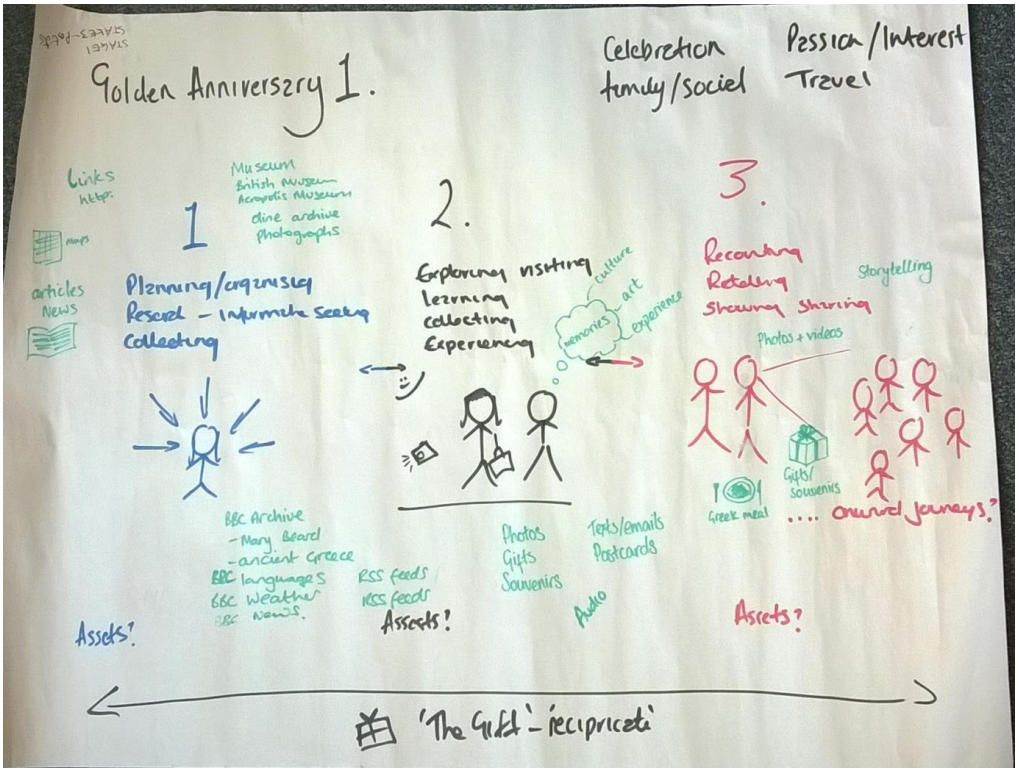

Figure 4.4: Representation of the canonical trajectory for the Golden Wedding scenario

4.4.2 Collating scenario outcomes

The resulting refined scenarios were, again, documented by Steve Benford, this time through a "zoomable presentation" using Prezi. This presentation shows the five scenarios as timelines, along with specific design challenges that were uncovered through questioning specific elements of the *trajectories* framework, and the dimensions of experience that each scenario traverses. The zoomable timeline for the Golden Wedding is represented below:

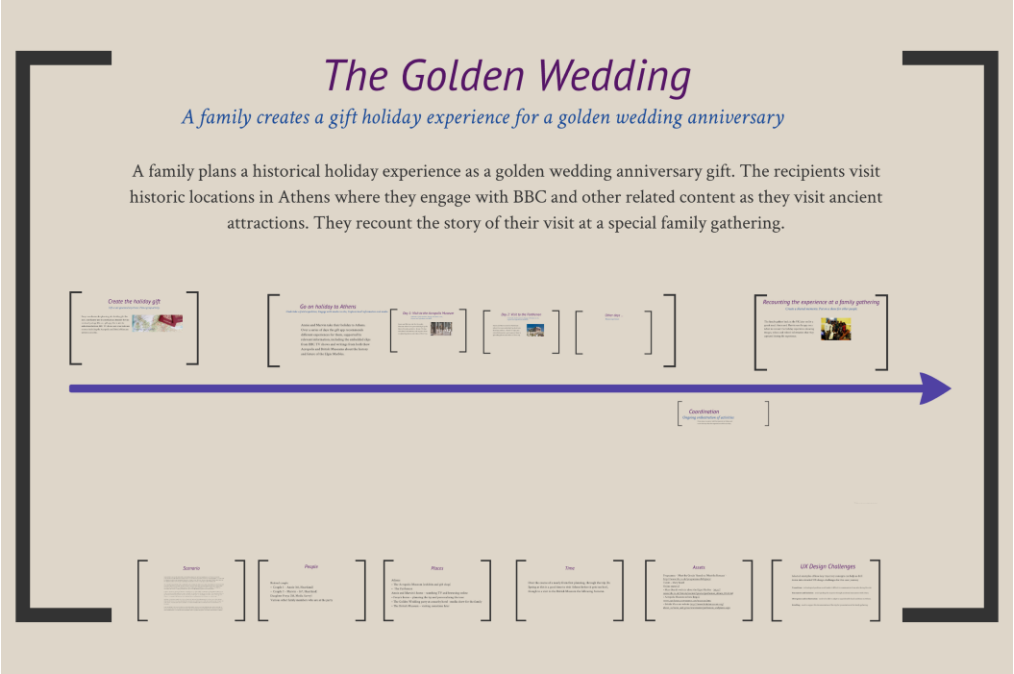

Figure 4.5: Zoomable timeline for the Golden Wedding scenario, created by Steve Benford using Prezi

This work led to draw a typology of these scenarios based on who leads the experience:

- The BBC itself, for example in the case of the Cooking Challenge, as it provides the blueprint for the experience and most of the content.
- Audiences, for example in the case of the wedding anniversary, where the individuals creating a guide have full control over the itinerary,
- Third parties, for example the owners of the nature reserve in the case of the Walk in the Woods scenario.

This was described as a triangular shaped continuum, given that some scenarios show shared control: for example, Stargazing is represented halfway between the BBC and the audience as it involves local groups taking on organization tasks, as well as national coordination around the BBC programmes.

On their side, K&L used scenario outcomes to identify which BBC content, technology and other assets could be used to support these scenarios, and which needed to be built, with the goal of identifying technology that could be commissioned to support several scenarios.

4.4.3 From trajectories to templates

Following on that, K&L expressed the desire to turn these trajectory scenarios into "trajectory commissioning templates" that they could use in future projects.

We discussed different approaches to create these "templates". BBC K&L favoured an approach where my colleagues and I would lead the work, being

"trajectory experts" that could bring "academic rigour", while I wanted to better investigate the BBC's requirements and in particular understand what they expected "templates" to look like. I suggested to start by concentrating on one scenario and then transfer our experience to develop the other scenarios, while K&L preferred to work on all scenarios simultaneously.

While K&L identified the "missing assets" needed to support all five scenarios, R&D and I were looking at commonalities between scenarios to explore the dimensions of trajectories that the BBC wished to commission. As the nature of "commissioning templates" was still unclear, I pushed for identifying production projects, rather than speculative ones, to better understand how the framework would be appropriated in a real-world context.

One challenge with that work was the meaning of "templates". While I had originally understood templates to be *canonical trajectories* made more abstract or generalized – for example, a generic "location visit" or "gift" template – alongside with guidelines for commissioning and delivering them, further discussions suggested that they may also have been meant as *trajectory*-derived requirements for commissioning the "missing assets" that would bridge the gap in the five scenarios.

4.5 Trajectories as heuristics

I now describe how my colleagues and I used trajectories as heuristics to discuss and critique the design of an existing experience.

This process follows Steve Benford and Edward Anstead's approach of "applying trajectories" to existing experiences. It was used with two BBC multiscreen experiences, the *Antiques Roadshow* and the *Jigsaw* app, and has been documented by its authors: the outcome of the first has been published as a zoomable presentation, and the methods and outcomes for the seconds has been formalized in a submission to the EuroITV conference (Anstead et al., 2013).

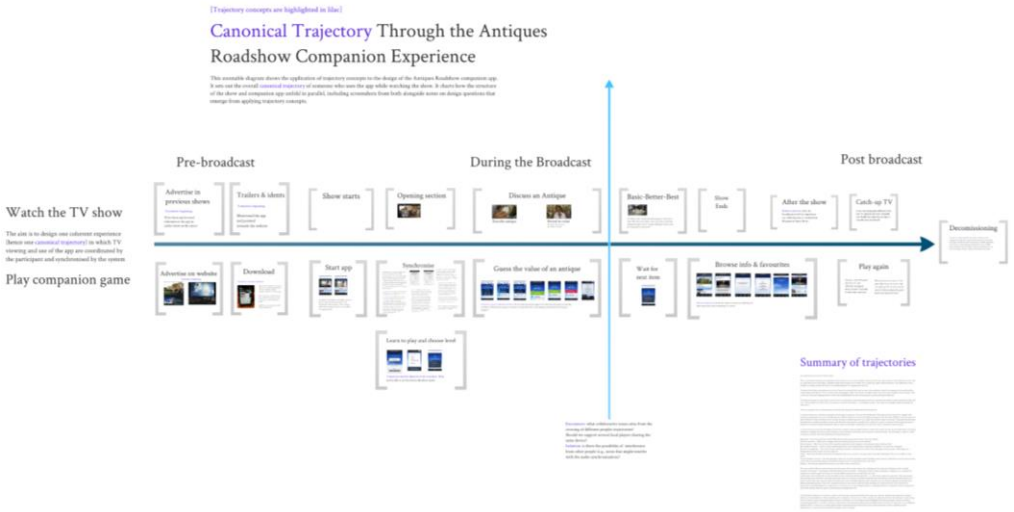

Figure 4.6: The Antiques Roadshow companion app, analysed as a canonical trajectory and published as a zoomable presentation. Created by Steve Benford on Prezi.

The method described in the paper is a nine-step process (see table below), modelled on the concept of *usability heuristics* in which different aspects of trajectories are considered.

Canonical Trajectories:
Step 1: Identify the core canonical trajectories in the experience
Step 2: Map out the overall structure of each canonical trajectory
Step 3: Identify key transitions along these trajectories
Step 4: Consider patterns of encounter between trajectories
Participant Trajectories:
Step 5: Explore possibilities for divergence
Step 6: Consider the need for orchestration
Historic trajectories:
Step 7: Ensure that the experience can be documented
Step 8: Support the telling and sharing of stories
Step 9: Connect this back into repeat experiences

Table 4.1: Nine steps of applying trajectories to multi-screen TV experiences (from Anstead et al. 2013)

I applied that process to a tablet application that was deployed in a nature reserve and had inspired the "Walk in the Woods" scenario described in the previous sub-section. The Wild-I app supports a visiting experience by providing video content relating to different animals residing in the reserve, based on the tablet's location (see screenshot below). It was developed as part of a research project involving multiple academic and industrial partners[4] aimed at investigating video delivery over wireless networks in public spaces.

[4] Arkive In Your Pocket: http://www.aiyponline.org

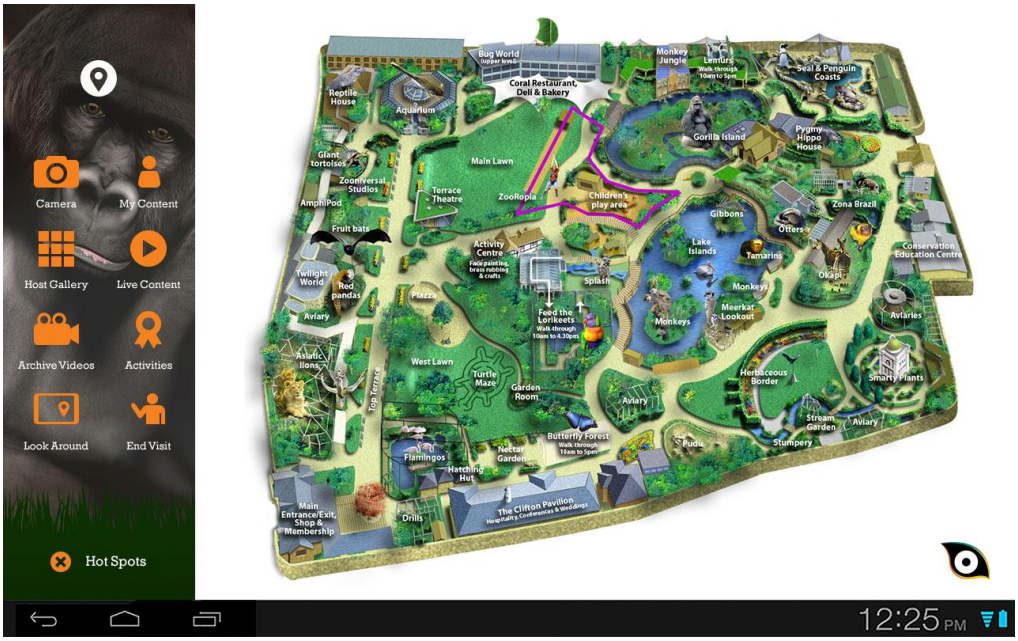

Figure 4.7: A screenshot of the Wild-I app for the Bristol Zoo, from aiyponline.org

Within that partnership, the BBC was tasked with evaluating and documenting the user experience. They had therefore sent a team of researchers to the nature reserve, who were handing out questionnaires, conducting short interviews, and filming app users on location. I met with the research team and did observations, both by using the app myself, looking at others use the app, and asking for informal feedback from BBC researchers. After I came back from the nature reserve, I followed the evaluation heuristics to question the features of Wild-I, producing a report showing design guidelines elicited by applying these steps.

I now reflect on the process. First, each of the steps did yield insight on the experience, although some were more productive than others. The "Identify key transitions" step was particularly useful, as I looked at seven different types of transitions. Second, there is some overlap between steps. For example, going out of the charted area could be treated under either the "Identify key transitions" heading or under the "Explore possibilities for divergence" one.

The first step, which is "identifying the core canonical trajectories" could have been done in a number of ways depending on my relationship with stakeholders and on how much I would consider myself as trying to improve a pre-existing *canonical trajectory* or proposing a whole new one. I took the first approach, and although there was no such *canonical trajectory*, I reconstituted it by combining information I had about the intent of the app and the app's navigation structure with how visitor information at the reserve and on the wildlife trust's website already prescribes a trajectory through the grounds. I looked at the trajectories of three roles in particular. These roles were based on discussions with the research team about target audiences. They are partly based on research commissioned by the wildlife trust about its visitors, and are consistent with the

types of visitors I've encountered while on location, and how the trust targets its communications.

Steps in the process that map with app features tend to show issues with these features. For example, considering *seams* in the infrastructure shows that GPS signal can't be relied upon to pair content with location, a result previously highlighted in several works around trajectories (Fosh et al., 2013; Nisi et al., 2016). Other steps specifically call for new features to be added, such as "ensuring that the experience can be documented". Finally, a number of steps use more careful language, phrased as aspects that need to be "considered" or "explored". Addressing these steps is ambiguous not only because there may be more than one way of orchestrating an experience or supporting divergence, but also because these considerations need to take into account the *value* that *trajectories* may bring to the experience. As an example, *trajectories* call for *encounters* to be successively encouraged or discouraged depending on the script's needs, but in Wild-I's case, these needs (which could have involved the reserve managing crowds or promoting activities) hadn't been elicited. This resulted in the evaluation resulting in a number of open questions, most importantly to what extent and for which purpose *trajectories* needed to be managed.

Finally, one important gap in these heuristics, when comparing them with the contents of the *trajectory framework*, is the lack of a step aimed at eliciting the four "dimensions of experience" – space, time, roles and interfaces – involved. Given that these heuristics cover evaluating the app as part of a *trajectory*, they don't address general app usability issues (such as confusing navigation), although these might be discussed along *transitions* as usability may prevent *transitions* from happening or trigger *early endings* or dropouts.

A few months later, I was invited to participate in a second round of evaluations, this time at a zoo. Changes to the user interface, beyond adaptations for the new settings, only included minor tweaks, given that BBC R&D had little input in the design process and most of the design decisions had already been settled. On some aspects, *trajectories* were a good match for this type of project – thanks to the multiple locations, multiple roles, traversals between virtual and physical assets, and a path across a location that could serve as a *canonical trajectory* – but there were no opportunities for stakeholders – whose main ambitions were to trial networking technology and to promote an existing set of video content – to engage with the values of *trajectories*, for example with bringing a sense of a global narrative to the project.

4.6 Co-creating a card-based prototype

I now describe another approach to introducing trajectories that involved creating and trialling a card based tool that was intended to support design processes. This is to an extent the continuation of the work described above, as involves several common stakeholders.

4.6.1 The development process

1 The original idea

BBC Knowledge & Learning and BBC Research & Development started this approach by assigning two BBC collaborators from other departments to the project for two weeks. They were based in R&D in November 2014 and their initial mission was to "illustrate trajectory templates". To help them do so, they were given academic literature on trajectories (Benford et al. 2009), as well as a report I had written for the BBC listing and comparing all the representations of trajectories I had encountered.

The outcome of the placement was the creation of a set of Near Field Communication (NFC) enabled-cards, each of which represented an element of the user's experience, e.g. a device or a location, and a mouse-sized NFC reader. Cards were designed to be tapped in a sequence with the reader, which would itself trigger PowerPoint slides on a laptop corresponding. At this stage, the prototype embedded *trajectories* only as far as it would capture user experiences in the form of sequences. It was envisioned as a tool that would be brought in design sessions to record their outcome and then used in meetings to play back that outcome.

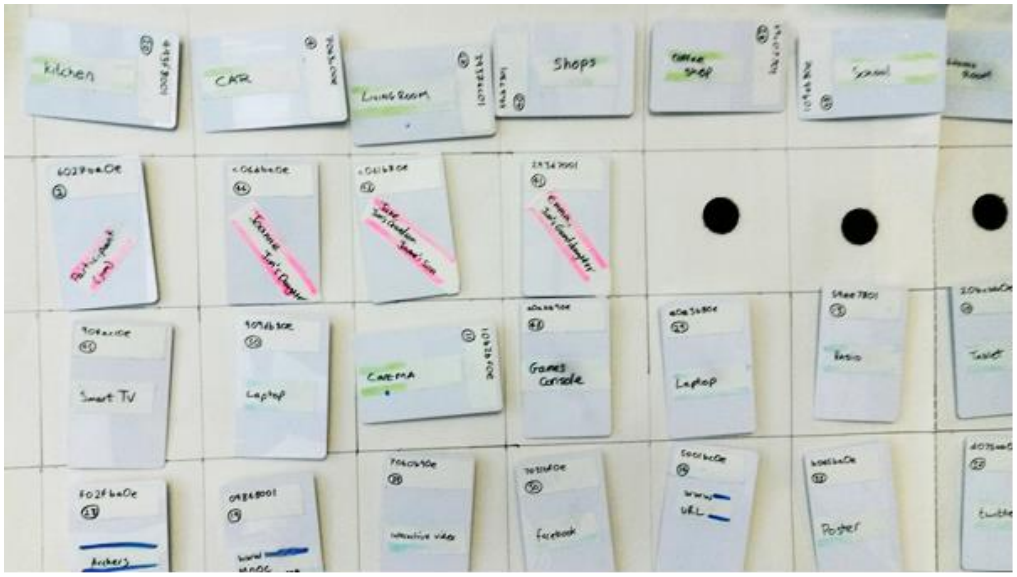

Figure 4.8: A photo of the original RFID pathway cards (© Spencer Marsden)

2 The browser user interface

I joined the project in a later stage, which involved only one of the two original collaborators. After discussing how we would share the work, we decided that I would work on developing a user interface (UI) to replace the PowerPoint deck and my colleague would improve the reader design and the card set, as well as identify internal stakeholders to gather requirements and disseminate the tool.

a First iteration: Recording the sequence

In the first iteration of the web-based UI I developed, the workflow was similar to the initial one, with recording and playback capabilities added. Specific cards would trigger the record or playback mode when tapped. We experimented with different types of output, one being a slideshow showing cards over time, one being a timeline with cards displayed side by side on a horizontal axis, and the last one being a "script" output, with content associated with cards displayed as a sequence of text blocks on a webpage, similar to a "news feed".

Given that elements on a trajectory may appear at several points or on the trajectories taken by different individuals, I experimented with showing timelines with loops and intersections, hoping that this type of representation would automatically elicit *encounters* and show the structure of *episodes*. I quickly ruled out this possibility, as the granularity chosen for cards (such as individual devices or locations) was too fine for that: loops and intersections would appear as soon as two steps in a trajectory share a common element, whether or not the steps were otherwise related.

The necessity to delineate steps in the trajectory also led to the creation of a special "group" card, which when tapped, would start a new group containing cards that would be tapped next.

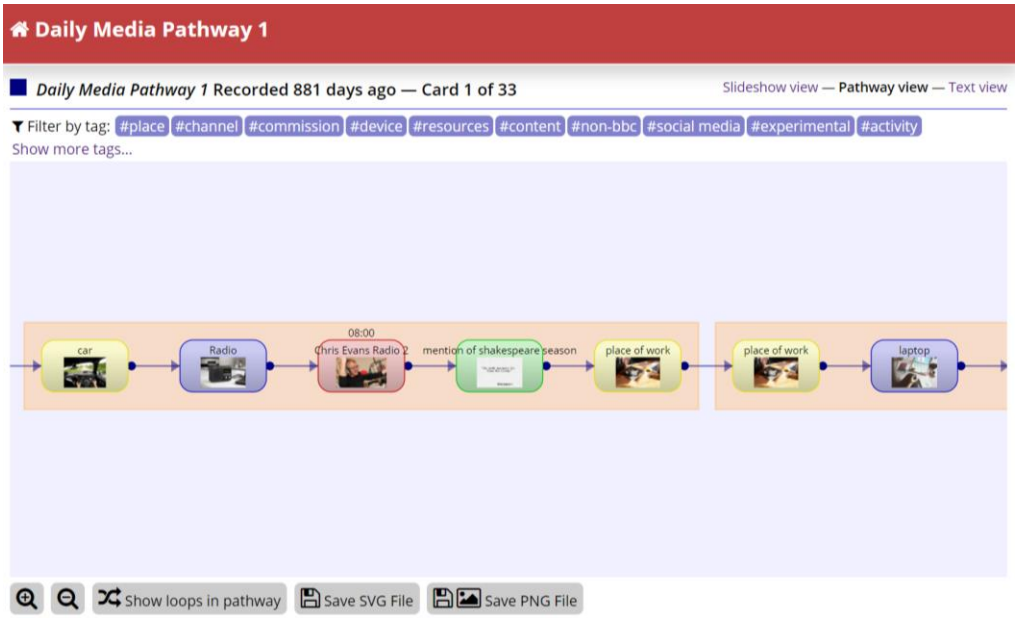

Figure 4.9: The first iterations of the Pathway cards browser interface

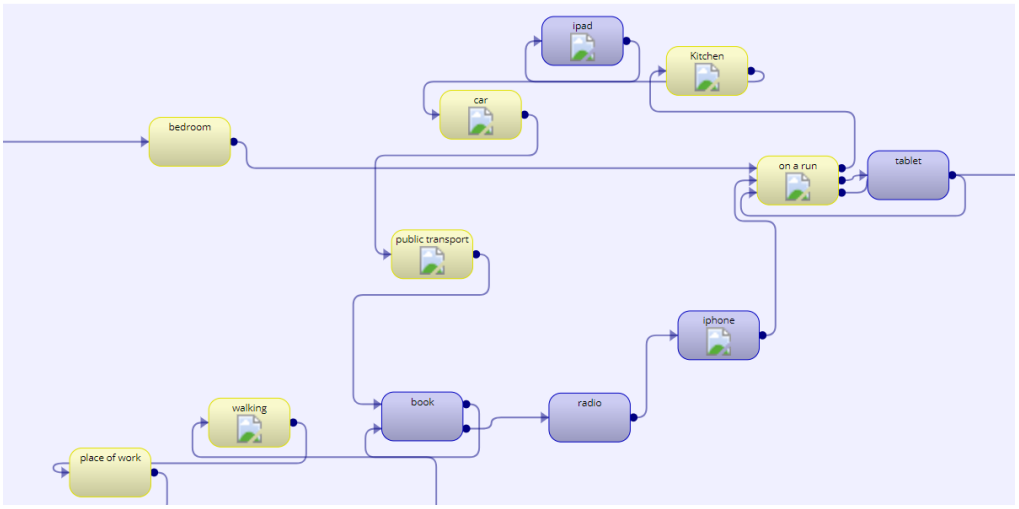

Figure 4.10: The first iteration of the Pathway cards browser interface, showing loops

b Second iteration: Recording the workspace

As we demonstrated the prototype, first internally to R&D and K&L stakeholders, we realized that we wanted to be able to place the cards manually on the UI's canvas when editing the outcome, or to record the layout of the cards as they were put on the table. To address this, I rewrote the UI to revolve around a blank canvas were cards could be added, removed and freely moved around. Sequences could still be recorded in a way that would result in a horizontal sequence of cards, but this was no longer the main input mechanism. Sequences could also be recorded to make use of cards already on the canvas and show as lines crisscrossing the table, but this means that the position of these cards would have to be manually set in the UI between the moment the cards were selected and the moment the sequences would be recorded.

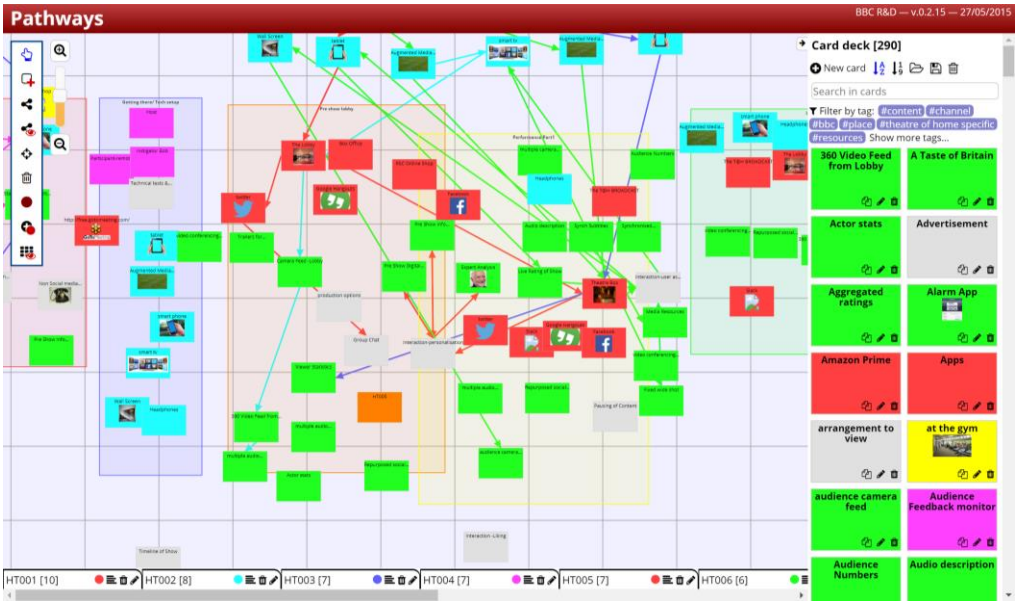

Figure 4.11: The second iteration of the Pathways browser UI

To improve the workflow, I started working on visual markers that would be added to the cards and enable automatic recognition. The target workflow would start with the creation of decks, from which a PDF file would be generated to print the cards. Users would then freely organize these cards on the table, with the only constraint being that markers should stay visible. Stakeholders would then, at any point, take a photograph of the table, upload it to the server, and computer vision technology would identify which cards had been used, and what their position on the table was, and capture the outcome of the workshop.

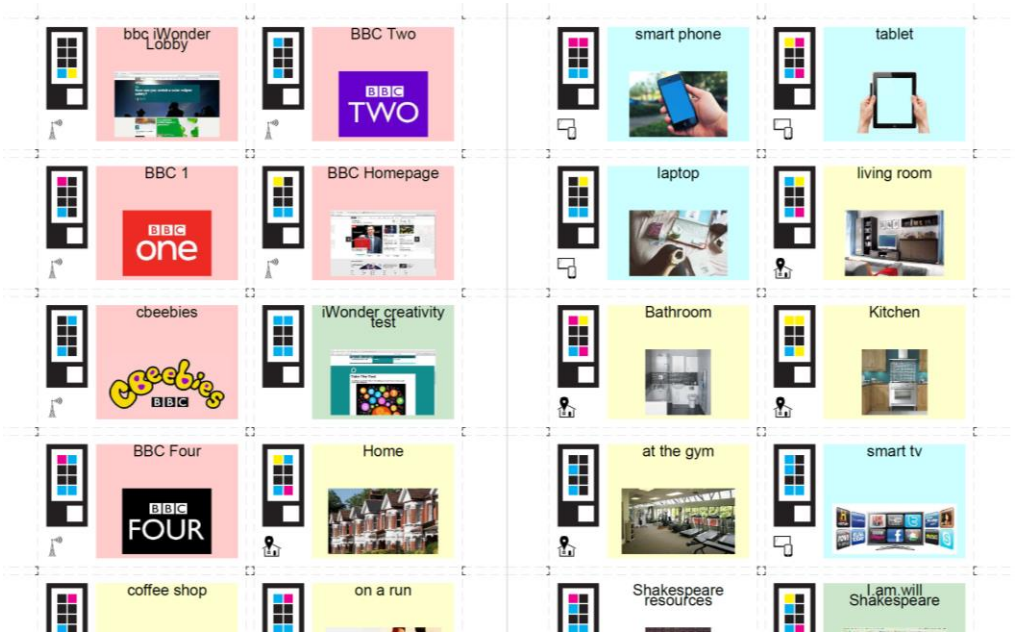

Figure 4.12: Example of printable cards with computer vision markers

In its current version, unchanged since May 2015, cards can be processed in a semi-automated way. The original ambition was to automate the workflow so

stakeholders could use it autonomously, but development stopped due to the lack of further commitment by K&L and R&D.

3 The cards

While I was working on these two iterations, my colleague at BBC R&D was looking at building a set of cards that would cover a broad number of BBC projects. To do so, he spent time meeting designers in several teams at the BBC, and looking at the resources they were using, amongst which audience research reports and *personas* were the most frequently used. In the final design of the deck defined six distinct card suits:

- **Participants**, which were defined as *personas*, and were meant to align with the personas defined by Marketing and Audiences that my colleague saw being used by designers around the BBC.
- **Places**, listing a number of everyday places where BBC audiences are expected to be reached.
- **Actions**, which may involve media consumption or not, and also describe everyday activities.
- **Devices**, which include both electronics (TV, mobile phones, game consoles), and print media (newspapers, magazines)
- **Channels** or **Services**, which include BBC and non-BBC Radio and TV channels, BBC content groupings (e.g. Sport), other British media outlets (e.g. newspaper websites), social networking services.
- **Content**, which either describe units of content such as a TV series, or a type of content, such as user-generated content.

There is a strong overlap of these categories with those defined by the *trajectories framework's hybrid dimensions of experience*:

- *Roles* correspond to a combination of *participants* (who they are) and *actions* (what they do)
- *Spaces* overlap with *places* (physical spaces) and to an extent with *channels* (digital spaces)
- *Interfaces* correspond to a combination of *devices* and *channels* (which include specific software applications or modes of delivery).

Where the two typologies diverge is first that *time* isn't translated into cards themselves, although when my colleague used the cards, he would always sort them or group them in chronological order; secondly, although *content* is treated in the *trajectory framework*, it isn't done at the same level as the dimensions listed above: it is either discussed as encompassing the whole *canonical trajectory*, which follows an overarching narrative, or described as

episodes and treated through the lens of *transitions* (specifically, *episodic re-engagement*).

We debated the open-endedness of the cards: my opinion was that cards should be imprecise enough to allow for refining along the design process – in the way that Buxton (2007) suggests *sketches* should be ambiguous and have no more than level of refinement appropriate for the current stage of the project – while my R&D colleague's opinion was that cards should be well-defined enough so that their pairing with a database could provide quick on-demand access to relevant data. For example, a stakeholder wishing to choose the appropriate BBC TV channel or social networking service to involve in their campaign given a target demographic could get immediate access to detailed audience data.

Building the card deck was part of a global shift from a tool to support the ideation of new *canonical trajectories* to a tool to analyse pre-existing *participant trajectories*. Given the choice of card suites and their augmentation with data, they align to the point of view of Marketing & Audiences as they describe the expected behaviours of audiences. This is reflected in the use case chosen for demonstrations, as I describe in the next heading.

4.6.2 Demonstrating the prototype

Demonstrations of the prototype were given to a number of stakeholders, mainly within UX&D and K&L and were led by my colleague attached to R&D. I wasn't able to attend all these demonstrations and had to rely on R&D and K&L's accounts of these.

My colleague had prepared a use case to illustrate the use of the prototype, and based it on analysing a hypothetical *participant trajectory*, which described an audience member's media consumption pattern over a whole week. That approach was expected to identify potential "touchpoints" which could be used to reach the audience, and the *canonical trajectory* would be a modified version of the *participant trajectory* that leads the audience member to interact with BBC content.

K&L stakeholders gave generally positive feedback about the prototype, but it mostly revolved around the benefits from an organizational point of view. It was described as a "propaganda tool" that would help to showcase the benefits of addressing audiences through multiple channels, foster cooperation between departments and in particular make sure that departments that benefit from "strong impact" (in particular production of TV content with mass audiences) take into account other pathways to content that depend on other departments.

I also presented the project to designers within R&D's Internet Research and Future Services (IRFS) team. This team, given its remit and the background of

its members, is generally more aware of methods used by the UX Design. They generally understood and approved the principle of the tool, but they found it to be too open-ended end loosely framed. They suggested to refocus the approach to target specific stages in the design process, and to design it in the same ways that we had observed BBC designers to work, namely by defining target audiences and looking at what would be the specific skills and job descriptions of potential tool users.

A demonstration to the team in charge of online analytics within M&A generated positive feedback: This team envisioned the tool as a way of making sense of their existing data. We didn't discuss the specifics of how the cards would be matched to data sources, but they agreed to give me access to their dataset through comScore's customer interface and to internal documents regarding that data through the BBC's workspace intranet. This strand of work ended at that point, as that team had no resources to commit to collaborating on a strategy to match the tool with data.

4.6.3 Testing the prototype on Digital Matchr

I now describe workshops I organized with K&L stakeholders and where the prototype was used to question the planning and design of a "real world" BBC project, "Digital Matchr" which would lead to the development of audience-facing assets.

1 The context of the project

A first project, involving a K&L producer, was identified, but was quickly ruled out due to extremely short deadlines. A second project with the same producer was selected, first because there were five months left before the release, secondly because the project was seen as a good candidate for using *trajectories*. Features that made it seem appropriate included:

- An audience that was considered hard to reach (teenagers)
- An "onward journey" that involved leading users to third-party online resources, which stakeholders consider "something the BBC is not good at".

That project consisted of a quiz where participants would answer a series of questions derived from a professional skills and personality assessment test. The results of the quiz would then be paired with skills sought after in the IT industry and would suggest types of jobs matching participant profiles. After reading their profiles, participants would see a list of online resources to practice or learn these skills, which were provided by partner companies. This project was part of a broader "Make it Digital" campaign, which was an umbrella term for a series of

IT-related programs and events spanning all BBC divisions, channels and target demographics.

The first contact involved one K&L innovation leader, the project's producer, the R&D colleague who had created the card set, and consisted of a short demo of the tool, a presentation of the K&L project, and was concluded by agreeing to use the tool in that project.

2 The first workshop

The first workshop took place a few weeks later. It involved three K&L stakeholders and my R&D supervisor. In preparation for the workshop, I was emailed a description of the project, a list of partner resources and a document prepared by describing "personas" which represented the digital skills that the project was meant to match with end users. I took these partner resources and personas and printed them onto cards just before the workshop. Although there were expectations on both sides that the workshop would help improve the general user experience of the project, there was no precise outcome that had been agreed upon.

I started the workshop by explaining what the cards meant and describing the suites. K&L the provided additional details about the project and its context. My R&D supervisor and I suggested to create cards corresponding to new information we gathered in that phase.

After that initial presentation, I decided to take a "backseat" approach to facilitating the workshop to look at how stakeholders themselves would appropriate the tool and *trajectories*. In particular, I didn't impose a structure on the workshop and avoided bringing in additional knowledge on *trajectories*, leaving a number of considerations (such as *transitions* and *orchestration*) untouched. The K&L innovation leader, who knew the most about the framework, was therefore the most active in kick-starting the workshop and calling for participants to "start creating trajectories".

K&L started by looking at cards and listing assets that were relevant to the scenario and the target audience for each category. There was debate on whether the content of cards should be provided by Marketing and Audiences or not. Following the example set in the first meeting, K&L chose to use the cards to describe a day in the life of an audience member. There was a debate on whether the "digital personas" were the relevant audience classification scheme to define separate trajectories, and K&L chose to introduce another type of classification, based on another audience research document.

Later on, K&L explored a different timeframe for the trajectory, looking at the weeks before, during and after the quiz is launched. This was quickly dismissed

as inappropriate for two reasons: first, they thought that quiz respondents should be able to participate at the moment they became aware of it, precluding the need for any promotion before launch; secondly, a large part of the onward trajectory was determined by external resources that were as yet mostly unknown.

The outcome of the *trajectory* was therefore mostly a marketing strategy, based on a number of different "touchpoints" that could be used to address the audience. The producer declared later on that the major outcome of this workshop was that it led him to redefine his target audience.

Although a number of blank cards were provided, stakeholders were initially reluctant to use them. This, combined with the choice to avoid discussing the parts of the experience where there was the most uncertainty, may have been in part due to the fact that the tool was seen as about how newly commissioned assets integrate with existing experiences. It may also be linked to the framing of the workshop and the wider project, as well as the professional roles of stakeholders, who were *producers* trying to find the best way of assembling existing resources in order to maximize audience impact, rather than *designers* trying to create a novel, compelling and distinctive experience.

The image below shows the state of the table corresponding to one of the final outcomes of the workshop, namely the *trajectory* for one of the personas.

Figure 4.13: One of the outcomes of the workshop

3 The second workshop

A second workshop was held two months later to refine the marketing strategy defined in the first iteration. The number of participants was reduced to only the K&L innovation leader and the producer. Unlike the first workshop, the outcome

was very precise, as the producer wanted to drill into the details of the marketing trajectory for two clearly defined target audiences: girls aged 16-19 and boys of the same age range.

The workshop did lead to formulating a refined strategy, involving social media and celebrity-driven promotion. This time, I decided to use the *trajectory framework* to critique the outcome, and look at transitions to try to flag up issues with the *trajectory*. For example, I suggested that the lack of a mechanism to "save" the list of resources suggested at the end of the quiz would make it impossible to re-engage with the *trajectory* as well as to create a *historical trajectory*, but this was seen as impossible given the current technologies used in the project.

4 Impact on the final project

The marketing strategy ideated during the two workshops was not implemented, because it was beyond the remit of K&L and would have required work-intensive cooperation with the M&A department. In interviews, the producer saw the benefit of the tool as enabling a deeper reflection on characteristics of the audience or, in his own words, it helped "focusing on what the audience were aiming at and how their lives worked so how we'd then tweak the product to their lives". To an extent, this was what the cards themselves had evolved to be and may not be directly traceable to the *trajectories* framework. Interestingly, when discussing evolutions of the project, he described how measuring traffic across the navigation helped them identify ways of improving the journey, by making access to the partner resources more prominent early on. This discussion can be directly mapped to a *transition* in the *canonical trajectory* and we could have expected trajectory interventions to be able to address that type of issues.

Another question regarding the impact of *trajectories* was whether that quiz would be a good fit for *trajectories*. Could it be described as a *hybrid cultural experience*? Although it involved putting participants on a journey across digital spaces, the development process was mostly about a single interface that, because it didn't support any form of handover, could only be used on a single device. Interestingly, some elements of the experience that *trajectories* could have addressed were beyond the remit of the production team. This included marketing, which was identified in the workshop as an area for intervention, looking at the onward journey, which would have required effort from external organizations, and finally making the *trajectory* expand over a larger part of the overarching *Make it Digital* event. For this last part, the producer reported that there was little coordination between the programs that made up the event beyond a common branding.

The screenshots below show the final version of *Digital Matchr*.

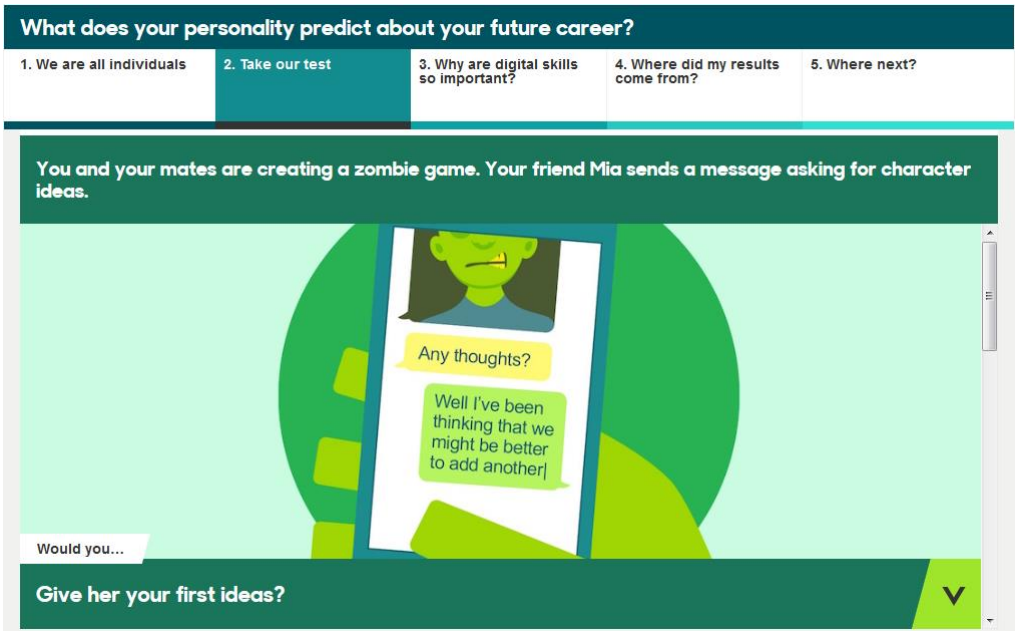

Figure 4.14: Digital Matchr: the quiz's first question (from http://www.bbc.co.uk/guides/zqdmp39)

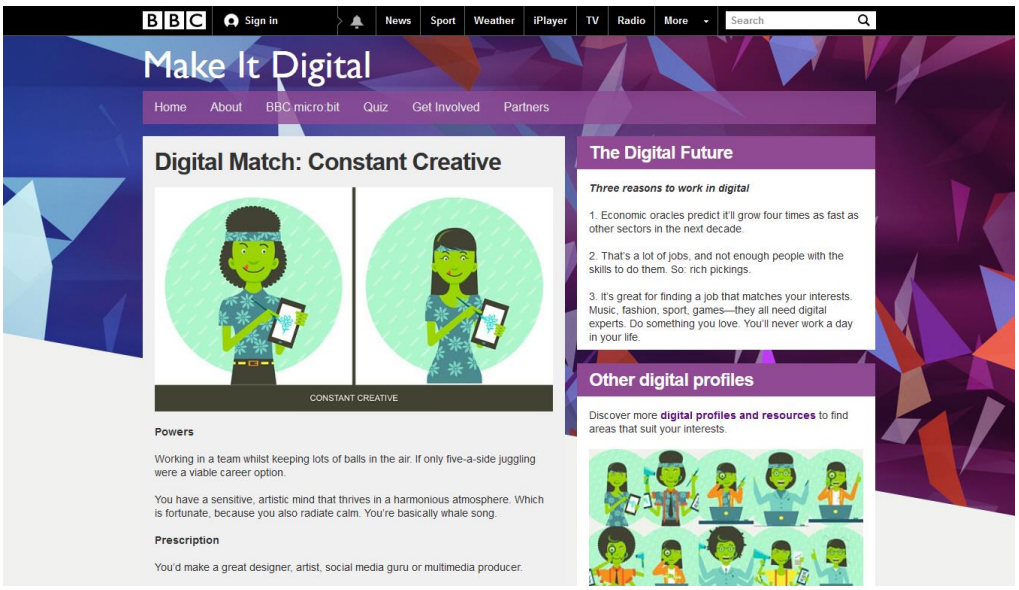

Figure 4.15: Digital Matchr, a profile shown after taking the quiz (http://www.bbc.co.uk/programmes/articles/2gCk9cWd8LGFr42B8XJf44z/)

4.6.4 The end of prototype development

One aspect of the tool that hasn't been used nor explored was the online interface for capturing and sharing the outcomes of the workshops to serve as a reference for collaborating teams. There was little value to that within the *Digital Matchr* project, first because the team structure – the producer was mostly working on his own, outsourcing specific technical aspects to external teams – didn't call for a shared reference to the meeting, and because the producer had made his own notes synthesizing the outcome – possibly in a more relevant way than the capture of the cards. This use of the tool was valued by K&L innovation

leaders though, as they wished to use *trajectories* in more complex projects that required stronger coordination between teams.

Following *Digital Matchr*, K&L and I made a plan for developing it from a prototype to a production-ready tool. The evolution required a set of new features, such as user accounts and an associated permission system to enable sharing projects within teams, and cards across the organization, and the automation of the existing workflow. The service would also be extended by a mobile app for use during workshops.

The development didn't go any further in that direction, mainly because K&L didn't have enough resources to help with technology development and provide use cases. However, my colleague at BBC R&D – though he had returned to his former position outside R&D – continued to showcase the cards he had created, and reported that they were found useful by user experience design researchers attached to BBC Sport. On further enquiry, the main use case these researchers addressed was modelling and probing user behaviours in ways that – in my mind at least – departed significantly from the model of *trajectories*. This, and the open-ended nature of the card-based prototype, led me to consider that it didn't embed or relate to the framework enough to be considered as an instantiation of *trajectories* in the same way that Hornecker's (2010) instantiate the Tangible Interaction Framework. This, amongst other motivations, made me try out a new approach, developed independently of the BBC and described in the next chapter, which was to build a *trajectory* prototyping tool.

4.7 Findings: challenges and opportunities for dissemination

I now discuss how the work described above have led to the identification of challenges and opportunities for disseminating *trajectories*. A first class of challenges is to identify opportunities to set up interventions, and a second is to take into account how the framework will be appropriated by stakeholders.

4.7.1 Identifying points for intervention

The interventions listed in this chapter have had varied levels of success. I discuss how this success has depended on when and where the interventions have taken place, then how tailoring interventions has been further complicated by organizational challenges.

1 Timing interventions alongside the design process

Interventions have happened at various stages of design processes, from early moments where experiences were still very open-ended in terms of options and decisions yet to be made, to late stages where the bulk of the experience was well defined and stakeholders now had to work on implementation details. I now discuss the fit between intervention times and points in the design process.

Love Festivals is arguably the project that made use of *trajectories* at the earliest stage, given that the project team was sensitized to the framework long before the start of the project. Its producer described storyboarding as a distinctive method that would help make the project a "pathway", and it's worth noting that the storyboard itself was seen as a broad inspiration rather than a description of the service as it should be. The original workshops corresponded to prospective planning upstream from the actual design phase, as they were about ideating novel scenarios. These specific designs were never developed further, although K&L tried to transfer the ideas for these scenarios into requirements for supporting technology (the "bridges"). This suggests that these workshops were timed too early.

The tool evaluation around the *Digital Matchr* project spanned several stages of the project, with a first workshop aimed at defining a global strategy, and the second workshop its details. It has shown the value of methods and tools that work at various levels of refinement, a requirement that I used to propose the approach of *prototyping trajectories*. Despite addressing the project early on, some recommendations could not be implemented because they had to integrate with existing BBC technologies with incompatible requirements.

Finally, *trajectory heuristics*, in the case of *Wild-I*, have been applied in late stages of design, when a large part of the experience was designed or even implemented This method needs a substantial part of design decisions to be made so they can be critiqued, but unlike Nielsen and Molich (1990)'s *usability heuristics*, which describe the language and patterns used in single interfaces, *trajectory heuristics* have a more in-depth impact on the experience itself, on commissioning decisions, and therefore involve a level of changes that couldn't be delivered in both case studies. They should therefore be used earlier in the design process. One way of doing so would have been through a better coordination with stakeholders that would ensure a timely intervention, but an even better option is to combine it with *prototyping* so these heuristics can be applied to the prototype rather than the final experience.

Even when interventions happened too late, we have produced some documentation of what could have been done. These have been produced in multiple formats (a research article, a report, and the online interface of the card

tool). Although this type of feedback may have helped further dissemination of *trajectories*, there is no evidence that stakeholders have reflected or acted upon it. The diagram below summarizes when interventions have happened.

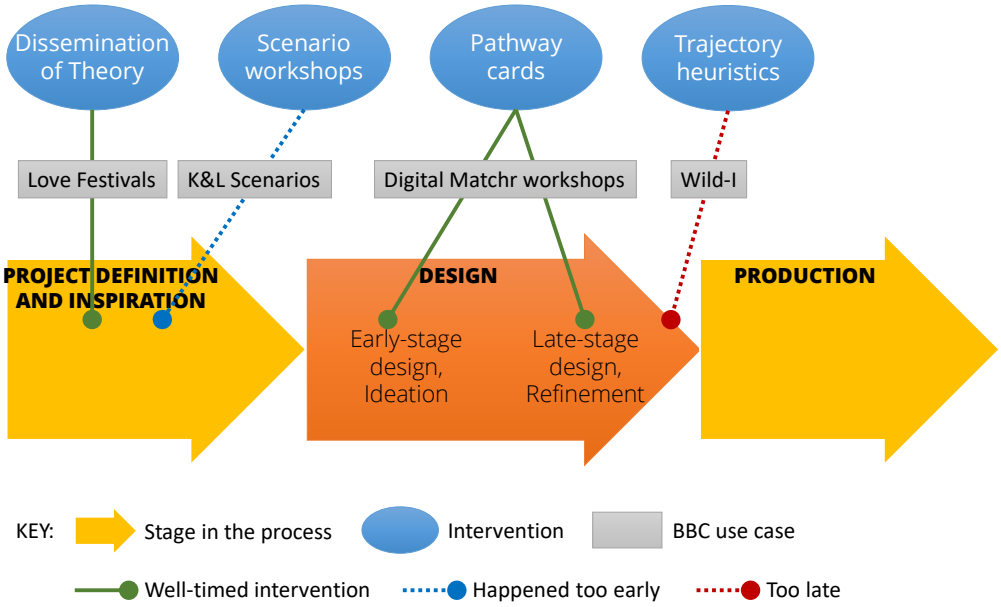

Figure 4.16: The timing of interventions at the BBC

2 Identifying projects, stakeholders and scope

A major difficulty was identifying *where* to intervene as it required not just identifying projects that may benefit from *trajectories*, but also identifying stakeholders that have a level of control or ownership on both projects and their broader context that enables *trajectory* interventions to make meaningful impact.

BBC Knowledge and Learning attributed the lack of impact of initial workshops to the fact that participants didn't "bring their own projects" and therefore had little interest and few opportunities for using *trajectories*. The *Digital Matchr* project may have benefitted more from *trajectories* if the stakeholders we met had more control on other aspects of the project, such as its marketing strategy, the broader "Make it Digital" event it was part of, or assets developed by partner organizations. This may mean targeting stakeholders higher up the hierarchy, although not too high: we met creative directors who have shown strong enthusiasm for trajectories, yet as they have been working on global strategy and on running departments rather than directly on design projects, they haven't had many opportunities to use *trajectories* themselves.

3 Organization related challenges

Many challenges arose from organizational constraints, not only because of the complexity and size of the BBC as a corporation, but also because of the reasons for which Knowledge and Learning wanted to use *trajectories* in the first place,

which was to drive projects that involved multiple departments at the BBC that have "different processes and needs" and "different priorities", and coordinate these conflicting interests given that "it's not just always editorially right for [production departments] to do the thing that [K&L] think would make the best trajectory". This has also been described a question of internal culture, with the *pathways producer* describing her role as coordinating the "old world" of TV production and the "new world" of web design.

Challenges also came from the difficulty in identifying stakeholders and projects, and when projects were identified, in getting into the project: before the intervention on *Digital Matchr*, we had identified a project led by the same producer, but his high workload and tight deadlines at that time made him turn down our intervention. Furthermore, many of the projects involved subcontracting at a level or another. This had two consequences: first, it meant that responsibility for implementing *trajectories* was split between the BBC and external organizations which were harder to access. Secondly, it also meant that *trajectories* had to be translated into requirements in ways that followed the BBC's contracting process, which "is set up to give very specific safe deliverables".

4.7.2 Working alongside appropriation

One of the challenges we've met was, to balance researcher-led and practitioner-led dissemination of *trajectories* or, in Gray et al. (2014)'s words, "to value both sides of discovery equally, and for both sides to respect the everyday reality and discourse of each other". This entailed developing – and to an extent "negotiating" – intermediary positions in terms of forms of knowledge, content of the framework and value for it. In the following sub-sections, I complement my observations on the diffusion of *trajectories* by relating them to Everett Rogers' discussion of the *diffusion of innovations* (2003), which suggests that adoption is affected by five attributes: *advantage*, *compatibility*, *complexity*, *trialability* and *observability*.

1 Forms of knowledge

Various forms of knowledge were produced, both by academics and BBC stakeholders, to disseminate *trajectories*, including:

- Research papers
- Presentations – usually supported by PowerPoint slide decks
- Visual representations of *trajectories* in multiple forms:
    - Diagrams representing framework concepts,
    - Sketches representing designs
    - Storyboards
- The partially formalized method of *trajectory heuristics*

- The *trajectory* "smart ideation cards"

Tailoring forms of knowledge to stakeholders can help diffusion by making them *compatible* with their professional practices. Stakeholders saw research papers as an inappropriate form of knowledge, and Knowledge & Learning innovation leaders described that one of their roles was to read academic literature and translate it into slide decks to disseminate it internally. During interviews, other forms of knowledge were mentioned as commonly used within the organization: *prototypes* and *portfolios*. These could have been used to showcase examples of *trajectories*. Producing these, in line with Rogers' model of diffusion, could have afforded *trialability* to *trajectories*.

2 Vocabulary

Vocabulary was widely seen as an important vehicle for adapting *trajectories* to practitioner audiences. On the academic side, presentations of *trajectories* at the BBC by Steve Benford included rephrased *trajectory* concepts, such as "planned journey" for "canonical trajectory". On the BBC's side, the word *trajectories* itself has been described as sounding too "academic", and alternatives like "journeys" or "pathways" have been preferred.

These vocabulary shifts go beyond simple labels, as they have been used to relate *trajectories* with familiar sets of concepts: *User journeys* and *customer journeys* are commonly used to discuss interaction in user experience design and service design, while "*pathways*" was chosen by the BBC's User Experience and Design department because it resonated with stakeholders' use of the word. *Naming* is also mentioned by Rogers as an element that "affects [an innovation's] perceived compatibility".

Vocabulary has also been an issue when defining forms of knowledge, as academics and practitioners don't necessarily share definitions for words. For example, I would present the card-based prototype as a "tool", a word that UX Designers equated with software packages such as Adobe Illustrator, while they framed it as a "method", as it supported a procedure for either designing or studying user behaviour – a word I wouldn't use because I hadn't yet developed a canonical way of using the prototype.

3 Fidelity to the framework

Reframing the expression of the framework, either in terms of vocabulary – which aligns *trajectories* with distinct concepts – or in terms of forms of knowledge, leads to a dilution or a change in the contents of the framework itself. For example, the card-based tool doesn't embed the full richness of the framework, and sketches and prototypes only show particular implementations, rather than the generalizations and abstractions made in the framework.

Stakeholders were aware that their understanding and use of *trajectories* were not always rigorous, but had diverging views on fidelity to the framework. Some felt that the role of academics was to bring this rigour into design processes, while others rejected it, seeing *trajectories* as an inspiration and emphasizing convenience and appropriation by practitioners. This divergence was linked to stakeholders' roles at the BBC: those who favoured fidelity to the academic vision of *trajectories* were those whose positions involved bringing academic ideas into the organization, while those with a more open approach were closer to production and design.

Complexity has been described as a barrier to adoption (Rogers, 2003). The *trajectories framework*, with its rich set of concepts, can arguably be described as complex. This means that its diffusion faces a major trade-off whereby broader adoption requires simplification, while fidelity will lead to a smaller rate of adoption.

4 The value of the framework

Another challenge for disseminating the *trajectories framework* has been to identify *value* for the use of *trajectories*. This challenge is important as bringing *value* to the BBC may both drive adoption for the industrial partner and help focus interventions. Within the HCI community, Cockton has suggested that *value* is "the most important goal" for design (2004a), and that "value can take many forms", including "organizational" (2004b).

Although the *trajectories framework* doesn't explicitly state its value to designers (Benford et al. 2009), a close reading suggests that value comes from supporting the design of "cultural experiences" with "hybrid structures" to "make them tick", as well as from specifically addressing the "challenge" of "maintaining continuity". For all these value propositions, the actual organizational value may come from enabling such designs, or making them easier, cheaper or improving their quality and fit to audiences.

Value for stakeholders lies in advantages it brings to stakeholders' practice. It is essential for dissemination, as innovation diffusion studies consider "relative advantage to be one of the strongest predictors of an innovation's rate of adoption" (Rogers, 2003, p. 233). In order for stakeholders to assess this advantage, interventions must help identify potential value then demonstrate such value.

a Identifying potential value

This process of identifying value for the framework has been driven both by academics and by design stakeholders. On both sides, it involved reframing and presenting the framework in ways that we thought would highlight such value,

as well as trying to identify specific projects and judge whether they would benefit from it. These perceptions of value were based on one hand on knowledge of the framework, its specificities, strengths and weaknesses, and on the other hand on understanding the organization's needs. Examples of this process of "negotiating value" include:

- Stakeholders equating *trajectories'* value to well-known needs, in the case of how *pathways* were seen to address the fact that audiences rarely navigate between BBC websites.
- Academics reaching out to stakeholders and getting positive or negative feedback (for example, my suggestion in a presentation that *trajectories* could address the complexity of some experiences was met by a comment that designers should reduce this complexity first).
- Stakeholders suggesting *trajectories* could be tried out on specific projects, and discussing with academics on the fit between project and framework. In the case of *Digital Matchr*, doubts about whether it constituted a *trajectory* were raised during the first workshop and led to reframing the value from product design to product marketing.

In all cases, stakeholders have the "final say" in the sense that it is stakeholders' perception of value that will lead to adoption of the framework. The specific design areas where potential value for the framework was identified are detailed in the next section.

b Demonstrating value

Demonstrating the value of *trajectories* has been very limited. In the case of the Knowledge & Learning projects (the ideation workshops and *Digital Matchr*), given that they didn't lead to building *trajectories*, only value in terms of *process* rather than *outcome* could be assessed, and this was only based on subjective feedback from stakeholders. This feedback was mainly positive, and suggested that our approaches allowed them to broaden up their perspectives on the artefacts and experiences being designed, but it may be that stakeholders preferred avoiding criticism.

Love Festivals gave opportunities for measuring value in terms of *outcomes*, although the BBC's Marketing & Audiences suggested that tracing audience journeys across BBC assets was difficult, partly because the broadcaster's limited deployment of a "logged-in experience" that could trace users' identities. Metrics for *Love Festivals* revolved around a single key performance indicator (KPI) which was to achieve a given number of "click-throughs". Because this was a novel project for the BBC, there were also very few points of comparison, stakeholders suggested that the target given had little grounding in either audience research nor existing projects.

4.7.3 Opportunities for trajectories

After discussing the challenges that working with practitioners in a professional organization has uncovered, I turn to the opportunities that were identified, looking at potential value for the framework in terms of design and audience research. I conclude by mapping a "design space" that is common to the different types of *trajectories* envisioned in the work discussed above.

1 Opportunities for designing with trajectories

In this heading, I discuss the value BBC stakeholders have identified for *trajectories*. Four main directions have been mentioned across projects: bringing products and services together, targeting new audiences, lowering costs and fostering long time learning and behaviour change.

a Trajectories as a way of joining up BBC services

The most common benefit which was seen for trajectories was to bring together a number of BBC services. This would fit the strategy laid out in 2011 by the then director of BBC Digital, Ralph Rivera. That strategy suggested that the BBC should work as "one service" bringing together "ten products" – News, Sport, Weather, CBBC (Children's TV), CBeebies (Toddler's TV), Knowledge & Learning, Television, Radio, Home (the BBC's website) and Search – on four screens – Television set, Desktop computer, Tablet and Mobile phone –, and that this should be delivered through "Connected storytelling".

This benefit was expressed by a number of stakeholders in several of the approaches I've taken: It was an integral part of the scenarios presented in the Knowledge & Learning workshop, was mentioned as a rationale behind *Love Festivals*, and was expressed by the design of the cards in the first tool, as both *channels* and *content* may correspond to disjointed aspects of the BBC's output.

Examples of joining up existing BBC elements that have been described by stakeholders (either in existing products or as potential designs) include moving across devices (the early work by Benford and Anstead focused on trajectories for multiscreen experiences), connecting content units across a single delivery mode (*Love Festival* was designed as an intervention to make website users hop across the BBC's websites), bringing content developed for one media to another (workshop scenarios included showing relevant BBC TV content in online guides), or making better use of communication and marketing on non-BBC channels (for example, using social media on *Love Festival* and on the *Digital Matchr* quiz).

Stakeholders, in particular UX&D and K&L, understood that joining up this content can be done by building "bridges" and "shortcuts", which may include

"calls to action" to move from one asset to another. K&L's early work on *trajectory templates* insisted on identifying the missing parts of user experience that would connect existing assets. *Trajectories'* focus on the global experience is seen positively as internal documents have stated the "journey" to be more important than the bridges that *trajectories* (or "pathways" in these documents) enable.

An example of an existing strategy used by the BBC to join up experiences is the Global Experience Language (GEL), a set of interface design patterns and graphic design elements, that intend to give a similar look and feel to BBC experiences across devices and delivery modes.

As we describe further in this section, joining up BBC assets from an output point of view also means coordinating the internal units who produce such content. This organizational challenge is probably the biggest impediment to delivering joined content. As Rivera's strategy shows, the value of joining up experiences was identified before trajectories were introduced, and it is well possible that *trajectories*, being a conceptual toolset, may not be enough to overcome these organizational blocks.

b Trajectories as a way of addressing new audiences

BBC stakeholders also saw value for trajectories in addressing "underserved" audiences, and the role of the "pathways producers" was specifically created with that mission, starting with the 16-34 female demographic, and expanding to a broader typology of audiences. At that time, a broader BBC challenge was put in place where staff in all departments were asked to propose ideas to address that audience.

The original *trajectories* framework didn't involve the discussion of specific audience demographics, but this opportunity emerged from how the institution perceived its weakness in addressing these audiences, and how it expected the behaviour of these audiences to match the framework's description of complex journeys. For example, younger viewers may interact with content through multiple screens and channels, a behaviour described in recent Ofcom reports as "media meshing".

c Trajectories for low-cost interventions

The question of cost was one of the requirements for *Love Festival* as described by the organization's Chief Design Officer: this project was to involve "minimal technological innovation", make extensive use of existing content, including user-generated content, and concentrate on building low-cost "bridges" between these units of content.

As value at the BBC has been often described by stakeholders in terms of the value audiences get for their licence fee, budgets are matched with expected audience impacts. For departments with smaller audiences and budgets, such as Knowledge & Learning, *trajectories* offered the promise of leveraging the audiences and contents addressed by stronger, richer departments. In that view, *trajectories* would both provide conceptual tools to support coordination between stakeholders, as well as guidelines to guide traffic between BBC assets.

d Trajectories to foster learning and behaviour change

The initial trajectory workshops focused on another value proposition for *trajectories*, as they were seen as fostering learning and behaviour change. This connects with uses of *trajectories* in education research, where Rosemary Luckin and Joshua Underwood's works have been trying to define "trajectories through learning experiences" (Luckin, 2010; Underwood et al., 2011). Similarly, the scenarios developed in K&L's workshop lead their end users through a succession of learning resources while giving them control over their own journey.

2 Trajectories as a design research tool

Although *trajectories* were initially presented at the BBC as a blueprint for generating new experiences, stakeholders have suggested they may have value a design research tool, in line with the framework's own ambition to "sensitise studies", and their use in the previous chapter.

This analytical use of *trajectories* was particularly developed in the case of the card-based tool. My colleague at BBC R&D, when creating the card set, started using it as a way of modelling TV viewers' daily patterns of media use based on existing audience research data. This use case became part of formal and informal presentations he gave at the BBC and resonated with their uses and needs. Most of the first *Digital Matchr* workshop focused on analysing the speculative existing *participant trajectory* of target audiences' use of media and identifying marketing opportunities.

Positive feedback about using *trajectories* to study audiences – in particular from *design researchers* who were part of the User Experience & Design department and embedded in the Sports team – was coupled with negative feedback about designing trajectories, showing that the need to understand the complex dynamics of audience behaviour didn't translate into the need to design complex experiences.

3 Modelling the design space for trajectories at the BBC

I now reflect upon the opportunities identified above to propose a model of the design space that trajectories could occupy.

a Control on trajectories: audience-led dynamics through broadcaster-controlled content

Comparing the projects discussed here with the previous chapters' conclusions on control in *trajectories* shows a distinctive pattern whereby stakeholders favoured an audience-led approach to the dynamics of interaction, offering multiple points of entry into an experience and avoiding "prescriptive" pathways. On the other hand, apart from the most speculative scenarios, the BBC has been very reluctant to include *user-generated content* in projects, unless they have a strong level of control on it, as they did when using the SeenIt platform on *Love Festivals*. This is in line with the traditional model of broadcasting, where the organization has full control over which content is being broadcast and when, but can only control who is going to access this content through its marketing strategy.

b Trajectories across internal and external assets

All the BBC projects where *trajectory* use was envisioned have a common denominator: a variety of design artefacts, technological infrastructure and content (which I discuss collectively as "assets"). These include:

- **Newly-commissioned assets**, for example the *Digital Matchr* quiz and the *Love Festivals* portals. Because of their "new" nature – from the point of view of the design process or the intervention, stakeholders have a large level of control on these assets and may include *trajectory* derived considerations.
- **Existing or independent internal assets**, which are integrated in a *trajectory*, but bring their own constraints. These include existing content and formats that *trajectories* traverse, as well as infrastructure that constrains new assets – for example the iWonder guide format in the case of *Digital Matchr*, or future content which will be commissioned independently – as is the case for some articles that the *Love Festivals* portal links to.
- **Third-party assets**, including social media for virtually all projects, and user-generated content. Some *trajectories* discussed in the early Knowledge & Learning workshop also involved tying in with organizations such as scout groups, schools, libraries or wildlife centres.

Integrating the latter two classes of assets involve adapting *trajectories* to their specificities, or devising orchestration strategies which give control to stakeholders. Given the configuration of projects, key assets for orchestration may be beyond the remit of designers – this was the case for *Digital Matchr* where designers had no control on marketing.

c Artefacts and activities as the objects of design

This picture of the design space shows two "things" being "designed" concurrently: the global *trajectory* and assets of the first class. This duality has been explored by Waern and Back (2017), who contrast the traditional view of HCI as concerned with the design of "artefacts", with HCI projects such as *trajectories*, where the "ultimate particular" of design is an "activity" and not an artefact. At the BBC, design processes were all centred on delivering artefacts. Even in more speculative cases, such as the five scenarios developed from workshops, Knowledge & Learning focused on identifying assets that needed to be commissioned to support the global *trajectory*. In that case, stakeholders explained this focus by the need to follow the BBC's commissioning process, whereby clear specifications had to be provided according to the corporation's templates.

4.8 Conclusion

In this chapter, I have described four types of interventions that have been conducted in collaboration with the BBC to make designers and other stakeholders in design processes use the *trajectories framework*. The first type of intervention described attempts at popularizing the framework through its conceptual formulation, and how stakeholders have engaged directly with the concepts. The second group discusses the introduction of *trajectories* by following up from the outcome of *ideation workshops* which has yielded scenarios that might have been commissioned. I have then discussed the use of *heuristics*, and finally described a process where *trajectories* have been turned into cards, though these differed from existing translations of conceptual frameworks into cards, as the *pathway cards* didn't map extensively to *trajectories*. I have then reflected upon these interventions, as they have led us to identifying challenges and opportunities for the dissemination of *trajectories*.

Chapter 5: Designing *trajectories* at a music festival

This chapter describes a two-year long *Research through Design* study, which led to develop iteratively a companion app for the Oxjam Beeston Music Festival for its 2015 and 2016 editions. I start with a description of the research work, then reflect upon two aspects of using *trajectories* for the design of a live event: as support for design decisions, and by integrating them in a design process.

5.1 Context

This study builds upon the works described in chapters 3 and 4, and constitutes an endeavour to put *trajectories* to work in practice in the context of live events.

Chapter 3 first showed that festivals could provide a rich setting in which to apply the *trajectories framework*. It also led to a series of design considerations which still needed to be validated through practice.

Chapter 4, by identifying a number of challenges to putting *trajectories* into practice in a professional organization, showed that it was important not just for the outcome of *trajectories* to be deployed "in-the-wild", but also for the process itself to be considered "in-the-wild", i.e. looking at how design happens within a set of real-world constraints, including working within organizational structures, with strict deadlines and with limited resources.

To strike a balance between the feasibility of designing meaningful interventions – which would have been hard to achieve in a larger festival, such as Glastonbury – and these real-world constraints, we decided to focus on local, small-scale, volunteer-run events where the organizers would be approachable. This led us to select the Oxjam Beeston Music Festival, a yearly mid-sized festival taking place close to our university. Other researchers from the lab had already been partnering with Oxjam Beeston, which made contacting the organizing team more straightforward.

5.1.1 The event: a description of the Oxjam Beeston Music Festival

Oxjam is a music festival taking place every year in October. This is a non-profit festival aimed at raising funds for Oxfam, a large international charity whose main purpose is the eradication of poverty across the world. Even though Oxjam is a United Kingdom-wide event, it is made up of multiple local festivals, each of

which is independently run by volunteers. According to its national organizers (Oxfam, 2016), the festival, since it started in 2007, has comprised 6,000 individual events. In 2016, "takeovers" – several hours of concerts in multiple venues in the same town – have been staged in 50 towns across Britain.

Since 2011, one such music festival has been held in Beeston, a suburban town located next to the University of Nottingham's main campus. Oxjam Beeston has grown to become one of the UK's largest Oxjam events, and has been consistently amongst the top three largest fundraisers between 2014 and 2016 (including number one in 2015). In recent years, the Oxjam Beeston Music Festival has comprised multiple events: the main 12-hour long "takeover" event, as well as smaller, shorter, single-venue events, which vary according to the year and have included events around acoustic music ("Oxjam Unplugged"), young performers ("Oxjam Introducing"), Scottish music and dancing (Ceilidh), classical music and a Pub Quiz.

5.1.2 Goals

I now describe two main classes of goals that this study aimed to achieve, and how the value behind these goals is shared between academics and stakeholders.

1 Outcome-centred goals: Understanding and improving the festival experience

One of the purposes of the study lies in the final product of the design process, namely the technology that I would design around the festival. In Cross's classification, this is the *phenomenological* aspect of design. These artefacts were designed to embed *trajectory* considerations as well as recommendations from previous studies and were expected to improve the experience of several classes of participants and bring value to stakeholders.

Data collection from participants was designed on one hand to refine the domain knowledge about media experiences in events laid out in the chapter 3, and on the other hand to serve an iterative design process and underpin potential improvements to the app. This process, centred on participant and stakeholders' engagement with technology, would identify *value* that technology could deliver.

Initially this *value* was determined mainly by the research team, based on previous research, and with limited input from the festival organizers I had been liaising with. In the second iteration, ways of determining value were extended to include reflections on data from the first iteration, as well as a much closer relationship with stakeholders – one of my supervisors and myself being part of the core volunteering team.

2 Process-centred goals: Understanding and improving "design"

The goals of this research activity shifted to incorporate a reflexive stance on the design process itself. This shift is not only related to the findings from the dissemination work at the BBC – which was conducted simultaneously with the work in this chapter – but also comes from the realization, during the work on Oxjam itself, that the use of the *trajectories* framework needed to be accounted for not just in terms of the outcome of design, but also in its process. In Nigel Cross's terms, this means attending to and reporting on the *praxeology* and the *epistemology* of design.

This reflection on design has been useful in serving the outcome-centred goal of the study and, by underpinning the second iteration of Oxjam, has indirectly brought value to participants and stakeholders. As this process-centred strand aims to inform future designs, it may offer value for the designers and producers of cultural experiences.

5.2 Approach

The research work described in this chapter follows the global *Research through Design* approach defined for this thesis in chapter 1. It differs from traditional uses of *Research through Design* in HCI in two major ways: first, it engages with *theory* for the sake of validating and refining it, rather than only producing it. Secondly, it tries to study design with production constraints, something which might be labelled "Research through Design in-the-wild". It is centred on my own experience of acting as a designer and stakeholder, and is a form of *autoethnography*. As part of my design work, I have used *design research* methods to collect insight for design, which I discuss next, and finally I have tried to make other stakeholders design *trajectories* by configuring a participatory process.

1 An autoethnography of a design-centred activity

As this chapter is a reflection on my own work, it constitutes a form of *autoethnography*, a type of enquiry which has been previously used in the context of understanding the activity of design (Faste, 2017; Duncan, 2004). As a form of *ethnography*, the focus of enquiry is my participation in the design and delivery of the Oxjam app, and in a broader sense, in the organization of the festival. I discuss different facets of my role, which, in other configurations, such as within large professional organizations, may have mapped to several professional roles.

a Role 1: a designer

The role of *designer* involved several tasks that generally fall within the role of a professional User Experience (UX) Designer or Interaction Designer: I designed the interface and the global experience of the Oxjam Beeston Music Festival app (in the first iteration) and website (second iteration). I also designed posters, flyers and various graphic assets for social media in the second iteration.

The date of the festival, at which my designs would have to be deployed in the wild, but a strict deadline constraint on the project. In the second iteration, as I took over the role of IT manager for the festival, its organizers depended on my work for publicizing the festival, adding more constraints to my work. In that respect, this project has many similarities with what is expected from a professional "real-world" project.

This role is grounded in my own training and experience as a *web designer*, which I was doing as a professional activity before starting this thesis.

b Role 2: an event organizer

This role only covers the second iteration – 2016 – of the research project. As the volunteer in charge of the website and social media stepped down from the team a few months after the 2015 festival, I volunteered to take over his role.

I was therefore a member of the core volunteering team and participated in most team meetings. This involved reporting on my work and being involved in the general running of the festival. This enabled me to get rapid feedback and requests from the rest of the team, but also support, for example for spreading communication on social media or arranging research workshops. For parts of the design work mentioned. This also enabled closer integration of the features developed in 2015 and the official website.

c Role 3: an IT specialist

My role also involved the technical tasks needed to implement my own designs, such as programming, producing documents using desktop publishing software, as well as provisioning and managing the server infrastructure. I had to take all technical decisions, which were partly based on my familiarity and proficiency with a variety of technologies.

My roles as designer and IT specialist were strongly intertwined, as this enabled me on one hand to make design decisions based on feasibility and available time and resources and on the other hand to quickly translate design decisions into either prototypes or fully available features.

d Role 4: a content curator

An important part of my work revolved around managing the content that would be displayed in the app – in 2015 – or in the website and on social media – in the second year. Specifically, I had to identify information about artists to fill in profiles in the program; monitor and moderate content produced by other users – in practice, there was no inappropriate content needing removal; prompt spectators, volunteers and artists for content; identify existing content that would be worth highlighting and sharing through Twitter; and finally – in the second iteration only – publish "official" team-endorsed content written by myself or by other volunteers.

e Balancing the researcher's perspective and design judgement

As a researcher, my interest has been to document, collect data and reflect on the process, but also to make sure research-related requirements, such as using *trajectories* and the insight from previous studies, were taken into account. In this project, there have been times when there was a need to balance *trajectory* requirements and other general requirements. Resolving this type of trade-off required using *design judgement*, which has been described as a key element of design (Nelson and Stolterman, 2003).

Because of the stated goal of studying *design in-the-wild*, I made the decision – at least during the design stages, much less so during evaluation phases – to prioritize my role as designer and volunteer, and to consider festival related success criteria as more important, in the sense that they represented the "design rigour" I was striving for. As a designer, promoting the festival and making its website accessible and available was more important than ensuring the *trajectory framework* was used at all levels. Having to make such *judgement* had a very strong impact on the framing of this research project, as it revealed challenges in bringing *trajectories* into practice and led me to refocus on analysing these challenges rather than on the outcome of the process.

This choice of prioritizing local outcomes over generalizable findings in the "action-driven" phases of the study is in line with the principles of *action-research* (Hayes, 2011), even though the project was not framed as *action-research* and didn't follow all its principles.

f Data collection

The data collected to support my introspection into design includes not only notes and observations, but also, as suggested by Margot Duncan (2004), supporting traces of activity. This includes email conversations with other stakeholders, wireframes and other design documents, and traces of the

development process, such as code repository history. Finally, this is also supported by *design research* data, as described in the next heading.

2 User-centred design research methods

I now describe the data I collected to evaluate my design interventions and identify requirements for next iterations – the requirements engineering for the first iteration, to some extent, includes the research described in chapter 3.

The methods and data collection described are at the intersection of HCI research – they are grounded in traditional research methods and approaches and help constitute a body of knowledge about technology use in live events – and design – they support the design effort, and can be used outside academia, as part of *design research* done to support design processes.

Data collected from app and website users include:

- Anonymous use logs, collected in the first iteration directly through the server and database I had set up to support the app, and through a third-party service (Google Analytics) in the second year.
- "User-generated content", which in turns includes:
    - Content added to the website and app by its users. This includes text and/or images, tagged with venues and artists.
    - Content collected from Twitter, and displayed within the app and website
    - Content volunteered after festival and sent to me or to an official Oxjam account through personal communications
- Questionnaires sent out following the first iteration, and interviews of selected users, organizers and artists.

3 Participatory design

During the second iteration, I involved stakeholders in the design of the website and app, and held a participatory design workshop. The reasons for a participatory approach included ensuring the final product matched stakeholders' needs, understanding where *trajectories* may bring value to an experience, and finally because it was a way to make others *use trajectories* and therefore disseminate the framework in a way targeted to non-experts. This phase is described in detail in the last section of this chapter.

5.3 Research and design activities

I now describe the research project by breaking down work in a chronological order. This description starts even before the festival was chosen as a research

setting, with first non-specific drafts created directly following the studies described in the previous chapter. The remainder is mostly broken down into *before*, *during* and *after* phases for each iteration, although for the second year, the process of configuring a design workshop is detailed in a specific heading.

5.3.1 Global timeline

The table below describes the global timeline of the work described in this section:

<table>
<tr><td rowspan="5">2015</td><td>J</td><td colspan="2" rowspan="4">Designing the Oxjam Beeston Takeover 2016 app.</td></tr>
<tr><td>J</td></tr>
<tr><td>A</td></tr>
<tr><td>S</td></tr>
<tr><td>O</td><td colspan="2">17th October Festival Day</td></tr>
<tr><td rowspan="2">N</td><td colspan="2" rowspan="2">Exit interviews and data consolidation</td></tr>
<tr><td rowspan="7">2016</td><td>D</td></tr>
<tr><td>J</td><td colspan="2" rowspan="3">Developing the trajectory prototyping tool</td></tr>
<tr><td>F</td></tr>
<tr><td>M</td></tr>
<tr><td>A</td><td colspan="2">1st team meeting for 2016</td></tr>
<tr><td>M</td><td colspan="2" rowspan="2">Merging the website and app</td></tr>
<tr><td>J</td></tr>
<tr><td>J</td><td>Oxjam Unplugged Event</td><td rowspan="3">Refining the Oxjam website iteratively</td></tr>
<tr><td>A</td><td>Stakeholder Workshop</td></tr>
<tr><td>S</td><td>Oxjam Introducing Event</td></tr>
<tr><td>O</td><td>14th October Festival Day</td><td>Developing the story generator</td></tr>
</table>

Table 5.1: Timeline of activities around the Oxjam Beeston Music Festival

5.3.2 Initial drafts

This sub-section describes a part of the process which took place between January and June 2015. At this stage, I made a series of drafts describing an "event coverage service" that could be adapted to multiple types of live events where user-generated content would be collected. The very first versions were designed to take into account the possibility of extending the existing RunSpotRun prototype.

The main requirement for these early drafts was to support conclusions from the previous studies, in particular the idea of structuring coverage of live events around individual participants' voices and stories and therefore fostering *interleaved trajectories*.

The way I chose to address these requirements was to provide a web-based service – initially called EventStories – to collect, curate and share various forms of media content covering events. The website to be developed would be the main interface used in the *trajectory*, but the *trajectory* itself would encompass

other interactions that aren't directly supported by the website, including activities done on location at the event, the use of non-connected devices such as cameras, print and broadcast media, or online interactions on social media.

This initial phase was documented through drafts aimed at describing the outcome of the design process to academic supervisors. They have been produced in two forms, which mirror the duality of designing at the same time a global experience – the *trajectory* itself – and an interface that is traversed by the *trajectory* (1) a map of the *trajectories* for a series of roles and (2) mock-ups or *wireframes* of the application's interface. These documents are shown below.

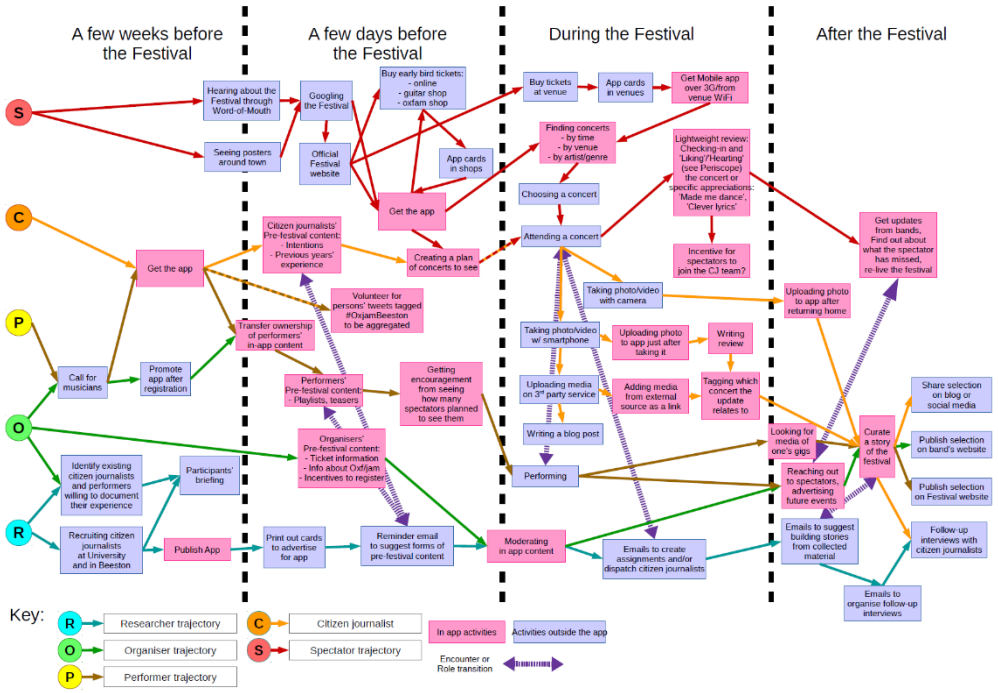

Figure 5.1: Trajectories for five roles at Oxjam Beeston

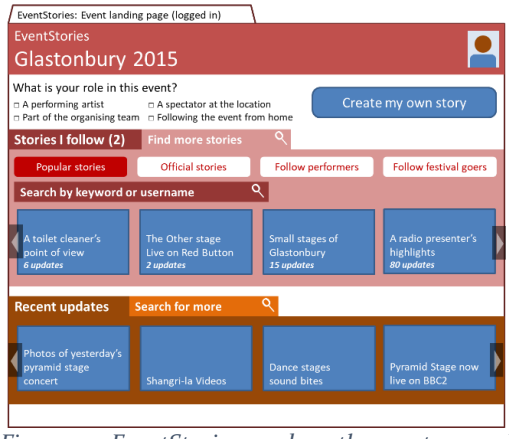

Figure 5.2: EventStories mockup, the event homepage

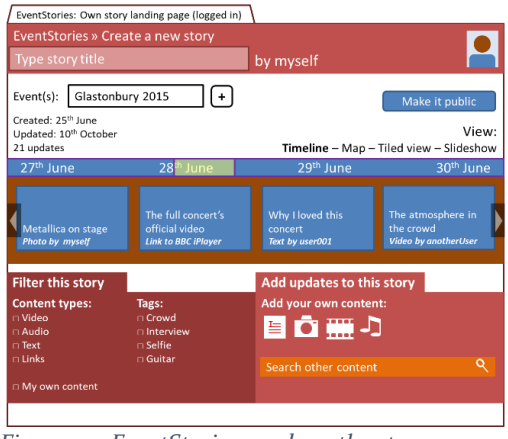

Figure 5.3: EventStories mockup, the story creation interface

5.3.3 Designing, building and delivering Oxjam 2015

Once the Oxjam Beeston Music Festival was selected for an intervention, work concentrated on designing a version of the "event coverage service" discussed above specifically tailored to that festival. This work took place between June 2015, when I first got in touch with the festival organizers and gained their approval, and the festival day on the 17th of October.

This 4-month time span (which also covered other activities, including engagement with the industrial partner) meant that multiple threads of my work had to be done in parallel. This included:

- Design work, both at the global – *trajectory* – and the local – the app's interface – level.
- Technical work: choosing appropriate technologies – the Angular and PhoneGap frameworks on the front end, the Django framework and a MySQL database on the back end –, provisioning, setting up and maintaining a server, developing the app and its back end, and finally making it available through Google's Play Store.
- Building up the database, which included feeding the program in the database and creating profiles for all artists. This was time-consuming as, despite this information being requested through the registration form, not all artists had given details about their music and their online presence. It also involved many last-minute changes.
- Finally, publicizing the app and the research project. In practice, most traffic to the app came through the organizers' efforts, who had posted links to the app on their website, social media and printed material

On the day of the festival, I restricted my role to implementing last-minute changes to the program, checking the system was kept up and running, and making sure no inappropriate content was posted.

The screenshots below present the different features of the app: a home screen showing the app menu along with the latest updates, a list of venues with a map, a searchable list of artists and an interface for adding updates. The updates included data pulled from Twitter.

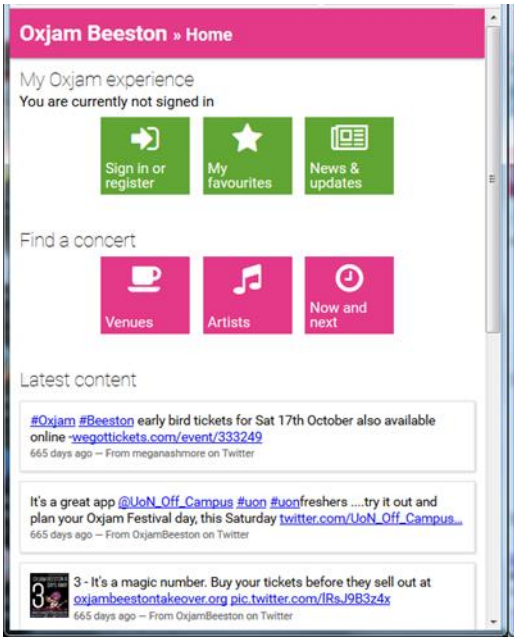

Figure 5.4: Oxjam 2015 App Home screen

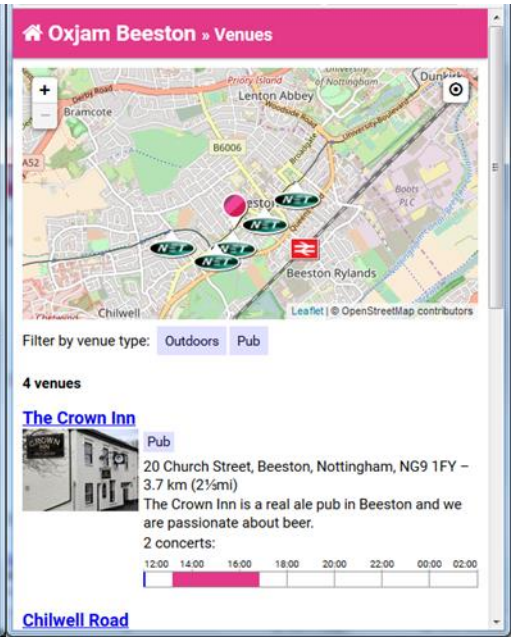

Figure 5.5: Oxjam 2015 App Venues screen

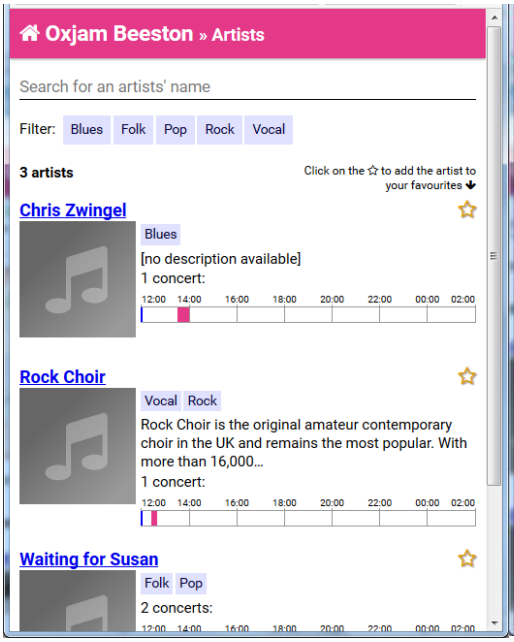

Figure 5.6: Oxjam 2015 App Artists screen

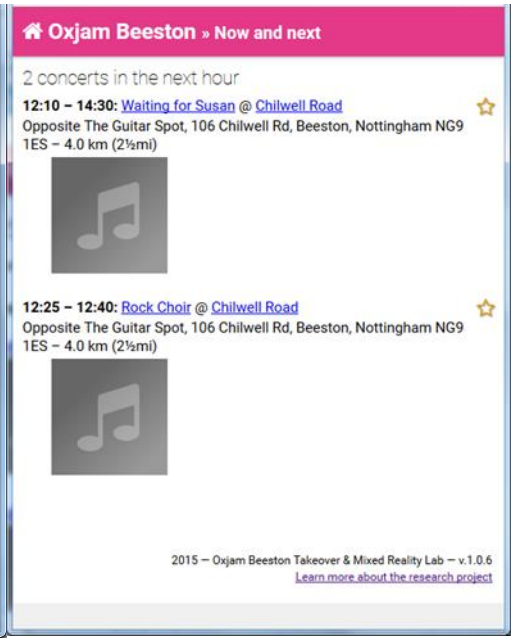

Figure 5.7: Oxjam 2015 App "Now and next" screen

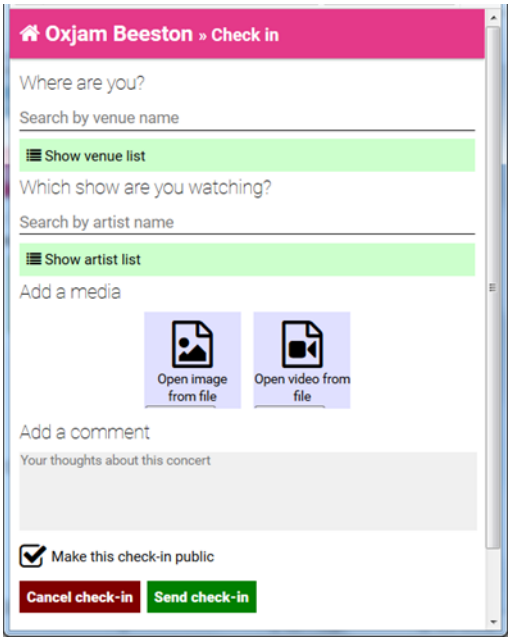

Figure 5.8: Oxjam 2015 App "Check-in" screen

5.3.4 Evaluating Oxjam 2015

Several strategies were put into place to evaluate my intervention, which I detail below:

1 Anonymous usage data

Download count for the Android application was available from the Google Play Store. App usage was traced by logging each page view within the app. This data shows how app use has changed over time and which screens were most used. Amongst ways of reading this data, the information that I found most relevant included:

- Global use over time, showing a build-up in the days before the festival, a peak on the day itself, and a sharp decline on the next day.
- The share of mobile browsing – 78% overall, rising to 85% on the day.
- Which pages were the most popular – beyond the landing page, "Now and next" had the most views.

What this data does not provide though, is a precise count of the total number of users, as it provides no way of counting together app uses coming from the same users on different devices, or between the app itself and a browser on the same device. The number of downloads give us a lower limit, and the number of browser sessions an upper one, suggesting between 100 and 300 people have used the app in one form or another.

2 User-generated content

A subset of these users registered an app account, 35 of which created content within the app. This content provided good coverage of the festival, including 59% of artists listed in the program, and all but one venues.

There was user-generated content available on social media as well, which I didn't comprehensively collect as the ethics application covered only content retrieved from Twitter and linked to a specific keyword or collected via the app. I did search for such content though to evaluate how media collection could benefit from extending its range. For instance, several bands had put photos of their sets on Facebook.

3 Feedback questionnaire

App users were invited to give their feedback on their experience of the festival and the app. Participants were recruited by sending emails to registered users and by presenting all app users with a short text asking them for feedback at the top of the app's landing page. Given this recruitment strategy, these users are not representative of the average user and correspond to a subset with a particularly strong engagement with the festival: users who have taken the survey were 2.5 times more likely to have submitted content than users who have not responded.

The first set of questions elicited respondents' profiles, asking for previous experience of the festival and motivation. This was followed by questions to gather opinions about the app itself, showing a positive reception for the app in general and – consistently with usage logs – the "now and next" feature in particular.

4 Interviews

In the months following the festival, I interviewed 14 actors: organizers, artists and spectators who had used the app, with some overlap between these categories.

Organizers – the general manager of the local festival, the publicity manager, the IT manager, and the organizer of "Oxjam Classical", a sub-event – were asked to describe their roles. They helped identify areas in which the app could improve their future activities, and a better understanding of their roles helped me both as the designer of the next iteration and as a new member of the organizing team.

Five musicians who had performed at the festival were interviewed, with a focus on two areas where I had identified potential value for the Oxjam app and the use of trajectories: cross-promotion between artists and festivals, as well as gathering images of one's performance. Artists were therefore asked how they

would normally identify, collect and circulate photos and videos taken during their sets, as well as what their online promotion strategy was.

Artist interviews revealed a great disparity in profiles, ranging from very occasional artists who would only perform during local festivals to professional musicians. Their ways of managing publicity would therefore range from none to maintaining an active online presence by publishing content on an almost daily basis. Most bands cater to local audiences, and promotion is strongly linked to what has been described as a "tight-knit community", where many artists know each other and reach out to their audiences through word-of-mouth, occasional use of social media and local advertising, for example as part of venue's event schedules.

I interviewed six app users who had contributed content through the app's "check-in" feature, and discussed how they had used the app in general and that feature in particular. For almost all of them, the main motivation for posting content was to engage in a community-centered conversation that would benefit both the festival and local artists. Some had also used social media to talk about the festival, but would tailor the type of content to each platform and their intended audiences. Participants saw value in the existence of a specific, non-commercial conversational space around the festival, where artists could be encouraged. Another participant mostly used their "check-ins" as a way to remember what they had seen, thereby collecting their own *historical trajectory*.

A common theme that arose throughout all interviews was that the festival is one of a series of locally important events happening in the town center where the community comes together to celebrate.

5.3.5 Planning, designing and delivering Oxjam 2016

I now describe the process of creating the second iteration of the Oxjam app. This process started around February 2016, when the organizing team was being reconstituted.

1 Becoming the IT Manager

The former IT manager had decided to withdraw from the festival because of the workload involved. As this gave me an opportunity to design the next iteration from within the team – and as it ensured the continuity of the festival – I volunteered to take that role. As I had identified from the interviews, the role covered multiple activities including:

- Setting up the website and maintaining the IT infrastructure, which I detail in the next heading as it has involved merging features from the app I had developed and the existing website.
- Publishing content on the website and on social media
- Designing print content, including:
    - Flyers and posters for each event in the Oxjam season
    - Paper programmes, with a map of the venues overleaf,
    - Individual posters showing the programme for each venue
- And, finally, attending team meetings and coordinating with other volunteers to define and implement a strategy for all the activities listed above.

Being in charge of all these media gave me the opportunity to consider the coherence of the journey across media – for example through common visuals – and to think of the *transitions* that would lead from one to another – links and QR Codes.

Thanks to the data I had collected from the previous Oxjam, I could also share my knowledge and support team decisions. For example, during a team meeting, questions were asked about venues and their configurations, which I could answer by looking up images of the venues from the database.

The images below show a sample of the print media I've created.

Figure 5.9: Poster for Oxjam Unplugged

Figure 5.10: Poster for Classical Oxjam

Figure 5.11: Flyer summarizing the festival season

Figure 5.12: Poster for the main Takeover event

Figure 5.13: The paper programme, distributed to ticket holders on the day of the festival

Figure 5.14: A poster showing the programme for a single venue

2 Merging the app and website

One major opportunity that came with this role was the possibility of merging the features that were available through the app and the official features into a single interface. This aligns with *trajectories*' purpose of supporting *joined-up experiences* as it reduces the number of *interface transitions* and as it facilitates

the deployment of a common visual identity. After pondering different technological solutions, I decided to make this a whole new website – accessible at the same location as the older one – rather than an extension of the existing assets.

From the website, I copied pages giving generic information about the festival – which were the first to be published, in early May – and the artist registration form, adapting it to the suggestions and needs given by the new Oxjam team. I also based the visual design of the new website on the old one, adapting it for better viewing on mobile devices.

From the app I had developed, I copied the interactive program, the newsfeed and the collection of user-generated content. One downside of this approach was a much more complex navigation: the features of the app – which were transposed to address any sub-events in the season – were diluted throughout the website.

I also brought in a "feature" from the 2015 paper programme, where a schematic map – produced by a local map enthusiast – had been included. I asked the map's producer to update it and I made it interactive.

Technology-related activities were identical in 2015 and 2016, including choosing technology solutions such as programming languages, provisioning IT infrastructure, development, and feeding content into databases.

The screenshots below show different views of the Oxjam 2016 website:

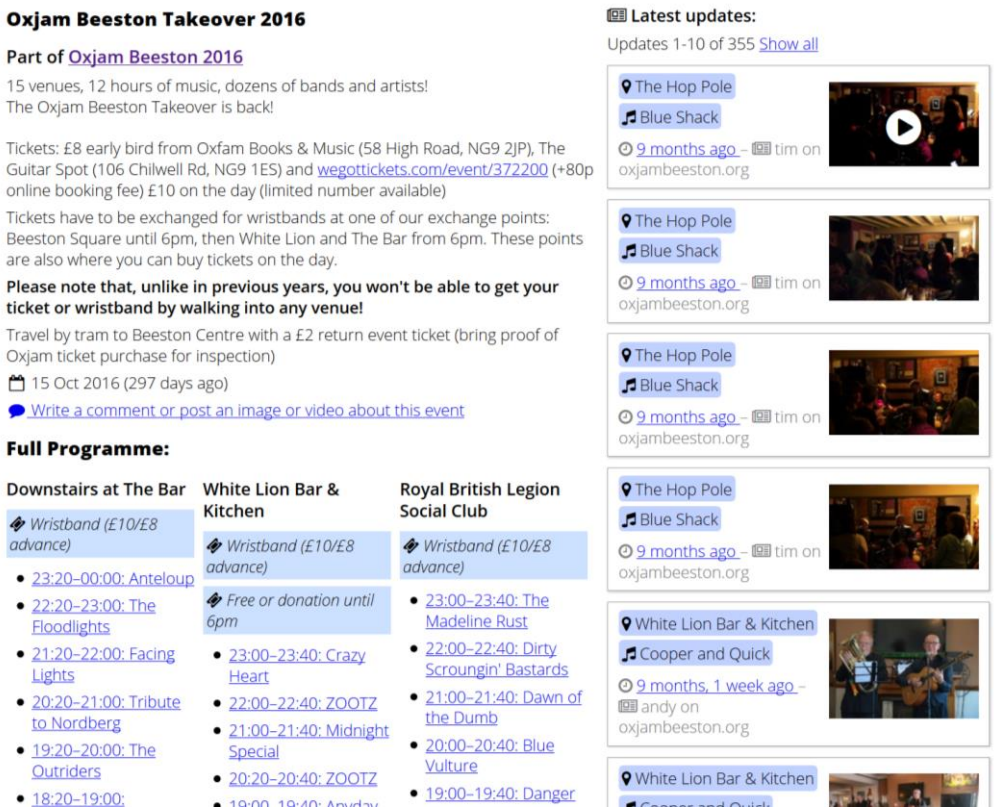

Figure 5.15: The takeover event home pages, showing the programme list inherited from the website and the update list inherited from the app.

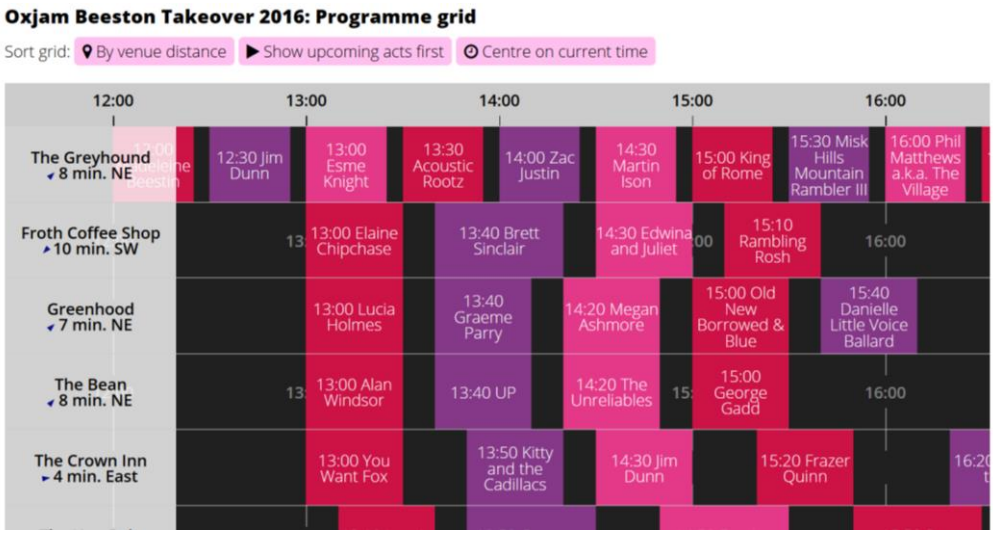

Figure 5.16: The "now and next" feature, redesigned as an interactive grid.

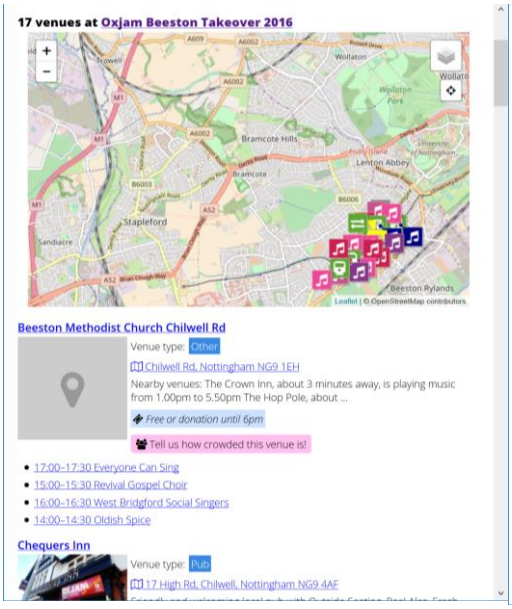

Figure 5.17: The 2016 venue list, adapted from the 2015 app

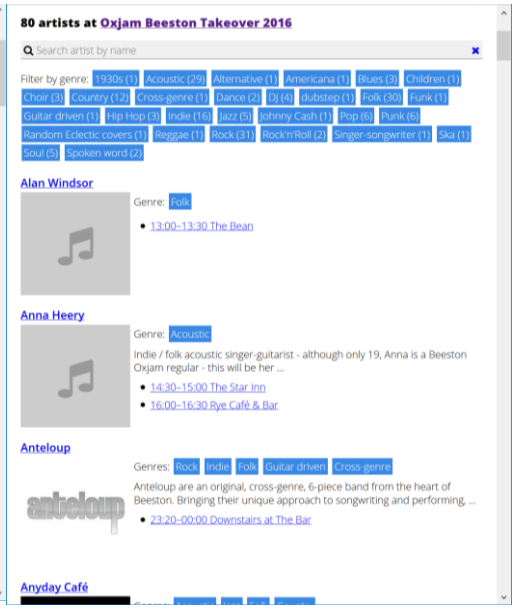

Figure 5.18: The 2016 artist list, adapted from the 2015 app.

Many thanks to Robert Howard for letting us use the "Beeston Tube Map"

Key:

- Daytime venue (until 6pm, free or donation)

Ticket exchange points:

- Beeston Square Exchange Point (12pm-6pm)

Figure 5.19: A custom interactive map

The venue map and the artist list, inherited from the app, and the schematic map, copied from the paper programme.

3 Integrating past data

My approach also allowed me to integrate data collected from the 2015 festival, such as artist profiles, concert schedules and updates, which has been useful because:

- First, it allowed me to test features related to the next takeover with a realistic dataset that involved a similar number of concerts, artists and venues.

- Secondly, I created a section of the website dedicated to past events, which I thought would give web visitors insight into what the festival looks like.
- Finally, some of the data itself was directly useful for the 2016 Takeover: a third of the bands or individual artists for 2016 had performed in 2015, and I could reuse their profiles, two-thirds of which were already associated with user-generated content.

4 Gathering requirements for design improvements

Improvements to the website, whether they be new or amended features, were decided based on the needs of the team in several ways:

- In some cases, I would identify a requirement myself and design and develop the matching feature. An example was the creation of a specific Oxjam Beeston logo.
- Sometimes, other team members would request features, as was the case with the volunteer registration form.
- In general, dialogue was important, and the artist registration form was gradually improved through email exchanges.
- Finally, the stakeholder workshop, in which team members, as well as one spectator and one musician, participated, was an opportunity to discuss and define opportunities for technology interventions. This workshop is discussed in detail in the next section.

The screenshot below shows the artist registration form, adapted from the previous form and input from team members. It has also benefitted from analysing the responses, which has shown some words to be unclear – "line-up" being used both to describe the composition of a band, and the list of songs played during a set.

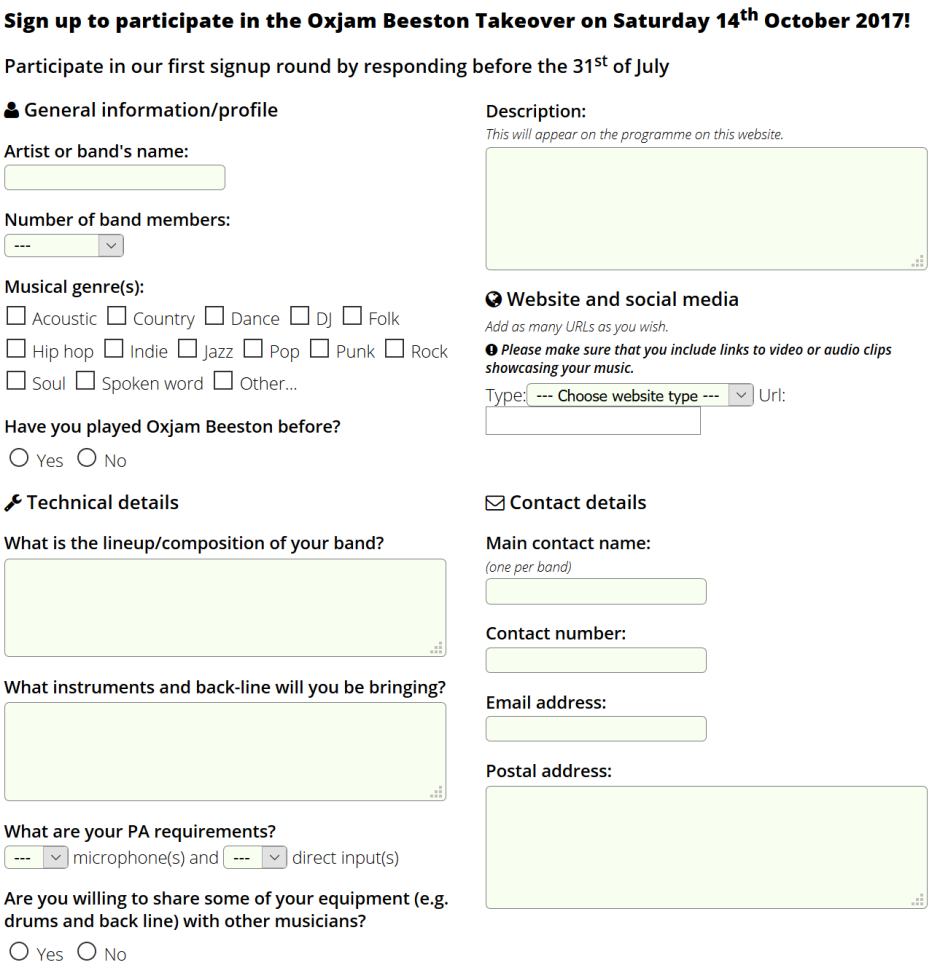

Figure 5.20: The Artist registration form

5 Orchestrating festival technology

On the day of the Oxjam Beeston 2016 Music Festival, I was present as part of the organizing team, and therefore of the global orchestration of the festival, and had set myself a number of IT-specific tasks, mostly around monitoring content and fostering content contribution. I had allowed myself flexibility to respond to unexpected changes.

Finally, my activity on the day included:

- Fixing a bug on the website.
- Talking briefly about the website as part of the global brief given to volunteers at the start of the day.
- Helping volunteer "venue managers" liaise with venues and audio systems providers.
- Contacting artists and helping reorganize concerts following the last-minute unavailability of a venue and of a band.
- Checking and moderating content, as well as collating content volunteered through other channels (emails and social media).

- Going to venues myself, chatting with other volunteers, and creating my own content.

Following the festival, a call for "stories" was sent out, and a story making interface was created, allowing website users to combine existing content from the website with their own. The screenshot below shows a story I have authored, including links to the concerts I've attended and photos and videos I've taken.

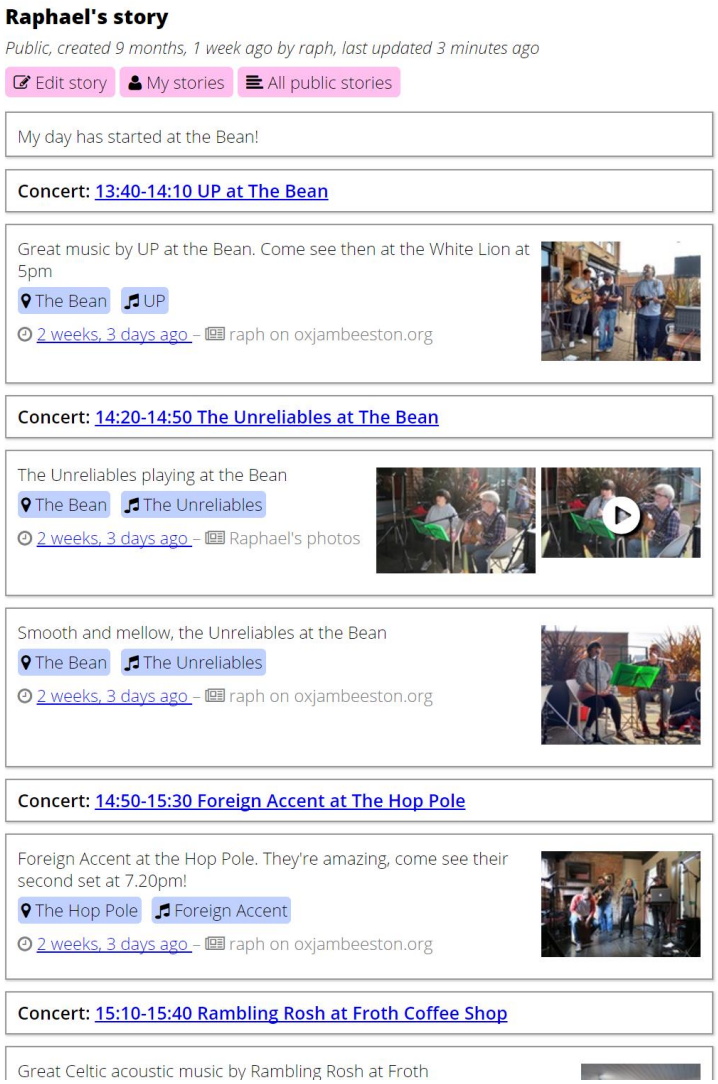

Figure 5.21: A story created through the website

5.3.6 A trajectory prototyping tool

The workshop was originally planned to revolve around a novel "trajectory prototyping tool", provisionally labelled "Protojourneys", whose development I describe here.

1 Prototyping trajectories

The idea of *prototyping trajectories* came about as an opportunity to bridge a gap in methods that could be used to design *trajectories*. Finding this gap can be

traced to conversations with BBC stakeholders, as *prototypes* were identified as one of the ways design knowledge is circulated within the organization, and there was nothing beyond *storyboards* that acted as low-fidelity representations of *trajectories*.

Prototypes can be defined in terms of their level of *fidelity*. At the lowest end of fidelity, *prototypes* may be equivalent to sketches (Buxton, 2007), and they can represent different aspects of an artefact to different, or *mixed* levels of fidelity (McCurdy et al. 2006). My approach was to represent the flow of interaction at the highest level of fidelity, with individual interactions being represented as rougher prototypes. Examples of *prototyping* techniques which are used to simulate flows of interaction include *role-playing* (Buchenau and Fulton Suri, 2000) as well as *cognitive walkthroughs* (Wharton et al. 1992), also used in service design (Blomkvist et al. 2013). *Protojourneys* addresses directly Johan Blomkvist's (2015) invitation to conduct prototyping at the level of the service, i.e. at the level of the global *trajectory*, rather than at the level of individual "touchpoints" along the journey.

2 A description of Protojourneys

The tool comprises two separate interfaces: an authoring part, where *trajectory* creators can author the flow of interaction, and a playback interface, which can be used for walkthroughs and testing sessions.

a The authoring interface

The authoring interface revolves around three types of entities: *projects*, which are placeholders for the other two, *activities*, which describe single instances of interaction, and *trajectories*, which combine several *activities* along a pathway.

At their simplest – and lowest *fidelity* – activities are descriptions of the interaction, done by authoring text blocks. The system is designed in a modular way to allow for extensibility and increasing the *fidelity* when needed. Specific *activity modules* that I have developed for that purpose include (1) time-triggered content, available at times predefined by the author, (2) location-triggered content, (3) content triggered by scanning a specific QR code.

Once these *activities* have been created, they can be assembled into *trajectories*, which are sequences of *activities*. These sequences may include branches and loops.

The screenshots below show parts the authoring interface: its home page, the trajectory editor, activity details and the activity editor.

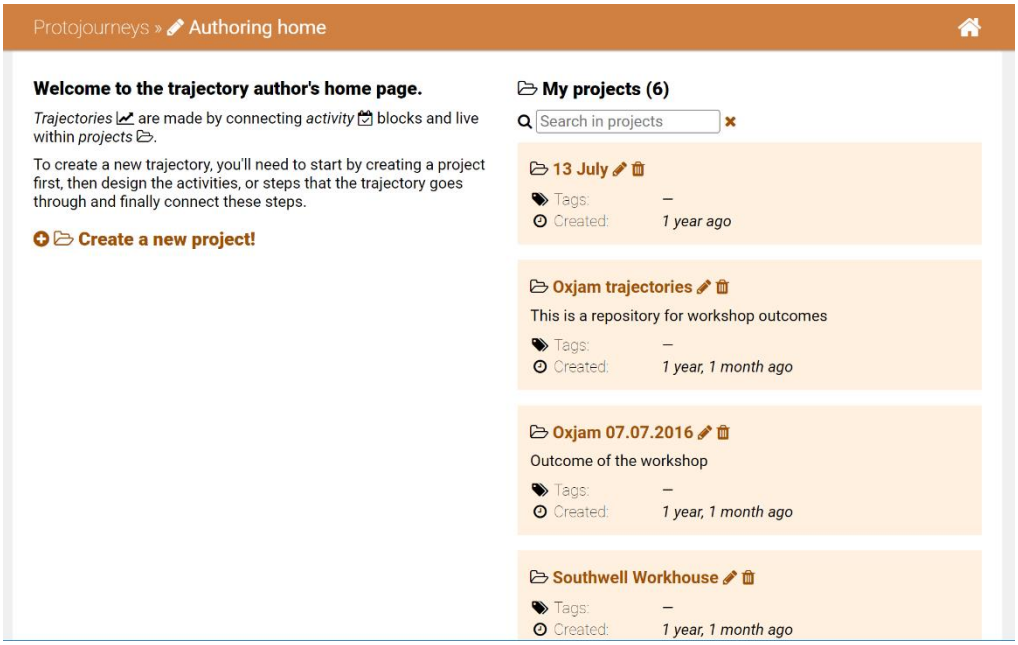

Figure 5.22: The trajectory authoring home page

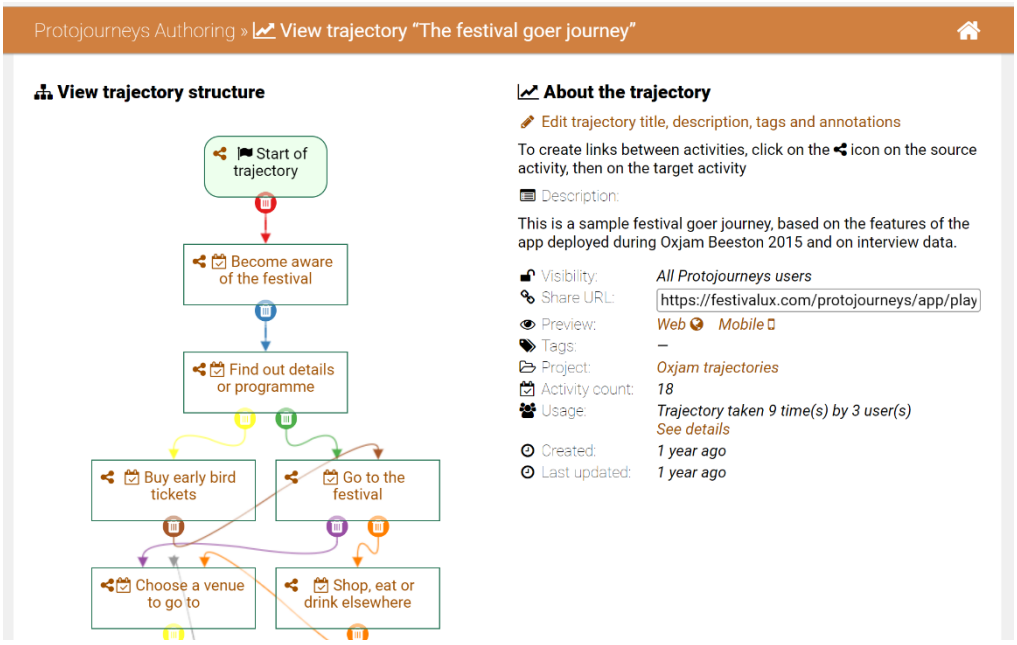

Figure 5.23: The trajectory editor

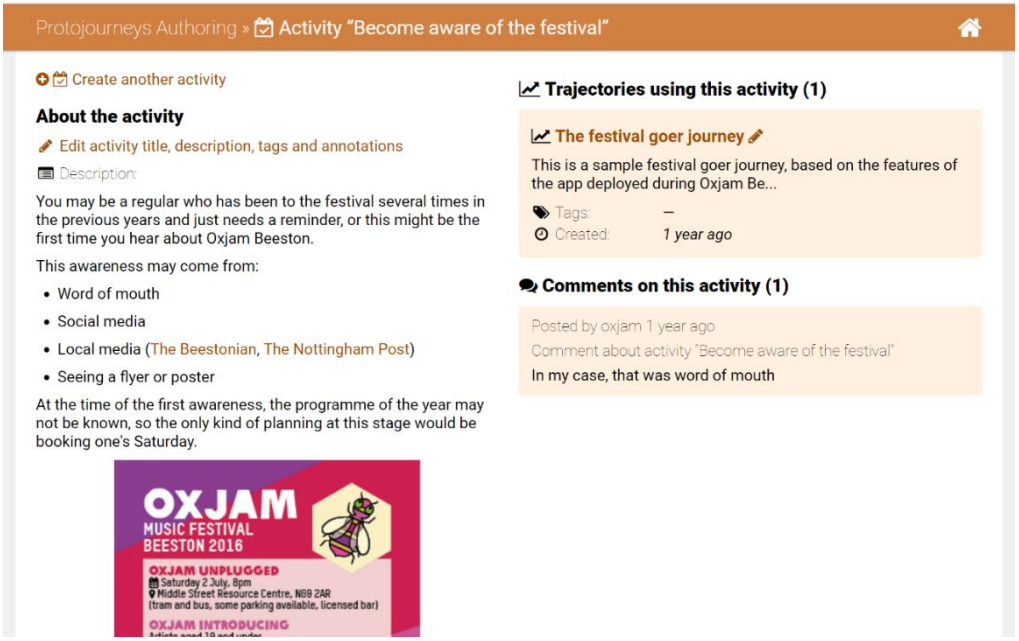

Figure 5.24: Activity metadata

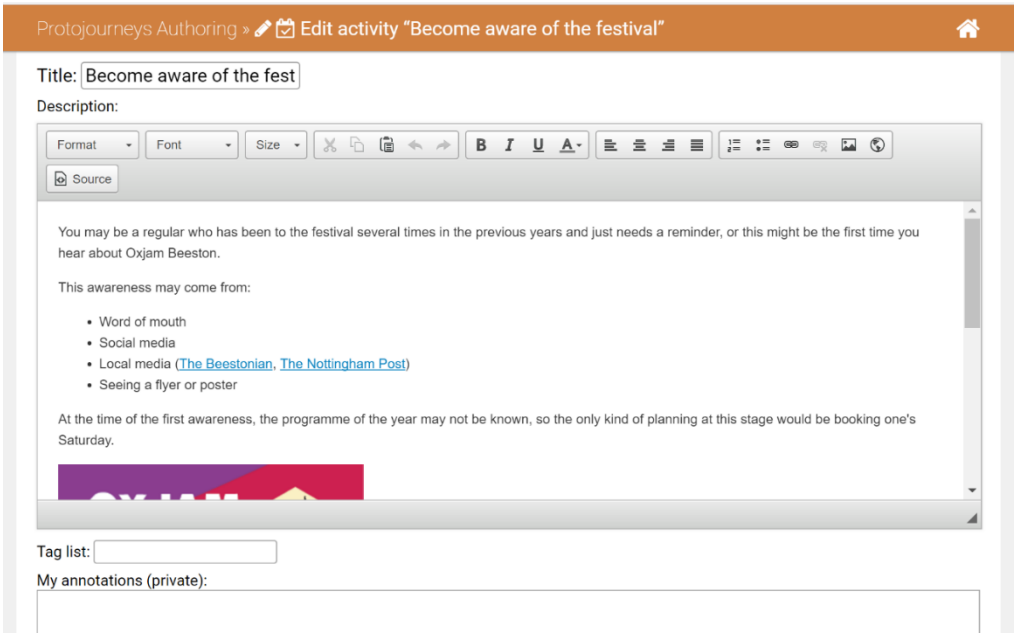

Figure 5.25: Activity editor

b The playback interface

The *playback interface* was created for evaluating *trajectories* once they have been authored. It has been designed to work on mobile devices, and therefore permit evaluation in-situ. Users of the *playback interface* can walk through trajectories step by step and for each step:

- Look at the *activity*. Depending on the level of *fidelity* of the *activity*, this can mean reading a description, following instructions to access content at specific locations or times, or even interacting with the prototype of an interface that would be used in that case.

- Document the activity through a rating, an image and/or text.
- Mark whether the activity was "done" or "skipped"
- Move on to the next activity, which can either be the pre-defined next step in the *canonical trajectory*, any other pre-defined activity, or create a custom *activity*.

At any point, users can stop and review their *trajectory*. Because of this flexibility, multiple use cases have been envisioned:

- By designers or other stakeholders, who want to sense-check their designs, either in their workplace, on location or, as suggested by Oulasvirta et al. (2003), in a similar location.
- By participants taking part in study sessions in situ. Depending on the goals of these sessions, they can be framed in a variety of ways. On one end, if the goal is more formative, participants may be told to use it as diary to document their experience rather than strictly follow a *trajectory*.
- On the other end, if the goal is to test the details of the *trajectory*, then participants may be instructed to carefully follow the *canonical trajectory* and provide feedback on that "ideal experience"

At the time of writing, both parts of the *trajectory prototyping tool* are fully functional, and it is available as an online service running on a private URL, but its level of refinement, and more importantly, its openness to changes based on feedback from users, makes it a prototype.

Screenshots of the playback interface are shown below:

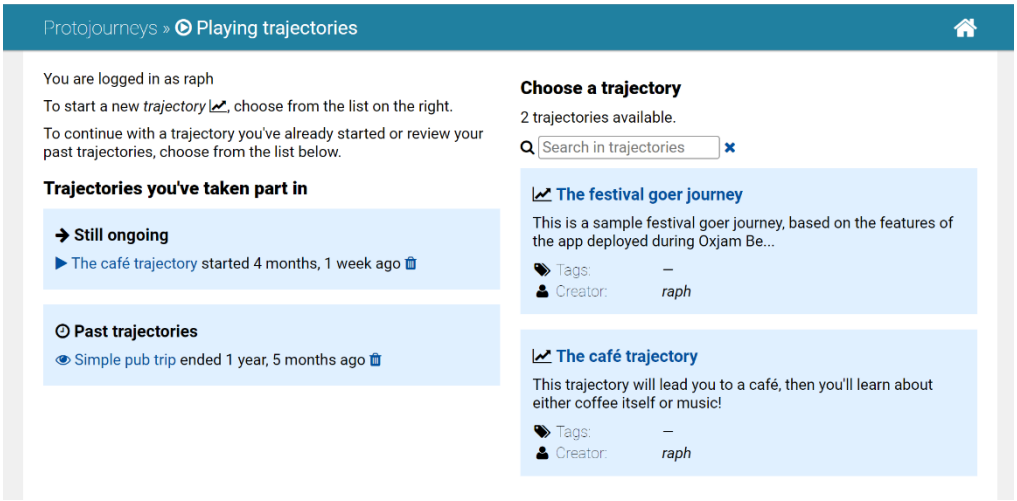

Figure 5.26: Protojourneys, the playback interface home screen

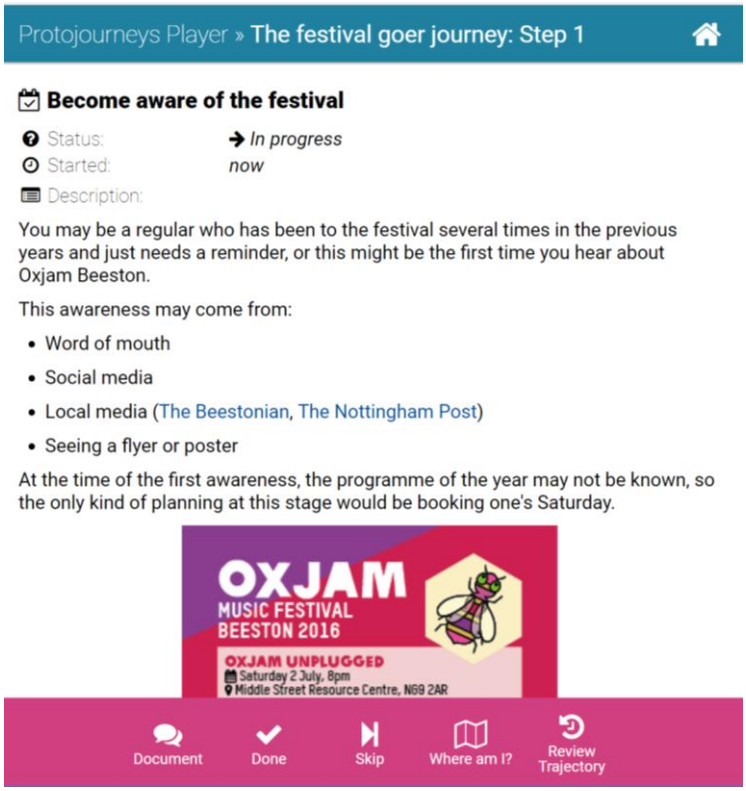

Figure 5.27: Protojourneys, the playback interface showing a step in a trajectory

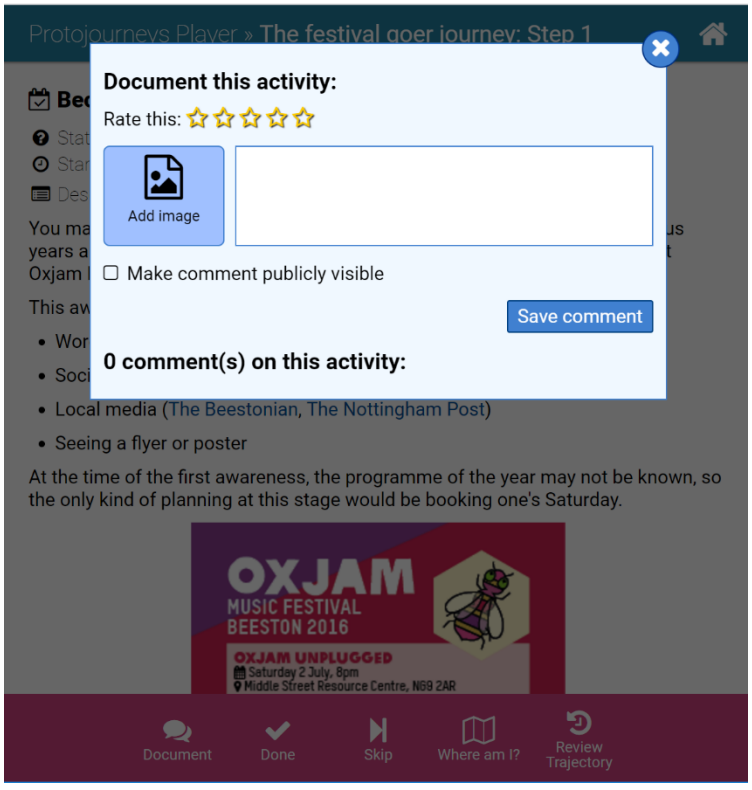

Figure 5.28: Documenting a step in a trajectory

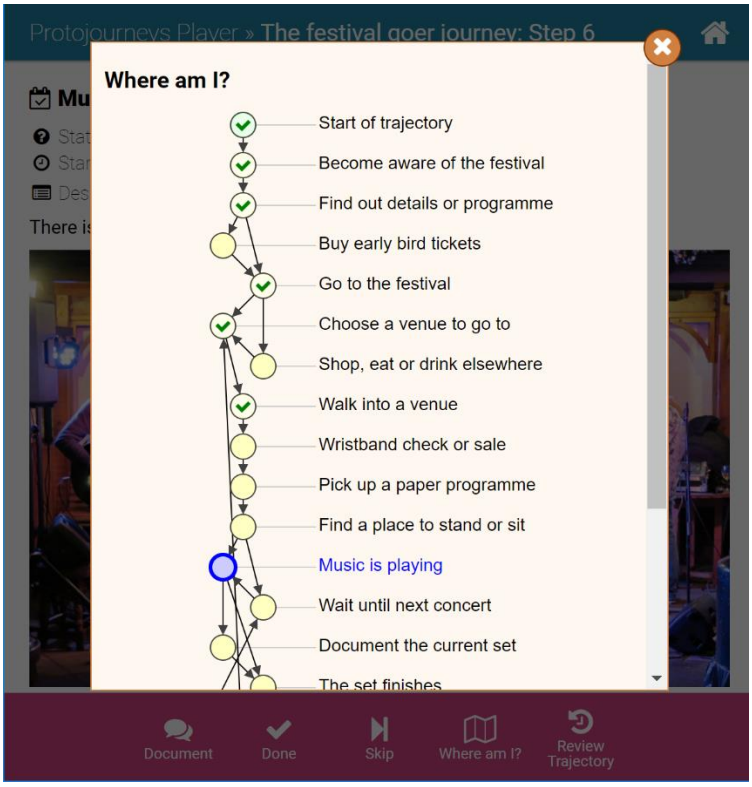

Figure 5.29: Showing the map of the canonical trajectory

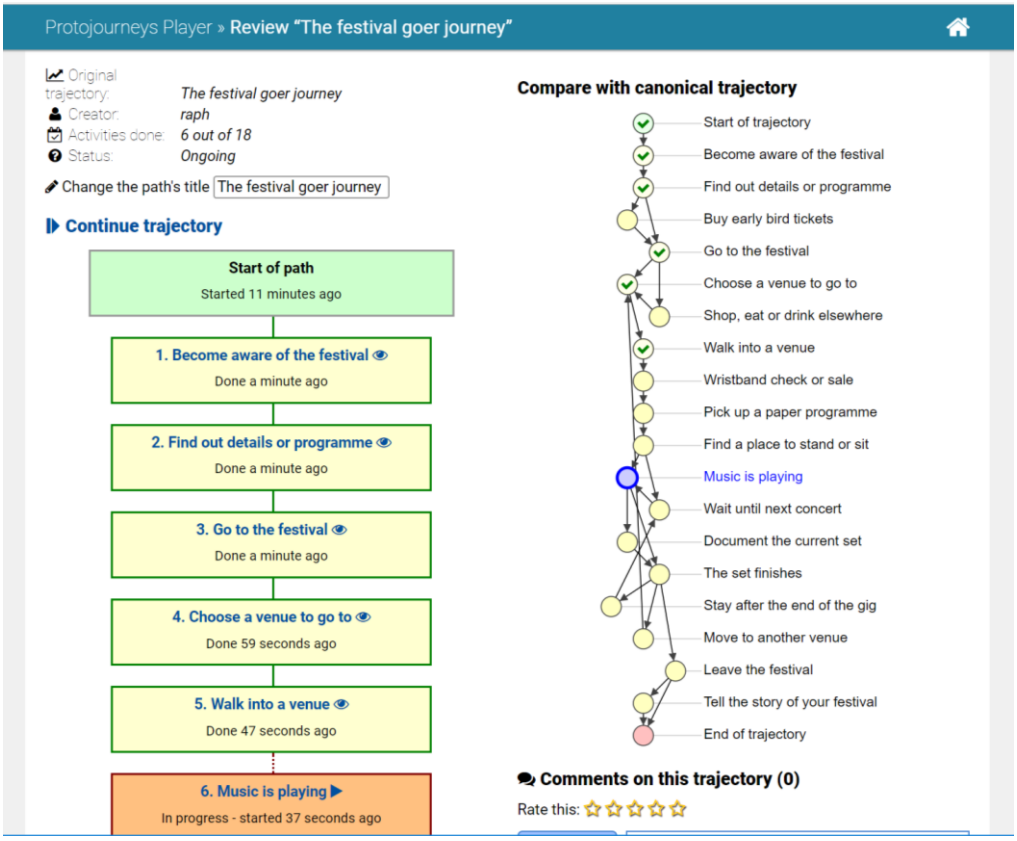

Figure 5.30: Reviewing the participant trajectory

3 Advocating its use

The *trajectory prototyping tool* was presented in multiple occasions. This includes informal feedback from my colleagues, presentations with several groups of stakeholders at the BBC, and workshops structured around the tool. I publicized the tool within my research group, hoping to identify projects which might benefit from using the tool. Apart from the festival described in this chapter, two potential applications were identified – one project around musical experiences, and one around visits at a heritage center – and I was invited to set up a *trajectory* workshop for the second one.

Informal feedback identified potential areas for improvement. The framing for using the *playback interface* was found unclear, as the different scenarios aren't clearly identified within the interface, which can't be tailored to support a scenario over another. BBC presentations, which involved mostly designers and design researchers, showed some interest for the approach, especially given stakeholders' familiarity with other prototyping tools, but failed to translate into intentions to use it.

4 Prototyping workshops

I now describe how the tool has been used in a series of three workshops. Two of these were internal workshops, attended by academics from my research group, all familiar to some extent with *trajectories*, and aimed at creating and refining a workshop format, while the final one involved stakeholders from the Oxjam festival.

a Preliminary Oxjam workshops

I invited my research colleagues to participate in two workshops whose role was both to define a *workshop format* and to ideate new technological interventions for the Oxjam festival. The original structure for the workshop started by a general presentation which would cover the specificities of the festival, the technology that had been developed in the previous iteration, and finally present the tool itself. I would then prompt participants for ideas to address one or more axes for improvement. We would consolidate these ideas into *trajectories*, which I would feed into the tool's *authoring interface*, and that we would then test using the *playback interface*, to come up with improvements.

Participants in both workshops provided both feedback about the process itself and ideas for the festival, although with a different balance, the first iteration being more focused on the process, and the second on the outcome. My initial intent to cover the presentation and a full iteration of designing, testing and using feedback to improve the first design in just three hours was too ambitious. Participants also suggested that the tool should be pre-populated with examples

relating to the design setting. Combining these two suggestions led to the idea of using the *trajectory prototyping tool* as a presentation tool which would show the previous year's intervention as a *trajectory*.

A tension arose from having two different goals: producing design and evaluating a tool for doing so. This tension was also expressed by participants who were aware of – though not fully proficient with – *trajectories*, as they felt they were straying too far away from my plans.

The two workshops therefore had vastly differing outcomes, depending on the balance between these considerations. The first one led to the step-by-step description of a distinctive "treasure hunt" following clear *canonical trajectory* and with consideration for the *historic trajectory*: The treasure hunt would be advertised in advance and festival venues would be equipped with Bluetooth beacons, whose presence would be picked up by festival goers' mobile phones and unlock content and virtual "badges". Once at home, participants would be able to access a "souvenir" based on the badges that had been collected. The second workshop didn't lead to a *canonical trajectory* that was as tightly structured, but did propose a broad range of interventions around the existing experience. This included offering physical badges that could be either scanned (for example, using the Artcodes technology), or could refer to specific Twitter keywords (hashtags), as well as improving aspects of the current app, most importantly the map. Some of the ideas from this second workshop were implemented in the website.

b The Oxjam stakeholder workshop

Following these preliminary workshops, my supervisors and I went on to schedule "stakeholder workshops" open to anyone with an interest in the festival. To identify participants, I contacted the volunteer email list, registered users of the 2015 mobile app, and artists. Taking into account the availability of team volunteers and of one of the venues hosting the festival, a single two and a half-hour workshop was set up. Participants included four volunteers who were part of the organizing team – including the head of the local festival as well as one of my academic supervisors, one artist who had applied to perform – and would later join the team, and one spectator. I made significant changes to the format of the workshop, given its shorter duration, the expectation that participants would be less familiar with design workshops, and the fact that pilot workshops had been too short to go through full design and prototyping iterations. The plan was to discuss the past years' experience through a *trajectory* authored in advance in the prototyping tool, get stakeholders' ideas for interventions, and consolidate their insight into. In the end, we didn't have enough time to perform the last step.

I had therefore prepared a representation of the trajectory of a hypothetical festival goer based on the data from last year. Being a synthetic representation of a *participant trajectory*, this may be considered as a *historical trajectory* in its own right. The original intent for this presentation was to take up a quarter to a third of the workshop's duration, but lasted longer as stakeholders had comments to share about challenges linked to each step in the trajectory. This format, although originally unplanned for, elicited precious feedback, and showed that presenting a synthetic *trajectory* in a workshop context can foster the collective evaluation of this *trajectory*.

Although the workshop was intended at defining "issues" to be addressed, the work of selecting a few issues for discussion was done in advance, and involved my supervisors and myself. The three issues that were finally discussed with stakeholders were:

- **Crowd management** issues, particularly with regards to a particularly popular venue. This is a complex issue, which ties in with programming, and was expected to be particularly sensitive due to the reduced total venue capacity that year. Several interventions were defined, including improving available information (both online and on physical signage), advertising real time crowdedness, and increasing the visibility of alternative venues. Although there were less complaints about crowding in 2016, it is hard to link that to one of these intervention – and this may also have been due to the decision to decrease the number of tickets on sale.
- **Maximising advance ticket sales**, for which solutions mostly relied on communication strategies and identifying multiple channels to direct spectators to online and physical ticket sales. After the workshop, one of the actions I put in place for this was to ensure that people who would post about ticket sales include the full URL.
- **Fostering cross-promotion** between artists and the festival, for which proposed solutions including the development of reusable promotional material.

In retrospect, the final workshop format fitted better the type of incremental improvements that we were seeking to make than the original prototyping approach. The festival had been undoubtedly successful, and the app was positively received for its usefulness, therefore there was a compelling rationale for keeping the overall experience (i.e. the *canonical trajectory*) mostly unchanged. This was compounded by the fact that, at the time of the workshop, most of the technical work of merging the features of the app and the website had already been done. Building a new *prototype canonical trajectory* from scratch, as my workshop structure initially intended to do, would have probably

missed the point, while annotating and refining an existing *trajectory* proved to be a fruitful strategy.

5 The prototyping tool as a presentation tool

In the final workshop discussed above, the *trajectory prototyping tool* was used for presentation purposes. *Presentation* emerged as an important use for my tool, and has also been discussed as a potential use when I asked colleagues for informal feedback. The tool currently lacks features for automating *presentations*, which were done in my workshop by running a *trajectory* step by step in the *playback interface*.

Authoring the Oxjam *trajectory* was more complex, as it involved loops – for example, many instances of "attending a concert" throughout the festival – and branches – corresponding to decisions festival goers can make, for example whether to stay at a venue or go on to another one. For these reasons, the tool may need options to author *trajectories* at multiple levels of granularity, in line with Flintham et al. (2011) discussion of *multi-level trajectories*.

5.4 Reflections

I now discuss the role of the *trajectories framework* in the design process. I start by showing how aspects of my design work map with the *trajectories framework*. I follow on by a reflection on how, as a designer, I have approached the *framework* as a resource to support individual design decisions along the design process, as well as the framing of this process. I conclude this section by proposing *design guidelines* grounded in this chapter and chapter 3's findings, as well as in the *trajectories framework*.

5.4.1 Mapping design features and the trajectories framework

In this first section, I discuss how the components of the framework match the features of my designs on the two iterations of the Oxjam Beeston Festival. This discussion is structured following *Interactional Trajectories*'s original presentation. It constitutes an analysis of the artefacts, the global experience and the way they were designed through the framework's lens. It shows how some concepts have been useful at a local scale, to support very specific aspects of the design, while other describe the experience at a global scale

1 Dimensions of experience

Dimensions of experience have been particularly useful in *framing* the scope for design across the festival.

a Spaces

In line with the *framework*, I discuss spaces in terms of *physical* and *virtual spaces*, and how they connect, forming a *hybrid space*.

i Physical spaces

The main *physical space* was the town of Beeston, whose relevant features for design are venues where concerts take place, but also the streets and transportation infrastructure that allow festival attendees to travel to, from and between venues. Helping spectators navigate this physical space and use mobile interfaces while on location were important considerations for the app and website.

The online assets were also expected to be accessed from other spaces, including people's homes or offices. These spaces correlate with time – before and after rather than during the festival – activities – planning and catching up – and interfaces – laptops and tablets, rather than mobile phones.

ii Online spaces

The festival experience also extended to online spaces, such as social media, including the festival's own social media accounts and artists' accounts. The app and website created its own online space for sharing and commenting around the festival. Bridges between these online spaces was done through links and by replicating content. Interviews have shown that participants embrace the multiplicity of these spaces – each corresponding to specific audiences or groups of friends, along with specific content sharing strategies. Creating an additional space for the purpose of festival coverage was therefore seen as welcome.

iii Hybrid space

The physical venues were a structuring element of the festival and therefore also impacted the structure of the app: this translated into individual venue programmes, but also allowed the grouping of content into "feeds" that mirror physical spaces.

b Time

Unlike original *trajectory* works such as *Day of the Figurine*, there was no complex mapping between the *experience* and a *narrative*. However, different considerations of *time* and mappings were relevant, which I discuss in terms of *timeframes*.

i Timeframe 1: Programme time vs. real time

Programme time diverged from real time due to multiple last-minute issues involving artists, venues and/or organizers. While the team structure in 2015 didn't easily permit these changes to be reflected in the app, the orchestration

strategy in 2016 made this information available as soon as possible over multiple communication channels, enabling some form of convergence.

ii Timeframe 2: Catching up

The closest mapping to that described by Benford and Giannachi (2008) – between *story time* and *clock time* is the one experienced when catching up with coverage of the festival, i.e. between the real time at the festival, and the moment people access coverage. Unlike Glastonbury, there was very little video coverage, and it only showed short snippets of concerts, so there are probably few examples of mappings that produce a "replay trajectory" that significantly follows festival goers' trajectories.

However, content contributions over time produce interesting patterns, with the availability of media ranging from near real-time to a few days later. High-quality content, requiring prosumer photography equipment and image processing work, tends to be available later than images produced on mobile phones and uploaded on the go. An analysis of website logs calls for streamlining this process, as visitor counts drop quickly within the few days following the festival.

iii Timeframe 3: Repeated experiences

Finally, the festival's yearly recurrence creates interesting time patterns whereby an experience can be informed by past occurrences of the festival. Working on two iterations of the festival has shown ways in which embracing past experiences has been beneficial:

- Coverage from past years have enriched venue and band profiles
- Past data has been useful in organizing the event, in particular as it provided inspiration for scheduling and matching artists with venues.

The stakeholder workshop, by presenting historic data and eliciting challenges for organizing the festival, may have had impact on the work on the organizing team, although this may have required an earlier intervention.

c Roles

Roles was a particularly useful dimension for designing *trajectories* at the festival. Identifying and distinguishing roles led to drawing specific *canonical trajectories* for each of these roles. It also helped anchor the intervention as community-centred, as it allowed to extend the audiences of the app and website to include more roles. The four roles that were defined, directly grounded in chapter 3's taxonomy of roles, were:

- *Spectators*, who would use the app to navigate the festival and send occasional content.
- *Citizen-journalists*, who would provide in-depth coverage of the festival.

- *Performers*, who would offer their own content and were expected to look at coverage of their own acts
- *Organizers*, who would create official content, publicize the festival and its app and moderate user-generated content.

In practice, we found out that *citizen-journalists* didn't map to a well-defined category of people – despite the town having a thriving group of *citizen-journalists* editing the "Beestonian" free monthly magazine – but that all other three roles documented their experience to some extent.

The *trajectories framework* invited us to consider "bystanders" that do not directly participate in the experience. We discovered that some of them were taken into account by the organizers of the festival, namely regulars at pubs hosting the festival, who would get free access to the pub without a festival ticket.

d Interfaces

Trajectories' discussions on *ecologies of interfaces* were particularly relevant to help design holistic interventions that expanded beyond the app or website. The interfaces that the *trajectories* covered included:

- The app and website (separate in 2015, merged in 2016), accessed through a variety of devices: mobile phones, tablets and laptops.
- Social networking services such as Facebook, Twitter and Soundcloud.
- Printed media, including posters, flyers, printed programmes and a special edition of *The Beestonian*.
- Additional devices belonging to participants, such as video cameras.

Interfaces for *orchestration*, such as email lists, artist and venue spreadsheets, and walkie-talkies also played a role in *trajectories*. I was responsible for maintaining some of these interfaces in the second iteration, for example by sending mass emails to artists and maintaining the artist spreadsheet.

2 Trajectory types

a The canonical trajectory as blueprint and as signposts

An early step in designing the Oxjam Festival app was to chart *canonical trajectories* for several participant roles in the diagram shown in Figure 5.1 (p. 120). These *canonical trajectories* were thought of as a strategic blueprint showing all activities that may be supported or joined up with the app and other materials we'd produce. We soon realized that time and resource constraints would make the implementation of every element in the diagram unrealistic. These *canonical trajectories* were meant to guide the prioritization of features rather than provide an exhaustive list of these features. The diagram looks more

like a complex workflow than linear *trajectories*: it has branches diverging and converging where multiple strategies are used to reach out to participants and then bring them back to common actions, and it shows possibilities for moving between different trajectories.

The *canonical trajectory* itself may constitute the "ultimate particular" of design. First, it is only one of the lenses through which design may be viewed. In Back (2016)'s taxonomy of constructs – which map to the individual interfaces and artefacts that were developed, activities and experiences, *trajectories* sit somewhere between the activities that compose a single *trajectory* and the overall experience that they traverse. Secondly, because it left so much freedom to *participant trajectories* to diverge, including the possibility to completely bypass technological interventions, the *canonical trajectory* is more of a *roadmap* or a *blueprint* that guides connections between the parts and the whole than a strictly defined "planned journey" or "ideal journey" as found in some formulations of the framework. Finally, ownership of the *canonical trajectory*, at least in the case I've explored here, makes it a complex, ambiguous design object: in both iterations, it has been encompassing way more parts of the festival experience that were under my control as a designer, yet there was no shared understanding of what the *canonical trajectory* was, as I didn't collaborate on the diagram with the organizing team.

Canonical trajectories through the Oxjam Music Festival were more tightly scripted for certain categories of participants than others: volunteers and performers were expected to attend specific venues at specific times, according to the running order defined by organizers, but spectators could choose to experience the festival in a loosely structured way, or to make their own plan based on the programme the team had produced.

Although there was no single authoritative, fined-grained representation of the full *canonical trajectory* that would constitute an actual "script" for the experience, it was made "tangible" – to use *service design* terminology – through a series of constructs, including design artefacts, team-wide best practices, meeting minutes or spreadsheets.

b Participant trajectories and their monitoring and evaluation

Participant trajectories are constituted by the experiences and the interaction patterns of the thousands of participants who have taken part in the festival. Identifying, monitoring and evaluating these individual *participant trajectories* has been complicated by several factors.

First, only some parts of the trajectory were covered by our research ethics application: the mobile application in the first iteration, and logged-in activity in the second iteration.

Secondly, beyond ethics and privacy, there was no easy way to track individuals without making the festival goers' experience or the volunteers' work more complex (e.g. by asking all ticket holders to give details or by tracking wristbands at each venue).

Finally, the looseness of the *canonical trajectory* means that sampling the *participant trajectory* at one or more points over time doesn't help predict what happens in between.

c Historic trajectories at the festival

I now discuss how *historic trajectories* were integrated in the design of both iterations of the festival website and app, examining how metadata supported the consolidation of content into *historic trajectories*, what types of stories were produced, and how a specific *historic trajectory* was integrated in the stakeholder workshop.

i Data used to support historic trajectories

The main sources of data that supported the retelling of stories of the festival were the programme and user-generated content. Some of this content can be paired through metadata, for example by tagging artists and venues in images and videos. In the case of Twitter, associating account handles from artist profiles and mentions in messages has led to automatic tagging of artists and venues. I reconstructed additional data through reidentification strategies – as did Flintham et al. (2015) for running races – for example by matching partial data with the programme or by visually recognizing venues and bands.

Usage logs were not used to reconstitute historic trajectories. As they were collected anonymously, they couldn't be matched to other sources of data, including device location, which wasn't collected at all. This data was therefore limited to a history of in-app navigation with little to no contextualization. These limitations also show how the reconstitution of *historic trajectories* conflicts with privacy issues and ethical frameworks.

Website users' concert schedules were also used to support the generation of stories, with users being given full control of this generation process.

ii Examples of historic trajectories and stories

There have been two places where *historic trajectories* were reconstructed automatically or semi-automatically in the work described here. First, *update feeds*, which can be filtered to show histories of the festival sorted by content

creator, artist or venue, and correspond to the "personal points of view" that chapter 3 studies called for. Secondly, stories could be created through the *story maker* interface – published only after the 2016 festival – either manually or through an automatic process based on the concerts users had scheduled to watch and on their own content.

But ways of retelling the festival go beyond these two examples that most closely fit the original definition of *historic trajectories* as synthetic journeys. Stories of the festival were encountered in a community magazine – *the Beestonian* – and would serve to publicize the festival, promote local artists, or recruit new volunteers. Posts on social media may also constitute such stories.

iii Historic trajectories created as part of research

I have also produced *historic trajectories* as part of my research in two ways: first, because the interview scripts were geared towards getting participants' narratives of the festival; secondly, when I crafted a composite *historic trajectory* in the *trajectory prototyping tool* and used it to support the stakeholders' workshop.

In some of the interviews, I used printouts from the data participants had contributed to support such retellings. In the case of the *historic trajectory* I authored, because it was based on heterogeneous datasets, there was no straightforward mapping with data that could have supported automation. One of the challenges in reconstructing the *trajectory* was to structure it into the episodes of interaction, or activities, that act as "building blocks" for the wider *trajectory*. In that sense, the data source that was most useful was the interview set, as it provided descriptions of multiple activities that participants were doing. Other sources offered limited insight: usage logs only showed when in-app interfaces were accessed, while user-generated content, in most cases – the major exception was content from volunteers, showing what happened behind the scenes – provided little more than lists and photos of concerts that participants had attended.

The *trajectory prototyping tool*, with a few improvements, might be used in the future to iteratively build, annotate and refine *historic trajectories* with direct input from research participants, making the process described above more straightforward.

3 Transitions

I now discuss how finer-grained concepts in the *trajectories* framework, namely *transitions* and *encounters*, can be used to discuss the global Oxjam Beeston experience, and the website and app I've developed around it. I note that some concepts may correspond to existing web design terminology.

a Beginnings

If taken at a global level, identifying clear beginnings for the Oxjam Beeston experience is hard. Interviews have confirmed the findings from chapter 3: this festival is a pervasive experience, intertwined with local community life, and engagement with the festival tends to build up in stages. For example, a participant may start by first hearing about it through word of mouth, then show casual interest by briefly looking at online updates, later engaging in planning one's festival and finally attending the festival, with each stage being the beginning of a closer engagement. It's a cyclical event, therefore a beginning may refer to multiple years of attending, a single year, or a single event in the season.

Beginnings were crucial for the design of the Oxjam website and app. Carefully planning points where participants would start using them was essential to the success of the interventions: the more people would be aware of the app, the more people would contribute content to it. To increase the chances of *beginnings* to happen, the strategy I chose was to offer multiple points of entry: the app was advertised through multiple channels. This strategy mirrors the festival's own publicity approach, which combined online services, posters and word of mouth.

Google Analytics, which I've used to collect website usage data, labels the beginning of the online experience as "User acquisition". However, these acquisition points may not be a *beginning*, but rather an *interface transition*, and data about traffic referrals may help identify this.

b Endings

Endings of the festival tend to be abrupt, and engagement with the event fades out in the next few days. Website and app traffic dropped sharply after the festival in both years, although there are some visitors looking for photos of the event. Volunteers also tend to disengage quickly after the festival, as organizing is an intense and exhausting activity.

These patterns of engagement have two consequences: first, it is essential to collate and publish content about the festival as quickly as possible, ideally on the next day; secondly, even when issuing multiple calls on different channels, it is very hard to get people to re-engage with the festival after it.

If endings are to be used to prompt reflections on the experience, as the *trajectories* framework suggests, then they need to be caught at the right moment. Updates sent by website and app users show that the ends of episodes are also good moments to collect such reflections.

c Episodic re-engagement

Episodic re-engagement happens at several levels in and around the festival. In this heading, I discuss briefly two examples of episodic re-engagement: engaging with online interfaces outside the festival, and moving between concerts.

In the build-up to the festival, participants engage and dis-engage repeatedly with its online presence. Referrer information from use logs help identify different patterns, with website and app use coming from three major pathways: direct entry (either opening the app, typing the URL or using bookmarks), from search engines, or from social media. These opportunities for re-engagement gave more control to website users than to festival organizers, and were generally led by participants themselves. Visibility on search engines may also be increased through "search engine optimization" techniques. These methods are generally used to appear higher in results lists than competitors, which may not be relevant as most search engines users were looking for the specific event – for example, typing "Oxjam Beeston" – and not for anything that would compete. The timeline format in social media allows organizers to "push" content into people's routines of using social media, although we decided not to pay for increased visibility on Facebook. Finally, other strategies where stakeholders had more control on re-engagement were limited to punctually sending mass emails. Another option for prompting engagement, "push notifications" from the app, were envisioned, but not implemented.

When considering individual concerts as the episodes of the festival, *episodic re-engagement* invites us to analyse how the transitions between concerts happen and can be addressed by technology. These transitions either involve staying at a venue or moving between venues. The main issue reported around such transitions was the lack of awareness of which bands were playing. Solutions proposed to improve that included making sure the online program was up-to-date, printing the paper program as late as possible to limit the number of last-minute changes, making sure the volunteers on the ground are aware of changes, and making announcements at the beginning and end of acts. On the day of the 2016 festival, a volunteer came up with an additional way of indicating the current concert, by adding arrow-shaped stickers pointing to the next or current act on the poster listing concerts.

Interviews also identified one obstacle to episodic re-engagement with the app, namely that spectators didn't feel appropriate to use their mobile phones when they were either enjoying the music or having social interactions with other spectators.

d Interface transitions

A wide variety of *interface transitions* happened around the festival and its website and app. They included, but were not limited to:

- Transitions between print media and online media, through calls to use the app and QR Codes that can be used as links.
- Transitions between digital cameras and computers, when images are offloaded from cameras, processed and uploaded to either social media, photo sharing services, or the festival website
- Transitions between different services on a single device: for example, between social media and the official website and vice versa.

Some *interface transitions* have been eliminated by merging the website and the app. The transition between features that were split between these two parts – for example, generic information on the festival in the website, details on the artists and venues in the app – is now more seamless, and they share a common look-and-feel, and a common navigational structure. Transitions between social media and the website can be made easier by providing appropriate links. This required making sure that links to relevant information were posted with each social media update, and adding appropriate metadata, such as Facebook's OpenGraph, within the pages served on the Oxjam website, to offer page previews on social media.

QR Codes pointing to the website have been provided in the second iteration and have not been used often – they were scanned twice according to system logs.

e Seams in the infrastructure

For the first year, I took the decision early on to make the user interface available both as a website but also as a downloadable Android application. I wanted to prevent issues around *seams in the infrastructure* of network availability by making sure most of the features would be available without a network connection.

The evaluation phase validated the presence of this seam, with several users reporting difficulties uploading material, not just because of lack of coverage indoors, but also because of the data plans they had.

However, the second year, no offline version was made available, as a trade-off that made the development of the website more flexible.

Another *seam* that was addressed was the non-reliability of GPS as a way of knowing one's location. This example is common in *trajectory* literature (Benford and Giannachi 2011, Nisi et. al 2016). Even though mobile phones'

location services were used to detect app users' locations, they had the option to choose venues manually, with the closest displayed first.

f Access to physical resources

The biggest issue around access to physical resources was the crowdedness of venues. In 2015 and in previous years, some venues reportedly had to turn away festival goers as they had reached full capacity and it was unsafe to let more people in. The configuration of another venue, where the concert room is located behind the bar following a corridor, meant that festival goers who had ventured out of the concert to fetch a drink could end up being stuck outside.

Strategies to deal with crowds were an important subject in the stakeholder workshop. Compared with the performances that led to developing the *trajectories framework*, festival organizers have much less control over where festival goers will go, as they retain their decision power as to which concerts they wish to attend. Preventing crowding was therefore done by combining a series of less constraining interventions:

- Selling fewer tickets to account for a lower capacity than the previous year.
- Offering updates on the crowdedness of venues so festival goers can choose to avoid the most packed ones.
- Making information on nearby venues more visible.

Although this was beyond the scope of my intervention, sound equipment – such as mixing equipment and drumkits – was another example where management of physical resources was crucial. This required carefully planning what artists needed or would bring themselves, while taking into account the characteristics of venues, and scheduling acts accordingly. There was, in the second iteration, an incident where a venue had reported technical specifications incorrectly and, upon discovering that on the day of the festival, several acts had to be cancelled and rescheduled.

4 Encounters

Exit interviews after Oxjam 2015 have confirmed the importance of the social dimension of the festival experience. There are multiple ways the experiences of participants, within or across roles are intertwined:

- The structure of the local music-playing community means that individual artists may perform as part of multiple formations – something that is part of the criteria of building the schedule.
- Many artists have a strong local following and bring in spectators to the festival.

- Several interviewees reported going to the festival with friends or family, or meeting friends there.

5 Orchestrating trajectories

Managing *trajectories* through orchestration processes in Oxjam has been a complex activity, that has formed an essential part of the festival organization. It has been distributed between volunteers – for example the online parts of *trajectories* have been the responsibility of the IT coordinator, while keeping the program on time has been in the hands of individual *venue managers*. Orchestration mixes planned aspects – for example, keeping with the published program – and improvised ones, when responding to last-minute changes.

Although there are cases where *orchestration* is more constraining, and involves ensuring participants are at the right place at the right time, this generally relates to managing specific "internal" roles, such as volunteers and artists. For festival-goers, managing trajectories is more about providing incentives and advice that supports their own decisions. For example, it means informing them about nearby, less crowded venues, prompting them for content, or responding to their questions.

The global roadmap for orchestration was based on knowledge passed on from the previous team. For example, we followed the timing of key events – such as calls for artists and volunteers, or announcements of ticket sales and programs – by issuing them roughly at the same time of the year. This knowledge was distributed within the team, but technological traces, such as the website and app's content, or social media profiles, has been supporting the transfer of this knowledge in several ways: for example, the registration dates were found on the registration form, past artists could be contacted thanks to the program, and images of the festival were used to discuss the configuration of venues.

Actions required for orchestration also included defining "best practices" for other team members to follow – for example, given that multiple stakeholders would post online content, orchestration involved asking them to include proper keywords and website URLs.

5.4.2 *Trajectories* and design decisions

I now discuss the use of the *trajectories framework* from a subjective point of view, describing multiple ways in which, as a designer, I referred to it. The structure of this section looks at the *framework's* uses before, during and after making design choices, suggesting that *trajectories* have supported *requirements*, then *design judgement* and finally *reflection* on design.

1 Trajectories within an ecology of requirements

Trajectories played an early role, both directly, as the goal was to design *a trajectory-supported experience*, and indirectly, through their influence on more specific guidelines derived from the Glastonbury study – namely interleaving *trajectories* based on individual voices.

The design for the festival app and the global *trajectory* that it is a part of were developed simultaneously, the local and the global designs evolving together and influencing each other. In the first iteration, the focus of design was the app itself, i.e. the artefact and not the experience nor its constitutive activities (following Back's 2016 three-tiered "FaTE" framework), and many other requirements and design considerations came into play:

- Recruiting and retaining participants was a major driver for requirements, as it meant that the app had to bring value to its users. This led to the programme being the central feature of the app, rather than the initial focus on collecting content. This allowed broader data collection, but also made the development closer to commercial need, and anchored this type of design research into the practice, rather than exploration corner of Fallman (2008)'s triangle
- Technology-related requirements, deriving from my own technological skills, the limitations of the technologies I chose, and the decision to make an app that would run on as many devices as possible.
- Privacy issues, which in turn connect with data protection regulation and the University's ethics requirements.
- The specificities of the festival, in terms of venues, artists, programmes, and availability of information.

These other requirements sometimes aligned with *trajectories*: for example, the need to drive festival goers to our online resources resonated well with *trajectories'* call for continuity and with the idea of *physical to virtual transitions*. On the other hand, orchestration was made difficult by external constraints. First, I lacked resources, both in terms of developing orchestration interfaces and of running the orchestration process. Secondly, there was a need to balance fine-grained orchestration based on extensive tracking and privacy concerns.

Trajectory considerations were most useful at two moments in the design process: in early stages, when drawing the global trajectory and identifying major transitions that have an impact on continuity, and in late stages where I was testing and improving the first iterations I had built, and needed to ensure that transitions were working. In the middle stages of design, I focused on information architecture, general usability and visual design.

2 Trajectories as a support for judgement

To action *trajectories* in the design process, they should be available at the point where design decisions are made. The way that I made such design decisions was supported by what Nelson and Stolterman's describe as *design judgement*: I didn't follow "strict rules of reasoning", yet my decisions were "practical, pragmatic", but not "irrational"; my decision-making was based on my experience as well as intuition.

Despite the "elusive" nature of *judgement*, I try to analyse it further, drawing upon Nelson and Stolterman's taxonomy of "design judgment" to identify *how* and *when trajectories* have been involved in judgment. Two types of judgement resonate particularly with my experience of using *trajectories*. First, *framing judgements*, as they define "the space of potential design outcomes" and determine "the 'edges' of the project", have relied heavily on *trajectory considerations*, including the definition of the global journey and which dimensions of experiences should be addressed. Secondly, *compositional judgements*, as they enable the creation of "relationships among a palette of elements, with an eye toward calling forth an emergent unified appearance", can be supported by *trajectories'* emphasis on the coherence of experiences, its considerations of how heterogeneous interfaces are assembled, and its attention to specific *transitions*.

These two types of judgement imply that *trajectories* support design on two scales, *local* and *global*, which are summarized in the table below:

Scale of design activities	**Trajectory concepts**	**Ways trajectories are engaged with**	**Form of design judgement**
Global	Trajectory types: canonical, participant and historic. Hybrid dimensions of experience	Framing the design process and the outcome of design.	Framing
Local	Transitions, encounters, orchestration	Supporting individual design decisions.	Compositional

Table 5.2: Ways trajectories are engaged with in design judgement

For these *judgements* to be supported by *trajectories*, knowledge of the framework must be available at the point where decisions are made. In the case described here, my personal awareness of the framework was good enough to know about most of its considerations "by heart" and not have to refer to its expression. My knowledge of *trajectories* also included using the framework to analyse the context of live events, as discussed in chapter 3, which meant that I already had concrete, contextualized examples of the framework in action. This

"conversation with *trajectories*" that started with studies went on during design phases as I played around with different concepts and discussed their application in the context of a live event with my supervisors.

Nelson and Stolterman also introduce the concepts of *default* and *offhand* judgements, that come without deliberation at the point of decision, yet can be learned as skills and become intuitive with experience. This shows the way for a long-term engagement with *trajectories* which, on early design projects, may be novel considerations with which practitioners engage with "full attention and deliberation", then become part of their experience and may support such *offhand judgements*.

3 Making sense of trajectories after design

In some cases, making sense of design decisions as being related to *trajectories* happened post hoc, as I was consolidating my findings to write the current section. For example, actions that led to strengthen *beginnings* were initially thought of as ways of *recruiting* more participants independently of whether they were part *trajectories* and drew mostly on my own knowledge and experience of online publishing. This kind of retrospective mapping seems at odds with the idea that *trajectories* have been useful in the design of the Oxjam app, yet it shows two interesting considerations for the use of *trajectories*:

- There is a strong overlap between *framework concepts* and other design considerations that may have greater currency in design communities. For example, a website designer may be aware, through their education, or through the sharing of workplace practices, of terms such as *conversion*, which describes a *role transition* whereby a website visitor becomes a customer. Identifying such overlaps may provide resources to make the framework's contents and vocabulary better match practices.
- Retrospective mapping between the framework and design features is also a way of building one's understanding of *trajectories* and, by making it part of one's reflective practice, foster appropriation of the framework.

4 Trajectories as a facilitation resource

Workshops described above in the context of prototyping *trajectories* have shown that the framework can support a facilitator-led approach, on both a global and a local level.

On a global level, facilitation has led to shaping global approaches to design, which has been the main positive feedback from workshop participants: in the previous chapter, BBC interventions have led to consider the specificities of audience segments; at the heritage centre, design has been refocused to consider the continuity and sequential aspects of the overall experience; for the Oxjam

stakeholder workshop – where, unlike the other workshops, some participants had little awareness of technological issues – it helped situate technological interventions within the larger scope of the work of organizing a festival, and frame interventions as not being necessarily about technology.

On a local level, facilitation helped surface issues linked to specific aspects of the framework, as I drew on my knowledge of *trajectories* to recognize potential *transitions* and raise them as issues. For example, in the BBC work, I saw what I thought to be a critical *interface transition* and made stakeholders aware of that issue, and for the heritage centre, I raised a question about a *physical-to-digital transition*. In both cases, I didn't phrase my comments using the *framework*'s term, but rather by directly discussing the local examples.

5.4.3 Reflections on the design process: action-research as a framing for trajectory design.

After proposing reflections on how *trajectories* have supported design decisions, I now discuss how it has framed the design process. I start by discussing how I have included participatory aspects to the design process, then relate it to *action-research*.

Multiple reasons led to broaden participation from the first to the second iteration of design. First, interviews at the end of the first iteration identified the local community both as a central aspect of the life of the festival, and as a resource to support design, research and communication around our work. Secondly, opening up participation was a way of identifying new features to explore in the second iteration, based on the value this would bring to stakeholders and users. This has also been the ambition of the first iteration's evaluation phase – in particular, interviews – but they had failed to identify strong enough cases for specific interventions. This goal is in line with the previous chapters' discussion on identifying the value of the *trajectory* framework. Finally, this was part of my ambition to identify forms of translations and dissemination for *trajectories* that could make workshop participants use *trajectories*. However, the first iterations of the workshop format suggested that this would have required a longer time commitment than was reasonable to expect from volunteers.

Participation, or at least inclusion of stakeholders, in the design process took two main forms. First, being a member of the team, where my role included implementing a communication strategy and responding to colleagues' requests. There wasn't a formalized framing for making stakeholder participate – there were no formal agreement nor expected deliverables and checkpoints. Rather, the configuration of participation took the a form of collaborative work adapted

to a small all-volunteer team. Secondly, participation was enabled through a stakeholder workshop configured to collect insight from a variety of participants: mostly volunteers, but also a spectator, an artist, and a venue owner.

Broadening participation in the design of *trajectories*, even if stakeholders have not directly designed *canonical trajectories*, has been essential because these stakeholders had control on different parts of the overall *trajectory*. For example, volunteers running the ticket sales booth control the early part of the *spectator trajectory* on the day; venue owners can impact the experience of festival goers and artists while on their premises; artists themselves may help bring spectators and other artists into the festival. Assembling the *trajectory* therefore requires at the very least an understanding of the roles of stakeholders, but better still, support and active participation in building a coherent experience.

One template that can drive iterative and participatory interventions is provided by the framework of action-research. Although the work described here has not followed action-research (AR), it provides a rich way of discussing a process for integrating *trajectories* into design. I therefore analyse the work described in this chapter by mapping it with the three phases of action-research, following Gillian Hayes' (2011) discussion of how the "user centred design cycle" of analysis, design, development and evaluation mirrors AR's spiral of **plan**, **act** and **reflect**.

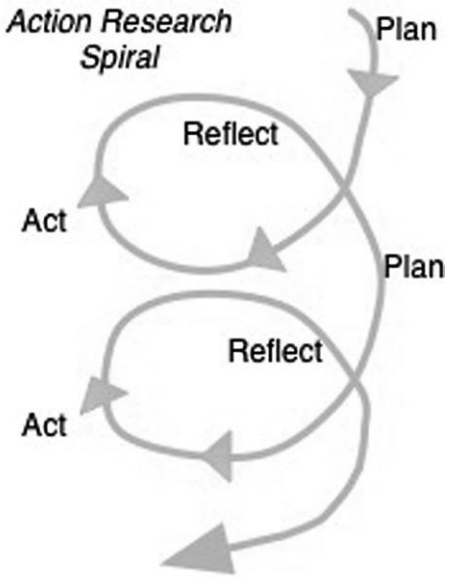

Figure 5.31: The action-research spiral, according to Gillian Hayes (2011)

In the first step – **plan** – of action-research, researchers and their partners define goals collaboratively. This was much more clearly the case for the second iteration, as the main goal in 2015 – driven by the context of my industrial collaboration and first studies – was to extend user-generated coverage of the festival and implement findings from what is now chapter 3. Gillian Hayes (2011) highlights the importance of grounding understandings of the setting in

fieldwork, and in particular in matching interventions with local specificities of the partner community.

Relating action-research with *trajectories* therefore puts the emphasis on defining what value *trajectories* should bring, in line with the findings from the previous chapter.

The next step in AR is to implement the plan that has been developed or "**act**". In the case described here, this has meant delivering the technological assets, publicizing them and running orchestration interventions. The main difference in actions between the two iterations has been in the level of coordination between researcher actions and partner actions. As joining up parts of the *trajectory* requires such coordinated efforts, there are strong opportunities for action-research to support the process of delivering *trajectories*.

Finally, the last part of AR is a "reconnaissance or fact-finding" (Lewin, 1946) or **reflection** step that enables further iterations. While originally, there has been a disjoint between evaluations of the festival itself and of technological interventions, using the stakeholder workshop to reflect on findings from the previous yea. Again, because *trajectories* call for assembling multiple aspects of experiences, some of which are not directly linked to technologies or interfaces delivered by HCI researchers or UX designers, action research's model of evaluating outcomes cooperatively help get an understanding of the impact of interventions at a scale that corresponds to the global *trajectory*.

Action research traditions are concerned with how knowledge is produced and can support both research and partner communities. In the case of a yearly volunteer-run festival, knowledge transfer has been essential to being able to hand over the management of the event to new teams, or to reshuffle activities and better balance the team's workload. In the history of the festival, there have been few examples of formalizing this knowledge. This has been done in 2016 though, but not because of this research. The head of the team, wishing to make sure his role could be taken over as smoothly as possible, wrote a report on the festival. I also sent an IT-specific report based on my work, and the treasurer made an overview spreadsheet explaining the major expense and revenues sources.

As consistent with AR's processes and goals, the knowledge produced by reflecting on the technologies deployed over two years have mostly led to local considerations, whose main benefit is to inform later occurrences of the Oxjam Beeston music festival. We have made attempts – so far unsuccessful – at reaching out to national organizers of the festival to make both the knowledge gained from interventions and the technologies developed, but at the moment there is no evidence of whether and how this knowledge could be transposed to

other events – and we know from informal feedback that the profile of other local Oxjam festivals can be very different, in terms of musical genres, of spectator demographics, and of relationships with local communities.

As Hayes highlight, HCI's concern with generalizing findings may be at odds with this local aspect of knowledge. However, the rise of design-centred epistemologies suggests that the discipline is now embracing knowledge residing in "ultimate particulars", i.e. situated artefacts whose form depends on both local considerations and on the designer's judgement. But again, this project was not designed as an action-research intervention, and beside the co-production of these local forms of knowledge with partners, analysing the resulting design using the *trajectories* framework and reflecting on the process has led to producing design about *trajectories*.

Action Research is also concerned with the sustainability of interventions. The work I've done suffers from major weaknesses in that perspective, and in its current form at the time of writing, can't be fully transferred to neither the local nor the national Oxjam organizing team without a major technological overhaul. This is due to the rapid, incremental, and ad-hoc development process I used, resulting in technologies over which other volunteers had little control, and had to rely on me to publish and update content.

The Action Research blueprint hints at a sequence for considering the three types of *trajectories* – *canonical*, *participant* and *historic* – over the course of a project. In this speculative model, each step in Action Research would lead to the production of one type of trajectory.

The outcome of the planning stage should be an "overall plan" (Lewin, 1946), a term which corresponds to the definition of *canonical trajectory* as "planned" or "ideal" journeys. The second step, action, hopefully results in changes in the experience of participants, who will go through a *participant trajectory*. Finally, the findings above describe how evaluations of an experience can be consolidated into a *historical trajectory*, which itself, can support a new iteration of the cycle.

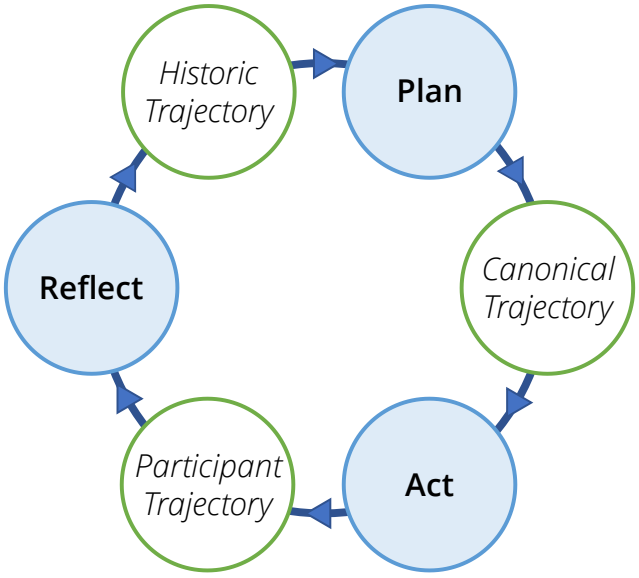

Figure 5.32: Relating Action-Research steps and the production of trajectory types

5.4.4 Design guidelines for *trajectories* through live events.

I conclude my reflection by proposing guidelines that arise from combining *trajectories* with the outcomes of the design interventions above. I group these guidelines according to which parts of the framework they address – although some cover multiple aspects. Some of these constitute refinements of design guidelines proposed in chapter 3.

1 Considering the dimensions of experience

Guideline 1: To foster online conversations around an event, consider the hybrid spaces it will span. This involves identifying existing spaces, such as social media, and how they are linked to events, locations and performers, creating new conversational spaces if there isn't a single main online venue for discussing the event yet and finally considering how to enable transitions between spaces and take advantage of standard practices set up by these spaces' owners or their users, such as URL sharing, mentions, hashtags.

This guideline builds upon how coverage of Oxjam Beeston has been distributed across spaces, the strategies I've deployed to identify this content and suggestions by interviewees that the app filled in a blank between these spaces.

Guideline 2: Cater to the core roles of *festival experiences* and consider their flexibility: *spectators*, *performers* and *organizers* are the three main roles in all festival events, big or small. Formal *journalist* or media roles may be present in larger events, but documenting events is an activity that the three base roles should be able to do. The smaller the event, the more overlap should be expected between roles.

This guideline is derived from the roles identified in chapter 3, and on how participants in all roles have participated in media coverage for Oxjam Beeston.

2 Considering canonical, participant and historic trajectories

Guideline 3: Provide "signposting" to make the *canonical trajectory* visible to participants at key points, and to provide information on potential "diversions" or last-minute changes. This last point also involves making sure that urgent information is spread by informing key volunteers and publishing updates.

This is justified by feedback which led us to clarify information about ticket sales, and how we ensured the smooth operation of Oxjam 2016 despite major last-minute changes in the schedule.

Guideline 4: Support *historic trajectories* in multiple ways: by harnessing the "conversational spaces" listed in guideline 1, by identifying moments when people are likely to reflect upon an event. To mix content from multiple sources, make sure they can be aligned through appropriate metadata schemes.

3 Considering transitions

Guideline 5: Make the *canonical trajectory* more resilient by offering multiple opportunities – at different points in time and space, or through varied supports – to engage (*beginnings*) or re-engage (*episode beginnings*).

Based on strategies to get participants to use the app and document their experience, this guideline doesn't seem to be unique to festival experiences and may apply to a broad variety of open-ended *trajectories*, as long as the authors choose to prioritize a broad user base over making very distinctive experiences.

Guideline 6: Use the natural structure of event to identify opportunities for *real to virtual transitions.*

For example, in the case of Oxjam Beeston, stages, venues, artists and concerts can all serve to "link" to online content, such as artist profiles.

4 Managing trajectories

Guideline 7: Trajectories can be managed by providing support for decision in ways that balance participants' preferences with issues such as *transitions into physical resources* and *seams* . These *transitions* need to be clearly signposted, but not discouraged.

For example, as reported by the Glastonbury study participant, crowdedness and being cut off from the "outside world" are part of the festival experience. For Oxjam Beeston, we reported which venues were crowded and made sure people

were aware of other options, but we made sure spectators could make their own decisions.

Guideline 8: Give people on the ground the role of *facilitators*, who know about the *canonical trajectories* and the available *technologies*, but scaffold participation rather than force participants towards a given path.

This follows Robyn Taylor and her colleagues' work at the Great North Museum (2015) and corresponds to the role Oxjam Beeston volunteers have taken, and which I have embraced by providing a specific "IT brief" to afternoon volunteers.

Guideline 9: Content creation may be scaffolding in multiple ways: (a) offering a selection of templates to frame creative expression – as suggested by the Glastonbury study's most popular probes – (b) "seeding" content to provide examples – to make content creation features self-explanatory and reduce shyness – (c) scaffolding metadata by making it easy to tag people and locations – which has worked well in Run Spot Run and Oxjam Beeston.

5.5 Conclusion

In this chapter, I have described a two-year cycle of *trajectory*-inspired interventions that I have conducted as researcher, designer and volunteer for a local music festival. This first-hand account of the design process has led me to a reflection on how to integrate the *trajectories framework* in design practice, first by considering how I have used it as a "resource" that supported my own *design judgement*, then how it has integrated with the *process* itself. I have concluded this chapter by contributing further design guidelines for live events, which are a form of support for these design decisions.

Chapter 6: Discussion

I now build upon both the research work described in chapters 3 to 5 and on the literature presented in chapter 2 to articulate three main classes of contributions.

The first part of this discussion offers a series of extensions to the *trajectories framework*. The second part provides a "process model" to scaffold the use of *trajectories* within real-world design processes, alongside a toolkit of methods and tools that support the process. Finally, the last part of this discussion addresses how this *process model*, as well as the design interventions presented in chapters 4 and 5, constitute *translations* of *trajectories*. I conclude this chapter by proposing a model for translating HCI theory.

6.1 Extending the trajectories framework

I start by proposing novel extensions to the *trajectories framework*. These extensions aim to make trajectories address new types of experiences, namely live events or the BBC's Knowledge and Learning scenarios. These extensions also build upon tensions uncovered during my review of *trajectory* uses, such as between authors seeing the framework as appropriate either only *close-ended* experiences or *open-ended* ones as well. I also incorporate knowledge that I have labelled during the literature review as "implicit extension" of *trajectories*.

6.1.1 An expanded scope for trajectories

I now discuss how new settings for *trajectories* that this thesis has explored differ from those that the framework initially addressed. These settings involve open-ended experiences, shared control between *participants* and multiple *stakeholders*, and situations which can be described as "design ecologies".

1 Trajectories in open-ended experiences with shared control

The original *trajectories framework* was developed by abstracting knowledge from mixed-reality performances, which are relatively self-contained, closed-ended experiences where the authors have a large degree of control on the experience. Participants are aware of the nature of this authorial control – in many cases, they have paid to enter – and wittingly "suspend their disbelief" to follow the script. Although the original formulation of the framework didn't restrict its scope to close-ended experience, it has been viewed as a limitation of

trajectories (e.g. Bonsignore et al., 2014), and Taylor et al. (2014) have suggested that *trajectories* could be successfully used to design *open-ended experiences*.

Festival experiences are open-ended in nature as – for most participants – there isn't a single prescribed path through the experience. Although these events have starting and finishing locations and times, participants have patterns of engagement that don't always correspond to the official framing of the festival. Also, when presenting the framework to BBC stakeholders, avoiding overly prescriptive experiences for audiences was discussed as a design requirement.

The *open-endedness* in festival and learning experiences means that the actual journey of individuals – the *participant trajectory* – is led by participants, based not on a script, but on participants assembling their own path based on a combination of planned and spontaneous interactions with a variety of interfaces. The *trajectory* may therefore be described as *emergent*, as in Dalsgaard et al. (2011)'s understanding of the framework. This provides an example, forecast by the original *interactional trajectories* paper (Benford et al., 2009), of "participants bring[ing] coherent meaning to experiences by reconstructing trajectories".

Trajectories have been a useful set of concepts to address open-ended and participant-led experiences, both for studying them and for designing novel services. Although not limited to the design of Alternate Reality Games (ARGs), this thesis suggests that *trajectories* could cover the whole range of Bonsignore et al.'s (2014) "narrative design dimensions", from close-ended to open-ended ones, and with varied levels of participant interaction. Like these authors, we suggest that the open-endedness and the shared control on *trajectories* can be described as a continuum, with for example *Uncle Roy All Around You* – with input from online players and the possibility of getting lost on the street – being arguably more open-ended than the much more self-contained *Desert Rain*. At the other end of the continuum, the experience of a marathon for the role of spectator, with a certain freedom in choosing where and when to watch the race, is more open-ended than that of a runner, who has to cross the start line at the right moment and follow the path of the race.

The diagram below represents this continuum:

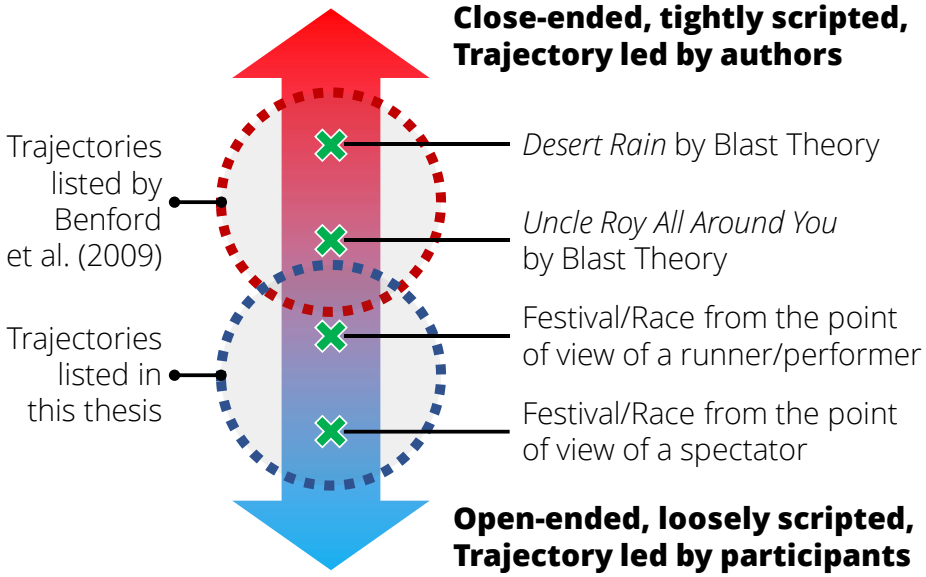

Figure 6.1: A typology of control and planning in trajectories

Although this diagram equates open-ended experiences with bottom-up, or participant-led ones, and closed-ended experiences with top-down, designer-led experiences, open-endedness and control by authors may be two different dimensions. Although these haven't been encountered in this thesis, there may be examples of *bottom-up close-ended trajectories*, for example when participants plan their experience tightly in advance, or of *top-down open-ended trajectories*, describing for example disaster response operations which involve "[managing] situational uncertainty" (Fischer et al. 2015).

2 Beyond verticality: trajectories and networks of actors

The picture described above relies on characterizing certain actors involved in *trajectories* as being "up", for example institutional actors, event organizers, media outlets, and others as "down", such as individual participants or "grassroots" community groups. This typology should be nuanced to consider shared structures of control between stakeholders. For example, in a festival experience, a large network of actors, including artists – professionals and amateurs –, media, online platforms and spectators – on location and beyond – may influence each other's trajectories.

This vision of trajectories as shaped by networks of actors may connect the framework to intellectual traditions such as *Science and Technology Studies* (STS), and Bruno Latour (2005)'s Actor-Network Theory (ANT). ANT considers non-humans, such as technological arrangements, to be actors on the same level

as humans. In that sense, *trajectories' ecologies of interfaces* constitute actors which interact with *participants* along the *trajectory*.

The diagram below is an illustration of how a participant's *trajectory* may be steered along time, either through planned or improvised actions, by a network of actors and technological artefacts.

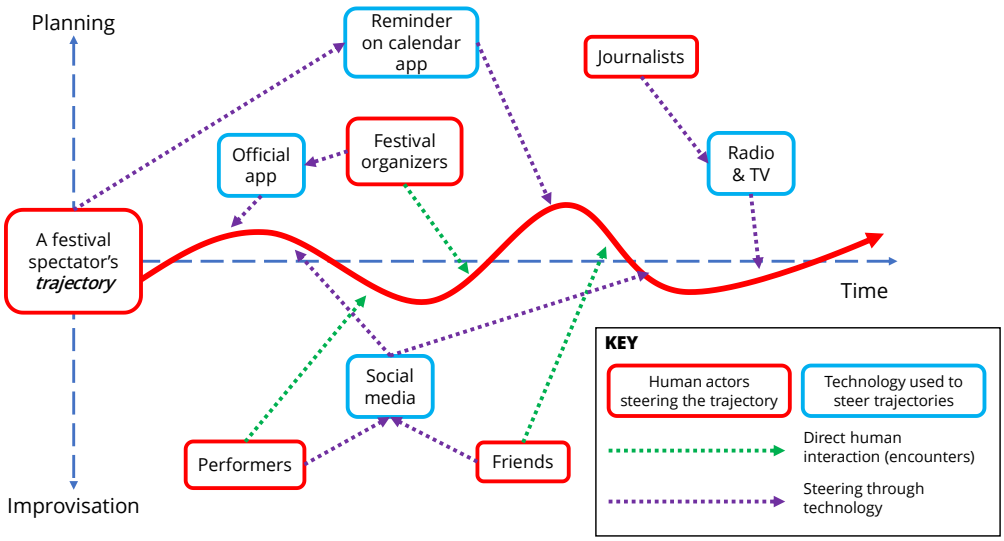

Figure 6.2: An example trajectory as shaped by a network of actors

3 Trajectories in "design ecologies"

Designing *trajectories* has been described as assembling *interface ecologies*. I discuss these ecologies by considering the interplay of the design of the parts of these assemblages and that of the whole. This joint attention to details and the whole has been described as an important skill for designers by Harold Nelson and Erik Stolterman (2012).

a Design of trajectories and design supported by trajectories

The outcomes of design activities described in this thesis show a great disparity of stakeholder control between parts of a *trajectory*. In other words, the opportunities for design have varied considerably depending on which interfaces were involved at each step in the *trajectory*. In some parts – for example when stakeholders interface with partners: target resources in *Digital Matchr*, sponsors at Oxjam – designers have little to no control on how participants interact with elements that are part of the broader *trajectory*; Other interfaces, like social media, lend themselves to developing content strategies, but without control on mechanics of use; finally, some interfaces involve detailed *interaction design* – the quiz for *Digital Matchr*, and the app at Oxjam.

Annika Waern and Jon Back (2017), by discussing *trajectories* alongside "activity-centric HCI research", have suggested that the framework differs from

traditional conceptions of design in HCI in that the final object of design – the *ultimate particular* – is no longer an "artefact" but the "activities" that participants do.

However, designing the Oxjam app and looking at the BBC's design projects suggests that, in many real-world projects, the design of a single interface is the frame of the activities of individual designers and project teams. In Oxjam, this was because a specific asset, the app, was the largest missing link in order to make the *canonical trajectory* follow our designs. For *Digital Matchr*, this was due to a division of projects that gave little scope for designers to coordinate the whole *trajectory*. In each case, the *trajectory* may no longer the *ultimate particular* being designed, but becomes a way of identifying requirements for an interface. To describe that situation, I therefore introduce a distinction between on one hand the "design of trajectories" – where a *canonical trajectory* is the outcome of design – and on the other hand "design supported by trajectories" – where the outcome is generally an artefact, but *trajectories* serve as heuristics.

b Orchestration as transversal design

I now discuss *orchestration* or, as a broader category, *processes for managing trajectories*, by considering how these processes are the object of design activities. In original *trajectories* work, *orchestration* is mostly described as a situated activity that is part of a performance. *Orchestration* as something that can be designed is discussed by Martin Flintham in an interview in *Performing Mixed Reality*. His description, consistent with my own experience as part of a team managing a festival, shows an assemblage of interfaces and activities that mirrors the *trajectories* of participants. *Orchestration* mostly deals with unplanned aspects of experience, and involves monitoring and intervening – sometimes through improvisation –, and may be distributed across team members and locations.

In open-ended experiences where control is shared with participants, orchestration takes a slightly different role, as it also involves reaching out to non-participants and enticing them into trajectories – this can be through advertising, or through Taylor et al. (2014)'s facilitation and scaffolding strategies for getting people to interact with their exhibitions – as well as striking a balance between steering participants into a direction and giving them the freedom to choose – an example was improving information so people could avoid crowded venues. Another specificity, taking into account other aspects of the design ecology, is that orchestration is transversal to the whole *trajectory* and does not solely concern the parts with the higher levels of control. The orchestrator's role therefore also includes monitoring and controlling parts where stakeholders have less control, for example by moderating social media. Orchestration may

also involve planned aspects, such as scheduling the delivery of social media content.

For all these reasons, as well as potential configurations where designers need to create instructions for the people who will do the *orchestration* legwork – this was the case in the Oxjam festival, with volunteers trained on the day –, *orchestration plans* may act as more or less prescriptive "blueprints" for the experience of these *orchestrators* in the way that *canonical trajectories* constitute blueprints for the experience of participants. With the extensions of *trajectories* listed above showing shared control between stakeholders and participants, *orchestrators* or *volunteers* may be considered as specific *roles* or classes of *participants* alongside *spectators* and *bystanders*.

Drawing *orchestration plans* in parallel with the *canonical trajectory* is similar to how "service blueprints" (Shostack, 1984) are represented, with supporting processes described along the customer's own journey.

c Artefact types in design ecologies

I now propose a taxonomy of artefacts, or stakeholder assets, that are traversed by *trajectories*.

A first class of assets are newly created and commissioned when the *global trajectory* is designed, with either that *trajectory*, or these "new assets" being the *ultimate particulars* of the design activity. An example of *new asset* at the BBC would be the *Love Festivals* web portal and the promotional material associated with it – wristbands, pamphlets and videos – or the *Digital Matchr* quiz. For Oxjam Beeston, those would be the 2015 app and the 2016 website.

The second category of assets are controlled by stakeholders, but afford fewer opportunities for change. They comprise existing technologies and resources that *trajectories* need to integrate with. They can't be "designed", either because adapting them to the *trajectories* would be too expensive, or because of organizational constraints, but they can be "designed around" or "designed with". At the BBC, this includes the web articles that *Love Festivals* aggregates, and the iWonder guide format that *Digital Matchr* fits in.

Finally, a last class of design assets are external resources that stakeholders have little control on. Like the "existing internal assets" above, they need to be "designed around".

d A model of "design ecologies"

I now synthesize the three headings above into a model of *design ecologies*, described in the diagram below, which includes:

- The three classes of design assets that support *trajectories*.
- The activities that happen when participants interact with the assets.
- The canonical *trajectories* which link these activities together.
- The orchestration processes, which stakeholders need to plan.
- Finally, the *experience* that frames the whole trajectory.

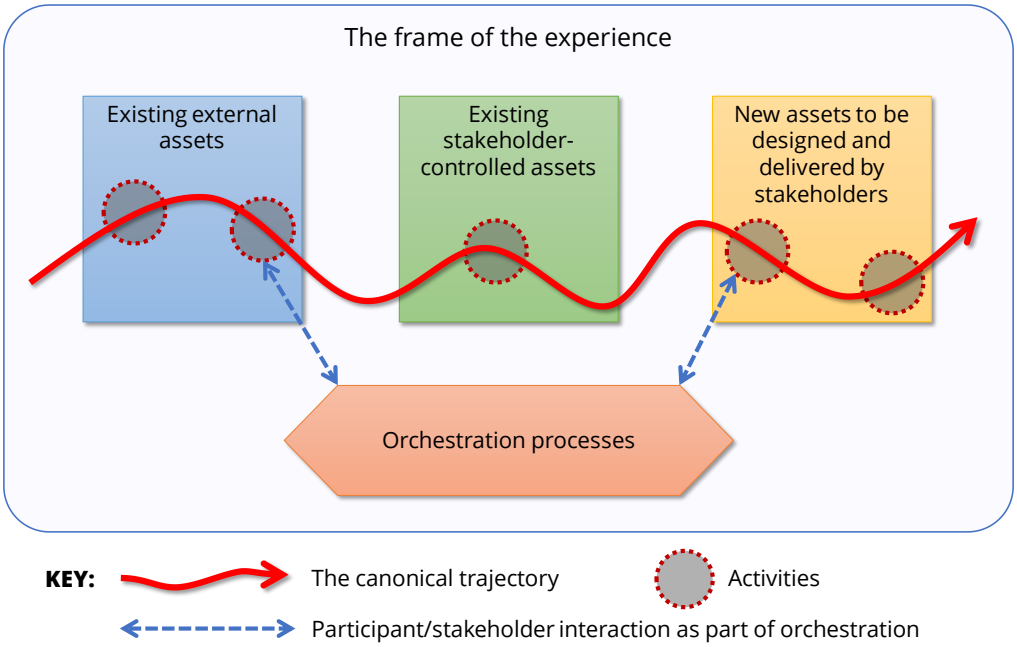

Figure 6.3: A model of the design ecology for trajectories

6.1.2 Expanding the dimensions of experience

This heading and next provide clarifications and refinements of existing concepts within the *trajectories framework*, starting by the *hybrid dimensions of experience*. Shifts in these *dimensions* are driven by the extension of *trajectories* in two directions: towards open-ended experiences and towards new domains. I start by discussing how existing *dimensions of experience* can be discussed as "expanded", then suggest examples of additional *dimensions* that mirror aspects of *design ecologies*.

1 Dimensions of experiences in expanded frames

Addressing *open-ended* experiences also involves *open-ended dimensions of experiences*, which can be related to Markus Montola (2005)'s definition of pervasive games as expanding beyond the "magic circle", i.e. the "contractual" boundaries of the game. "Expanded games" involve three expanded dimensions, which map to three of Benford et al. (2009)'s *dimensions of experience*: *Spatial*

expansion describes how experiences pervade extended spaces, both physical or digital, beyond those created by game designers – Montola provides the example of "forums organized by players themselves"; *temporal expansion* involves expanding experiences beyond clear moments of play, and may weave them "with everyday life"; finally, *social expansion* means that interaction between an experience's participants and non-participants impact the experience.

Although mixed-reality performances described in original *trajectory* works do show such elements of being *expanded experiences*, for example when discussing *Uncle Roy*'s involvement of bystanders, these experiences tend to be relatively self-contained. Festival experiences, on the other hand, can be described as expanded on all three dimensions – for example, the Oxjam Beeston Music Festival goes beyond the frame of the self-contained event to become a convergence point for the local community.

Benford et al.'s fourth dimension of experience, *Interfaces*, may also be described as expanded, as media use in festival trajectories involves a palette of devices and interfaces controlled by participants, stakeholders and third parties.

To summarize, the *four expanded dimensions of experience* reflect, on one hand, the complex structures of control shared between actors, and on the other hand experiences whose framing is not clear cut. These *pervasive experiences* overlap with other experiences and weave in with the everyday life of participants.

2 Domain-specific dimensions of experience

I now introduce the idea of "domain-specific dimensions of experience" that may be considered alongside *hybrid time, hybrid spaces, hybrid roles* and *hybrid interfaces* and express the heterogeneity in "design ecologies" described above.

Depending on how these *design dimensions* are perceived by end users – for example, BBC channels have their own branding and correspond to historical constraints in broadcast technology, but have less relevance when catching up with content on iPlayer, making them more or less salient to audiences – they may go beyond being solely relevant at the design stage and shape the final experience.

I discuss two candidate "design dimensions", one which has been described at the BBC as "channels", and one which designates groupings of content.

a Channels and divisions

Channels was one of the dimensions explored with the BBC card tool. *Channels* are best described as coherently branded assemblages of *spaces* and *interfaces*. For example, BBC One is not just a TV channel, it is also a brand and grouping of programs that are considered to fit its "editorial line" and a different target

demographic from other BBC channels, and is delivered through multiple interfaces, including a dedicated set of webpages on the BBC website.

This definition of *channel* corresponds to Resmini and Lacerda (2016)'s own, i.e. "an abstract, high-level construct, and a designer-made artefact", which they use to discuss "cross-channel experiences".

At the BBC, *channels* map to some the corporation's operational divisions. Such stakeholder-centred divisions may not directly translate into *dimensions* of the end-user experience, but they should be carefully considered to prevent lack of coordination between teams from causing seams in the *canonical trajectory*.

b Content

Unlike original *trajectory* works, the experiences discussed here do not involve a single "story", but multiple units of content. Considering the *hybrid structure of content* involves looking at different types of groupings: user-generated content as opposed to "official" coverage; distinct programs or series; broad categories such as *news*, *sports* or *fiction*; or media types such as *audio*, *video* and *text*.

c Associated transitions

Seams in the *dimensions of experience* drive *transitions*, another part of the *trajectory framework*. *Channel transitions* may be associated with other *transitions*, for example *interface transitions* when two *channels* use different *interfaces*. In cases where no other type of *transition* happens, it is important to consider what constitutes the seam between two *channels*, as designers may want to balance the visibility and coherence of a single *channel* with that of the whole experience. *Content transitions* may be the generalization of the *episodic re-engagement transition* in the original *trajectories framework*, with the difference that two units of content may be less related to each other than two *episodes* relating to the same unit of content.

6.1.3 Clarifying trajectory types and their relations

I now turn to another part of the framework, namely the three types of *trajectories: canonical, participant* and *historic*.

The necessity for redefining these core concepts arose from conversations with PhD supervisors and BBC stakeholders on how some *trajectories* should be labelled, as they didn't seem to fit the traditional presentation of a *participant trajectory* as being the concrete realization – with some level of *divergence* – of a

canonical trajectory. This section also explores tripartite relationships between *canonical*, *participant* and *historic trajectories*.

The role of this section is not to introduce entirely new concepts, but rather to clarify *trajectory types* and expand their interpretation in the light of the work presented in this thesis.

1 Participant trajectories

The research work presented here has analysed a variety of experiences as *trajectories* and investigated what participants' actual journeys were. This was done either directly by documenting the experience of research participants – as was the case in chapter 3 – or indirectly – in the design workshops described in chapters 4 and 5 – by hypothesizing what this experience would be. In most cases, there wasn't a clearly identified *canonical trajectory* at that stage, but the design research work of drawing out the *participant trajectories* was done with the intent of grounding *canonical trajectories* in a better understanding of the experiences they would unfold in.

One of the contributions of this thesis is therefore to clearly state that the term *participant trajectories* applies not only when describing how participants diverge from a *canonical trajectory*, but also to *emergent trajectories* that exist regardless of designers' intent and intervention.

2 Canonical trajectories

I now discuss ways *canonical trajectories* interplay with *participant trajectories*. I build upon the *canonical trajectories* identified throughout this research, which tend to be more loosely defined than the original presentation of *trajectories* seems to show, and are situated within shared structures of control. Again, this is not entirely new: offering possibilities for *divergence* through interaction is an important part the framework and less prescribed ways of following journeys are discussed by Benford and Giannachi (2011, p.19) who suggest strategies where participants do "wayfaring" – supported by "signposts" and one's previous experience – as well as "navigation".

Crafting *trajectories* has been described as "the assembly of diverse computer interfaces into complex ecologies" (ibid., p.115), a characterization that also fits how festival participants assemble their own media experiences in a combination of planned and situated moves. This first means that a *participant trajectory* may overlap with one or more *canonical trajectories* as defined by the points of view of multiple stakeholders, and then suggests that there is more to *managing trajectories* than getting participants to converge back to a given path.

To embrace that, designers of *canonical trajectories* may wish to rely on more than a single path, and provide multiple entry points and branches. They might also offer complementarity, with one *canonical trajectory* picking up participants where another one stops.

This also opens a space for a typology of relationships between *canonical* and *participant trajectories*, beyond converging and diverging. These *trajectories* may follow each other at a distance, or a softened version of convergence may be that *canonical trajectories* "steer" or "bend" *participant trajectories*. Engagement between *trajectories* may become closer over time, as proposed by Abigal Durrant and her colleagues' discussion of "gearing in" with a *trajectory* (2011a).

Robyn Taylor (2014, 2015) and Lesley Fosh (2016), in their discussion of *trajectories* through cultural visits, have used the term "scaffolding" to suggest that these experiences should be framed in a non-prescriptive way. In Taylor and her colleagues (2015)'s "design sensibilities", "technologies serve as a resource for interaction, rather than mandate what should occur".

Scaffolding is a term originating in education theory, where it describes a process where adults help children learn by "'controlling' [...] elements of [a] task that are initially beyond the learner's capacity" (Wood et al., 1976). Scaffolding emphasizes teaching through tutoring and guiding, rather than offering prescriptive knowledge.

Considering *canonical trajectories* as "scaffolding" means that they act no longer as prescribed paths through an experience, but as ways of guiding participants to resources.

Another lens to discuss *trajectories* that don't prescribe paths but still steer participants towards a desired destination is the idea of "nudge", introduced by behavioural economists Richard Thaler and Cass Sunstein (2008), who have suggested that desired behaviours can be incentivized, rather than prescribed, through the design of "choice architecture". Like in BBC Knowledge and Learning's workshop scenarios, long-term behaviour change – which in Thaler and Sunstein's "libertarian paternalistic" approach, is towards greater individual and social good – is seen as the purpose of "nudging".

Assembling *interface ecologies* into *trajectories* may help build such "choice architectures", both at the global level, by defining an overall outcome for a *trajectory*, and at the local level, by steering participants back towards the *canonical trajectories*.

3 Historic trajectories

The third type of trajectory, *historic trajectories*, is the least discussed in original *trajectory* work – it's not even mentioned in the *Interactional Trajectories* paper, the most cited source for the framework (Benford et al. 2009). Building up on their original formulation as "synthesiz[ing] different historic views" (Benford and Giannachi 2008), *Performing Mixed Reality* investigates how their generation could be supported by collecting traces of *participant trajectories* – such as "system log files" – and automated "with a set of 'synthesis rules'" (Benford and Giannachi 2011). Based on the studies in this thesis, and on the lifecycle of historic data, I propose new considerations for the collection and the generation of historic trajectories, and suggest a shift from fully automated reconstructions towards subjective stories.

a Collecting data from participant trajectories

Given how they span *hybrid structures*, the types of data collected as *trajectories* unfold are very heterogeneous: interactions with single interfaces may be thoroughly documented through fine-grained system logs, while parts of the *trajectory* which involve print media or face-to-face interaction may leave no direct trace, or only aggregate data – for example, ticket sales numbers.

This data collection can be partly or fully led by participants themselves, for example through diary, whose own trade-offs lead to a selection of a smaller, yet – for the purpose of building story potentially more relevant – set of data points. This can take the form of inviting participants to submit *user-generated content*.

Collecting properly structured *metadata* along the *trajectory* is essential to supporting *historic trajectories*, with dimensions in metadata schemes offering the possibility of generating a "cut" through the data that corresponds to a specific point of view worth synthesizing – e.g. *historic trajectories* corresponding to individuals, locations, musical genres, moods, etc.

Identity and *privacy* are important consideration for *historic trajectories*: accounting for *identity* across multiple interfaces is required to be able to trace single *participant trajectories* from one end to another – and has been described as a major hurdle by the BBC's own audience measurement department. This conflicts with privacy issues, as even with anonymized data, distinctive features of each *participant trajectory* increase the risk of re-identification – as RunSpotRun as elicited both in terms of tagging strategies (Flintham et al., 2015) and in terms of ethical issues (Anstead et al., 2014).

b Towards subjective historic trajectories

Building upon the stories identified in my studies, I now suggest that there may be multiple models for *synthesizing historic trajectories* beyond automation or *historic trajectories* where the logic for creating one out of *participant trajectories* isn't led by *trajectory authors*.

Participant-led historic trajectories are stories of events curated by participants themselves. As with *participant trajectories*, some of them may pre-exist design interventions, and include blog posts, content posted on social media, or articles in community-led media.

Some material produced as part of the studies in chapter 3 and 5, such as interview data and system logs, may also be collated into *researcher-led historic trajectories*. Rapid ways of creating *historic trajectories* out of research data and system logs may have value as *design research methods* and can inform the creation of *canonical trajectories*. *Historic trajectories* elicited by researchers also connect with existing research traditions such as *narrative inquiry* (Clarke and Wright, 2012).

These two ways of eliciting *historic trajectories* make them subjective recollections of events. This can be related to Marc Hassenzahl's definition of "experience", which suggests that even though experiences exist in a "moment-by-moment" basis, "memorized experience is of more practical relevance" and that experiences should be considered as "memorized stories of use". In that sense, *participants* relate to their experiences through what is already a *historic trajectory* and a "sharpened [and] levelled" representation of experience. These considerations may make *historic trajectories* a core part of the experience of an event.

c Storytelling and its challenges

In the studies discussed in this thesis, souvenirs curated by participants did not tend to follow rich narrative structures, but they have nevertheless been repeatedly used as support for recollections and building oral stories.

The idea of *participant-led historic trajectories* shows a promising design space for tools and platforms that integrate various data sources and help participants consolidate their stories. The design of storytelling tools has long been a subject of interest in HCI, as suggested by research into supporting storytelling (Balabanović et al., 2010), or using storytelling to foster education (Lu et al., 2011) or to support development (Frohlich et al., 2009).

However, the limited uptake of Oxjam's "story generator" – and of a similar commercial product, Sumrise (Adourian, 2017) – suggests that creating and curating stories is a time consuming activity rarely done outside of very specific

contexts, such as the need for volunteers to recruit their replacement, or to support fundraising.

But this may also be a question of what we consider to be "stories" or *historic trajectories*. This work – and those cited in the previous paragraphs – have been looking at structured stories made of a series of items, but simpler forms of souvenirs should be taken into consideration. One interviewee from chapter 5, reflecting on their own photographic practice, suggested that a single image, paired with text could constitute a story, while participants in chapter 3 kept memoranda in the form of photos displayed at home or on social media.

Strategies for getting people to reflect on their experience and build a souvenir involve finding the right moment and integrating the production of a *historic trajectory* within the *canonical trajectory* itself, as have done Abigail Durrant and her colleagues with Automics (2011b), or Bettina Nissen and her colleagues (2013) with their on-site digital fabrication process.

d Historic trajectories as a support for encounters

Chapter 3 has elicited a reflection on how individual points of views – for example, of performers, friends, and news anchors – have supported *participant trajectories* by offering guides and entry points into experiences. Some of these subjective experiences have been expressed as partly formalized stories, or could be recomposed as stories, for example drawing upon social media feeds.

In that chapter, I suggested that these stories could foster *encounters* between participants across roles. Connecting this with the expanded definition of *historic trajectories* as subjective stories above, I now rephrase this by suggesting that *historic trajectories* can support *encounters*, when fed back into *canonical trajectories*. For example, the stories of past participants can be woven into that of newer participants, as described in the figure below:

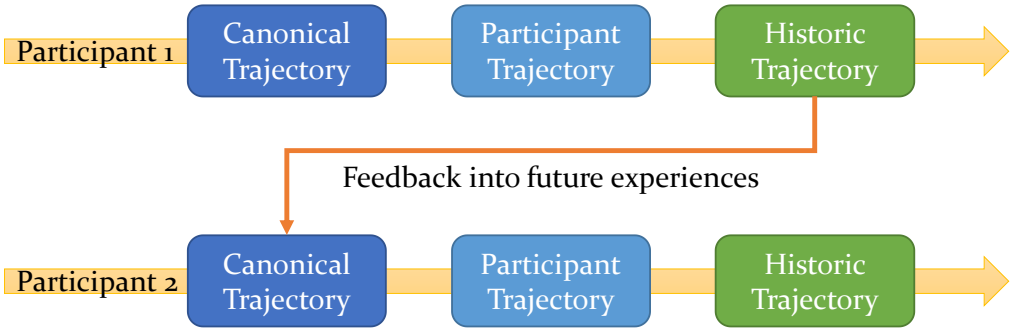

Figure 6.4: Encounter supported by feeding a historic into a canonical trajectory

4 Relationships between trajectory types

After clarifying the nature of the three core *trajectory* types in the framework, I suggest different ways these *trajectories* inform each other by discussing all six possible relationships:

1. *Canonical* (CT) to *Participant* (PT): Following the classical presentation of the framework, a CT may be the "ideal design" for a PT. A CT can be described as a "blueprint" and may include signposts, maps or orchestration plans to support PTs.
2. PT to CT: Designers may adapt the journeys they created based on live feedback from participants. This has been discussed around *Flypad* by Flintham et al. (2011). As hinted by Benford et al. (2009), designers may choose to take existing *participant trajectories* – even when there are no formal *canonical trajectories* – and consolidate them into *canonical trajectories*, in the same way as physical "desire lines" are consolidated into official paths.
3. PT to *Historic* (HT): Participants leave traces of their journey, which are captured and later reconstituted into *historic trajectories*.
4. HT to PT: Past experiences of *trajectories* can be used as ways of guiding one's journey. In the case where a HT embodies the point of view of one individual, the HT and PT may be that of the same person, or different participants may act as guides for each other.
5. HT to CT: HTs can inspire the design of CTs in multiple ways, for example by consolidating insight about users – and help identify possibilities for improvements – or by identifying remarkable trajectories that can form the basis of new experiences.
6. CT to HT: Mirroring how CTs inform PTs, a CT can act as a blueprint that provides a structure for reconstituting HTs. This relationship offers a way for CTs to help participants to "make sense" of their experience in retrospect.

The diagram below summarizes the six relationships listed above:

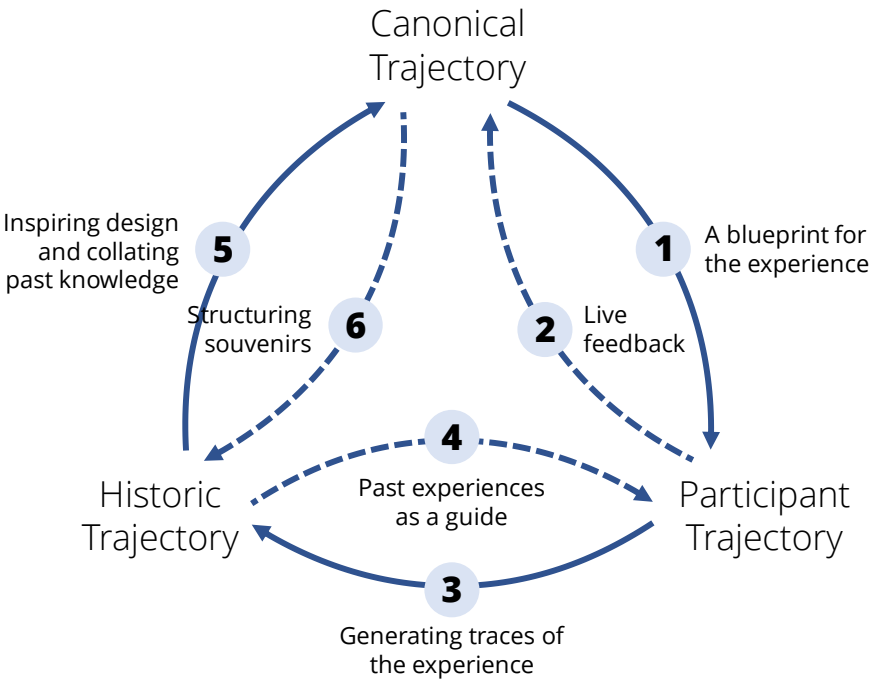

Figure 6.5: Relationships between trajectory types

5 A trajectory lifecycle for recurring experiences

Repetition is a common aspect to festival experiences, with either the same event repeating every year, or participants taking part in multiple similar events over time. This means that the relationships listed in the previous section can span several occurrences of an event, each informing the subsequent ones.

The year-long chronology of organizing an event invite us to read the cycle in a specific direction: in the months before the event, planning is done to organize the event and design companion technologies – this is where the *canonical trajectory* is created; on the day of the event, participants experience it and event organizers orchestrate it – the *participant trajectory*; finally, once the event is over, the experience is evaluated, photos of the event are gathered and feedback is used to plan the next iteration – this is the stage for the *historical trajectory*.

This direction for the *trajectory lifecycle* happens at the global level of planning and delivering experiences. On a smaller scale, a *trajectory type* shown downstream can inform one upstream: for example, the design of the *canonical trajectory* can change on the day of the festival following live feedback; the availability of short-term historical data (what happened on the same morning for example) can shape participants' trajectories.

Although this lifecycle was particularly evident for yearly festival events, it may also inform the original works *trajectories* were based on, as most of them are touring performances which happen more than once. This lifecycle has been

introduced in this section as it describes the nature of recurring experiences, but it also supports a generative agenda, and it forms the basis of the design process we introduce in the next section

6.1.4 Summary of "extended trajectories"

I now summarize the extensions and clarification I have added to the *trajectories framework* in the table below:

Concept	Description
Control in trajectories	The control over one's actual trajectory may be shared between the participants who experience it, and the various stakeholders who either produce and author the experience, or have ways of steering it.
Expanded dimensions of experience	In pervasive experiences, these four dimensions – time, space, role, and interfaces – may expand and overlap with other experiences
Design-specific dimensions of experience	Alongside the four original dimensions, designers may want to consider groupings in the domain they design for, such as stakeholder-defined "channels", and units of content.
Design ecologies	The structure of design projects that trajectories traverse.
Canonical trajectory	Canonical trajectories offer "blueprints" for experiences and may seek to provide resources ("scaffolding") or encourage participants ("nudge") rather than prescribe their paths.
Participant trajectory	A participant trajectory is not necessarily the realization of a canonical trajectory, but may emerge through experience.
Historic trajectory	Historic trajectories may cover multiple forms of collecting and presenting memories of experiences as stories
The trajectory lifecycle	In recurring experiences (which may involve yearly editions of a festival, or multiple instances of the same performance), there is a lifecycle where canonical, participant and historic trajectories iteratively inform each other.

Table 6.1: A summary of proposed extensions to the trajectories framework

6.1.5 Conclusion: should this be still labelled as "trajectories"?

Because of the wide-ranging nature of the extensions proposed in this section, it is worth wondering whether they still constitute a part of the *trajectories framework* or a whole new *framework* that should be named differently – possibly "pathways" if we follow the BBC's suggestions. However, there are multiple reasons why keeping the label of "trajectories" is important as part of this thesis' contribution.

First, the literature review has shown HCI theory's "toothbrush" problem, which leads to an accumulation in the number of frameworks produced by academics and little used elsewhere. Enriching an existing framework is a way of fighting this trend.

Secondly, it continues the work started by Steve Benford and Gabriella Giannachi, where *Day of the Figurine* was analysed, then abstract concepts were defined, which served as the basis for an expanded analysis which now included three more performances and led to a broader framework, while retaining the name of "trajectories". My thesis adds more cultural experiences into the analysis and intends to deliver a generalized framework.

Finally, it resonates with *trajectories'* ambition to be a "vehicle for compiling craft knowledge", as this ambition suggests that *trajectories* could be made an ever-growing body of knowledge, into which I am now adding insight from the domain of live events.

6.2 The *trajectories design lifecycle*: A model for weaving *trajectories* into the design process

I now follow Jonas Löwgren and Erik Stolterman's (2004) invitation to "design the design process", and propose a model for integrating *trajectories* and the design and production process for live events. I start by presenting the model itself, which I label the "trajectories design lifecycle". I then discuss how design methods and tools can be integrated in the process model and I finally suggest the role of *prototyping* for harnessing this model.

The ambitions for this process model work on two levels: providing a framing to design processes and supporting design decisions at various points along the process.

6.2.1 Presentation of the model

The model I discuss in this section builds upon the *trajectory lifecycle* described just above, and on the mapping between the Oxjam Beeston design process and *action-research* proposed in chapter 5. It may not be a generic design process adapted to every *trajectory*-related design situation, but is suited to the recurring structure of live events, and the year-long festival organization cycle.

This process is a cycle and corresponds to the full lifecycle of planning, delivering and evaluating recurring events. It goes through *canonical, participant* and *historic trajectories* and mirrors *action-research*'s iterative spiral of *planning*,

acting and *evaluating*. It is also inspired by Bill Buxton's argument that design isn't limited to a self-contained "design phase", but follows a product's full lifecycle, across multiple iterations (2007).

Starting from the top of the diagram, what turns the *canonical trajectory*, that is the blueprint for the experience, into a *participant trajectory*, is a delivery process which involves building the assets that support the trajectory, launching and orchestrating the experience and finally having audiences experience it.

Following onwards, *participant trajectories* can be collated into *historic trajectories* through researcher and participant-led methods of collecting data, evaluating experiences, and building stories.

The outcome, *historic trajectories*, by providing accounts of past experiences and a description of the "situation" that designers are addressing, supports the design of future experiences. This design process, which results in the creation of *canonical trajectories*, involves the design methods listed in the previous section.

These three process phases and the three *trajectory types*, which constitute the core of the model, are shown in the diagram below:

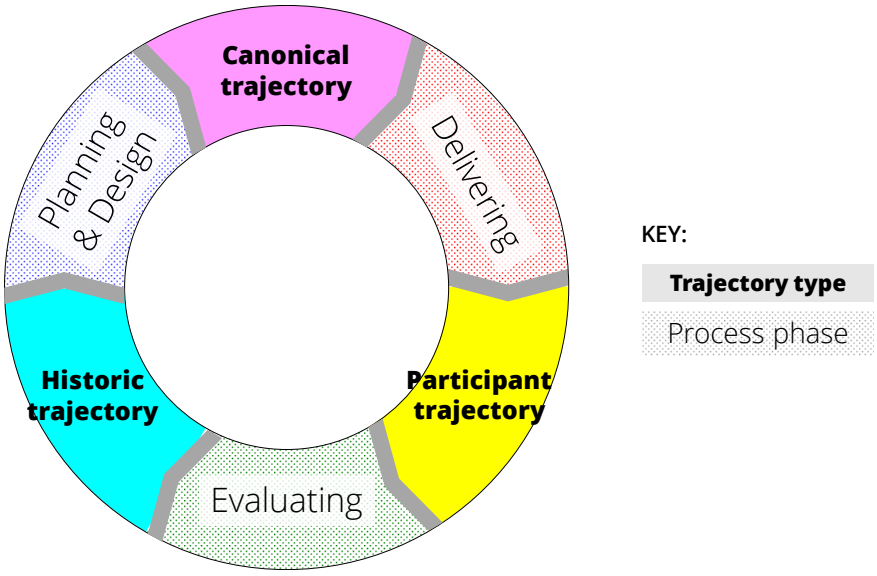

Figure 6.6: The trajectories design lifecycle model

The cyclic nature of the model raises the question whether it has a single starting point. Using *action research* as a blueprint suggests that planning comes first, but the experience of Oxjam Beeston Music Festival doesn't show a univocal starting point, and where "things start" depends on what is considered. A design intervention may itself start at the "planning and design phase", but it may draw on reports and insight about the past iterations of the festival which are grounded in *historic trajectories* produced by other stakeholders. Likewise, does the whole Oxjam Beeston Music Festival series start when it was first planned in 2011, or was it built upon experience shared by other festivals organizers?

If we take individuals' perspectives on the design cycle, most organizers we've interviewed started their involvement in volunteer roles with fewer responsibilities, and were likely involved in the "delivery" rather than in the "planning" stage of the festival.

To complement the cycle described above, I propose a "canonical starting point" for the *trajectory* lifecycle process at the planning stage, but offer multiple possibilities for various stakeholders and for interventions varying in scope, to engage with the lifecycle at different stages.

Multiple iterations of the lifecycle deliver iterative improvements, but also shared knowledge between stakeholders – as for *action research* – and, when media coverage is involved, it also helps build a database of content about the events. This continuous improvement is represented by the spiral on the diagram below.

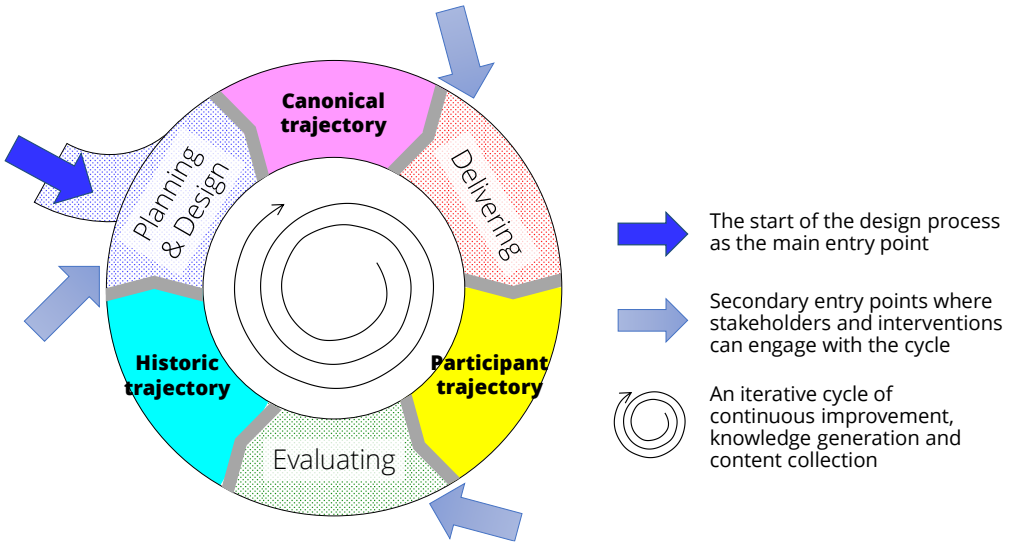

Figure 6.7: Start points within the trajectories design lifecycle

6.2.2 Populating the lifecycle with methods and tools

To help designers use the *trajectories design lifecycle*, I suggest a list of methods and tools that can be used throughout the design process. I group these methods according to the stage in which they appear in my model.

1 Supporting the "planning & design" stage

The methods described here support the first stage of the lifecycle and help create *canonical trajectories*. The first, *ideation methods* and *sketches*, help inform the early, "divergent" stages of design as they help ideate and explore multiple solutions, while the last ones, *prototyping* and *heuristics*, help inform the "convergent" stages of design as they help validate these solutions.

a Ideation methods

Ideation methods, such as brainstorming sessions, aim at generating a broad variety of ideas from which the most relevant will be further refined. Methods used at that stage can be either generic – applying to any kind of project or expected outcome – or can be used to explore specific experiences. They include ideation cards, which have previously been used as translations of HCI frameworks (Hornecker, 2010; Mueller et al., 2014).

The *pathways cards* developed at the BBC supported ideation as they helped explore of the dimensions of experience.

b Sketches and visual methods

Rough visual representations, or sketches, are considered a core aspect of the work of designers, and are discussed at length in the context of interaction design by Bill Buxton (2007). Some forms of sketches may be suited to describe *trajectories* across interfaces and spaces, for example workflow diagrams, timelines and storyboards. *Service Design* literature includes visual methods, such as *service blueprints*, which represent interaction over time, and may be adapted for *trajectories*.

Sketches of *trajectories*, mostly in the form of diagrams and timelines, have been extensively produced during Steve Benford's *trajectory workshops*, and have been readily appropriated by stakeholders. A storyboard has been produced at the BBC on *Love Festivals*. It was used to portray an example *canonical trajectory* that was open to refinement, and also to document the agreement of BBC stakeholders who participated in building the trajectory.

c Prototyping

Prototyping is a very common design approach, and is described by Buxton as being at the end of a continuum that starts with sketches, prototypes being more refined and definitive, and produced later in design processes. Prototypes involve reproducing some aspects – for example, the aesthetics, the physical structure, or the interaction mechanics – of the final product at given levels of fidelity – which may involve mixed-fidelity prototypes (McCurdy et al., 2006). The fidelity of prototypes affords the possibility of testing these aspects, either internally, or as part of *user research*.

In industry, prototyping is often done using tools that generate user interfaces with fully functional interaction in a rapid way – commercial "services as platforms" to do so include AxureRP, UXPin and Framer. However, these tools are generally tasked with designing single interfaces, and not a heterogeneous assemblage of interfaces. Design researchers at IDEO, a large multinational consultancy, have explored several approaches to prototyping something that is

not a single interface, but an "experience" (Buchenau and Fulton Suri, 2000). *Experience prototyping* can take many forms, including physical prototypes, diaries, and role-playing or "bodystorming" the experience (Oulasvirta et al., 2003). Walkthroughs – again popularised by *service design* – offer the possibility of prototyping at the level of the whole experience rather than its parts (Blomkvist, 2016).

The prototyping tool I've proposed in chapter 5 is related to role-playing, diaries and walkthroughs, as it is based on the authoring of a "trajectory script" that can be performed and annotated or documented.

d Trajectory heuristics and guidelines

Trajectory heuristics, first proposed by Edward Anstead and his colleagues (2013), relate to the commonly used method of *usability heuristics* (Nielsen and Molich, 1990) and similarly consists of a "checklist" of considerations derived from the *trajectories framework*. Where these heuristics have been tested, they have resulted in open-ended recommendations, as they describe *what* should be addressed, rather than *how*. This approach, although promising, has not been used at the right time or level for it to have an impact on BBC projects.

The *design guidelines* listed in a chapter 5 can be used to support design decisions as *heuristics* do, but they are more specific and don't address all design situations that *trajectories* are relevant for. For that reason, unlike *heuristics* which can be structured as a systematic tool to be followed step by step, designers may choose to pick a subset of the guidelines above.

2 Supporting "Delivering"

The *delivery* stage involves multiple support processes, starting with the engineering work whereby artefacts are built, publicizing and marketing the experience, setting up ways of monitoring *participant trajectories* and finally orchestrating them.

Beyond this list, and although the *delivery* stage of the Oxjam Beeston website and app have been described in depth in chapter 5, Because the focus of this thesis, and of the studies I have conducted, on design activities, rather than on engineering ones, I do not contribute any specific methods and tools to support the *delivery* of *trajectories*. Connecting this with the literature review, this mirrors the lack of examples of *trajectories* used to support the generic technological requirements – including *orchestration* interfaces – called for by Benford et al. (2009).

3 Supporting "evaluation"

The evaluation of *trajectories* during and after experiences: first, it collects the data that supports the construction of *historic trajectories* and secondly it helps improve the design of future *canonical trajectories* by providing insight about use and constituting *design research*. The methods listed here, although I have only described them in the context of studying experiences in the wild, might also to some extent be deployed in *prototype evaluation* sessions.

a Diaries

Diaries are a good fit for trajectories as they allow to prompt experiences longitudinally. A major challenge for using diaries is to find the right balance to ask the appropriate amount of information. Strategies may include experience sampling, for example by prompting participants at specific times or based on the location detected by their mobile devices. It may also involve structuring the diary around specific questions, or around the *canonical trajectory*, by asking participants to document when they take specific steps in the *trajectory*. Diaries structured in this way may suffer from reporting biases, as participants are more likely to complete pre-filled choices rather than report things that have not been envisioned in the *canonical trajectory*.

b Analytics

Trajectory authors suggested using system logs to consolidate *historic trajectories*. Online interfaces make it easy to collect such logs in real time and centralize data from multiple participants and devices. This is further facilitated by off-the-shelf services such as Google Analytics – which I've experimented with directly – or comScore – used by the BBC.

These services offer a broad variety of reports, including metrics that may be related to *trajectory* concepts. For example, in Google Analytics' glossary, "conversion" may map to a type of *transition* and "session" to an episode of interaction.

c Interviews

Another method for *user studies* conducted in this thesis has been interviews. Again, interviews are not specific to *trajectories*, but the framework has proven useful both to guide the structure of the interview script – in the work described here – and to analyse and make sense of interview contents – as shown by Kan et al. (2014).

4 Conclusion: methods along the lifecycle

The methods, activities and tools described above can be used to annotate the *trajectories design lifecycle*.

To reuse a terminology found in the *double diamond design process* (Design Council, 2015), I suggest a further division of the stages in the *trajectories design lifecycle* into "divergent" stages, where multiple activities can be conducted in parallel and lead to exploring multiple aspects of design knowledge, and "convergent" stages, where these are consolidated into a single expression of a *trajectory*.

- Diverging at the *design* stage involves creating and exploring multiple ideas
- Converging at the *design* stage involves filtering these ideas and settling on a single *canonical trajectory*.
- Diverging at the *delivery* stage means conducting multiple activities at the same time, for example creating the website while scheduling venues at the Oxjam Beeston Music Festival.
- Converging at the *delivery* stage means ensuring that all the pieces developed independently fit well together and *orchestrating* the *participant trajectory*.
- Diverging at the *evaluation* stage involves collecting disparate data relating to multiple *participant trajectories*.
- Converging at the *evaluation* stage means filtering that data and building a narrower set of *historic trajectories* that stakeholders consider to be representative enough to inform future designs.

Another version of the *trajectory design lifecycle*, annotated with the methodological toolkit, and with divergent and convergent movements, is represented below.

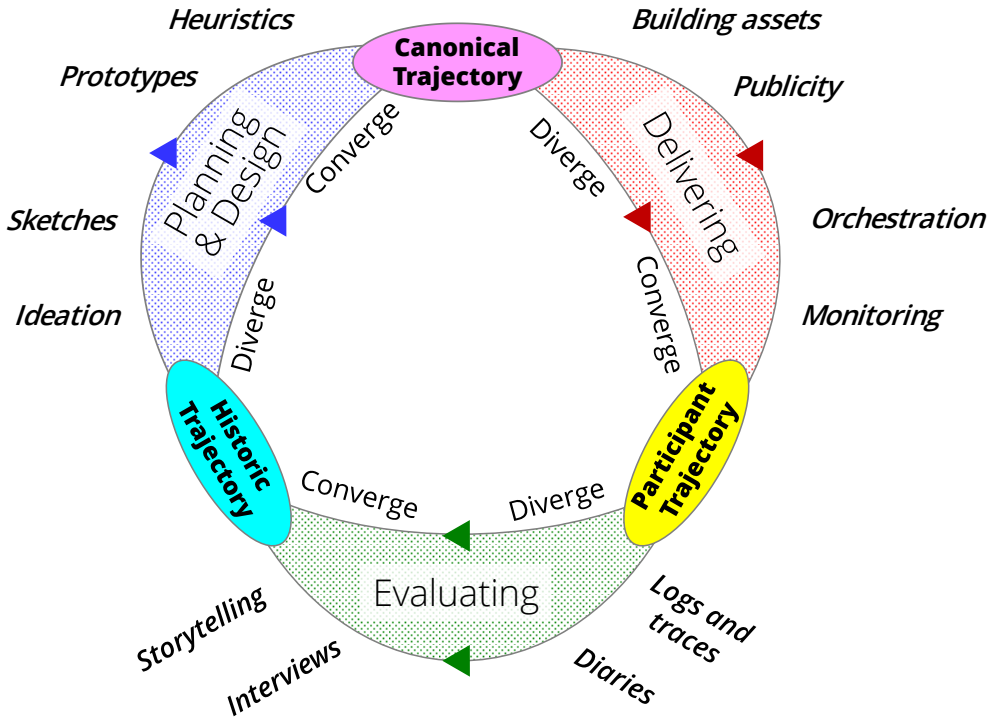

Figure 6.8: Methods in the trajectories design lifecycle

6.2.3 The place of prototyping in the cycle

The cycle above doesn't show the iterative nature of the "design" stage – present in both the *Double Diamond Design Process* and the ISO 9241-210 model – and seems to imply that no evaluation takes place until after the actual experience – for example the festival – happens. Individual interfaces can easily be prototyped, evaluated and iterated, but the complex nature of a multi-stage live event with several dozens of artists and over a thousand spectators makes it harder to evaluate the whole experience in a realistic context of use before it actually happens.

The *trajectory prototyping tool* proposed in chapter 5, along with methods imported from *service design*, such as *service walkthroughs*, makes it possible to prototype the sequence and flow of the global journey, and evaluate it in-situ. It may therefore provide an intermediate level of prototyping that fills the gap between testing individual interfaces and going through the actual journey.

In the *trajectory prototyping cycle*, designers author a *prototype canonical trajectory*, which is provisioned to to evaluation participants who "walk through" the prototype – either by simply discussing it, performing aspects of it, or following instructions in-situ – with this activity constituting the *prototype*

participant trajectory. Finally, the outcome of this evaluation session, be it annotations on the original prototype or diary entries, constitutes a form of *prototype historic trajectory*.

This *trajectory-level prototyping* cycle – to mirror Johan Blomkvist's (2016) description of "service-level prototyping" – is represented along the full *trajectory lifecycle* and along traditional iterative processes on the diagram below.

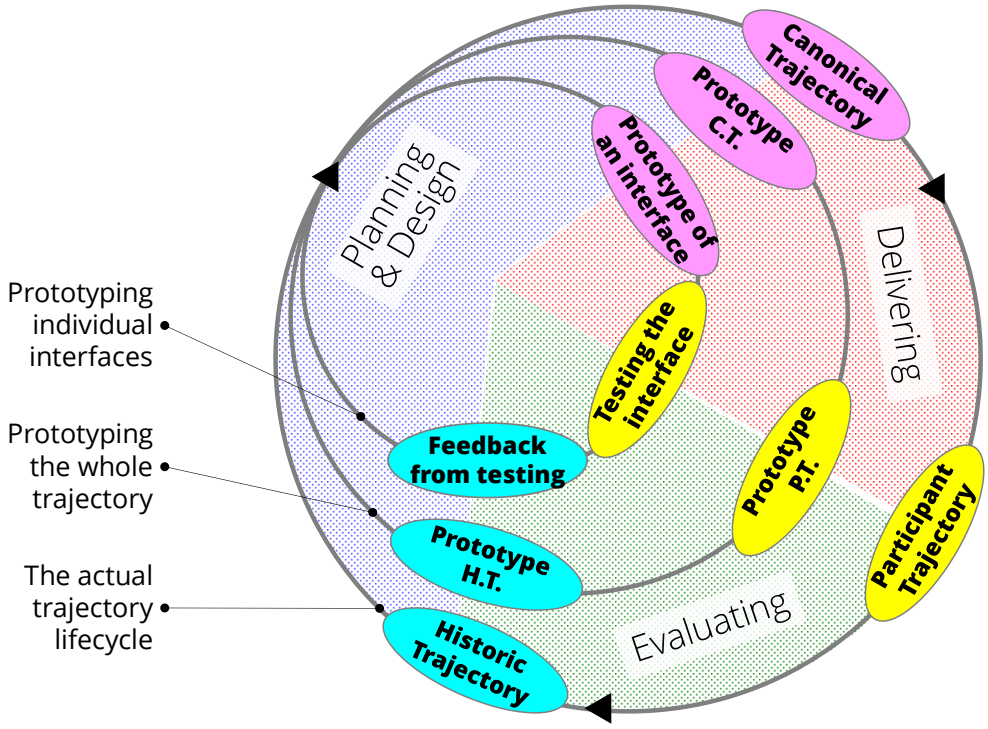

Figure 6.9: Prototyping trajectories

6.2.4 Conclusion

I have presented a model of design process to help design, deliver and evaluate complex journeys through cultural experiences, which doesn't pretend to be the *best* or the *only* way. It is a reference point that I hope may help designers and provide a guide to "putting *trajectories* to work" in the case of recurring experiences, including, but not limited to, live events. It structures, but doesn't prescribe design processes, and leaves a large scope for designer agency. As Nelson and Stolterman (2012) have suggested when proposing "crystalline" and "fluid" models of the design process, designers can pick and mix aspects of it with other perspectives on design, and adapt it to fit the constraints of their projects.

6.3 A model for translating HCI knowledge

I now take a step back from these *trajectory* specific contributions and reflect upon the broader process of bringing the framework into practice. I build upon the process model described above and the interventions conducted at the BBC, which constitute *translations* – a term I use to relate them both to Colusso et al.'s call for *translational resources* (2017) and to Callon's discussion of the configuration of actors in applied research as "translation" (1984) – of the framework, to provide a reflection on putting HCI knowledge into practice. I start by situating *translations* with regards to the gap between research and practice, and between theory and design artefacts, then discuss multiple modes for *translation*, and map them with the work described in this thesis.

6.3.1 Charting the position of *translations* across two gaps

I start by charting the knowledge space in which *translations* of *trajectories* happen with regards with two gaps – the gap between academic HCI research and UX design practice, and the "intermediate level knowledge space" – which are distinct from each other.

The latter gap presents forms of knowledge in design research and in design-centred HCI as situated in a "non-empty space" between design instances or artefacts, and theoretical knowledge. It has been thoroughlt formalized in papers by Kristina Höök and Jonas Löwgren (Höök and Löwgren, 2012; Löwgren, 2013). The nature of the first gap, between "research" and "practice", despite being the object of a special interest group (Buie et al., 2010), doesn't seem to be as clearly formalized. In line with Gray et al.'s (2014) work, I define that gap as sitting between two different "practices", which I label more precisely as "Academic HCI Research" and "UX Design Practice". A definition of "practice", proposed by Theodore Schatzki's (2001, p.11) and building upon a common core of the use of the term in social science, cultural studies, science and technology studies (STS), and philosophy, describes "practices" as "arrays of human activity [...] organized around shared practical understanding".

At first glance, academic practice may look like it is collocated with the "Theory" end of "intermediate-level knowledge space", as it strives to produce abstract and generalizable knowledge such as the theories listed by Yvonne Rogers (2004). On the other hand, design practice, with its focus on delivering "ultimate particulars" which are *design instances*, would cover the other side of the gap. While this may hold true for what researchers and designers consider to be the

primary output – or at least the one they value the most – of their activities, this isn't the case for the full range of their practices, which involve engaging with types of knowledge that may be located across the whole spectrum.

For example, on the academic side of the gap, activities include creating *ultimate particulars* as part of *Research through Design* work, as well as the generation of the multiple forms of *intermediate knowledge* in design research listed by Jonas Löwgren (2013). On the other side of the gap, designers also engage with multiple forms of knowledge which mirror Löwgren's list. To list a few examples: portfolios are a common feature of design practice – and were reported by BBC stakeholders as a way of circulating knowledge; design methods mirror research methods, and may be borrowed directly from HCI research – however, design methods, as noted by Erik Stolterman (2008), are different from research ones in that obey to different rigour criteria; finally, designers also create and engage with higher-level conceptual knowledge, which may take forms similar to HCI's *frameworks*, an example being Garrett's "Elements of User Experience" (2010).

The fact that this "conceptual-design practice" quadrant is not empty is significant, as it means that *trajectories* have to somehow "compete" with other conceptual considerations when supporting *design judgement* and informing practice.

To show how intermediate-level knowledge spans both practices, I draw the HCI-UX gap across Höök and Löwgren's diagram, as a diagonal line to express the fact that academic research is driven by generalizability, while design practice is driven by *ultimate particulars*.

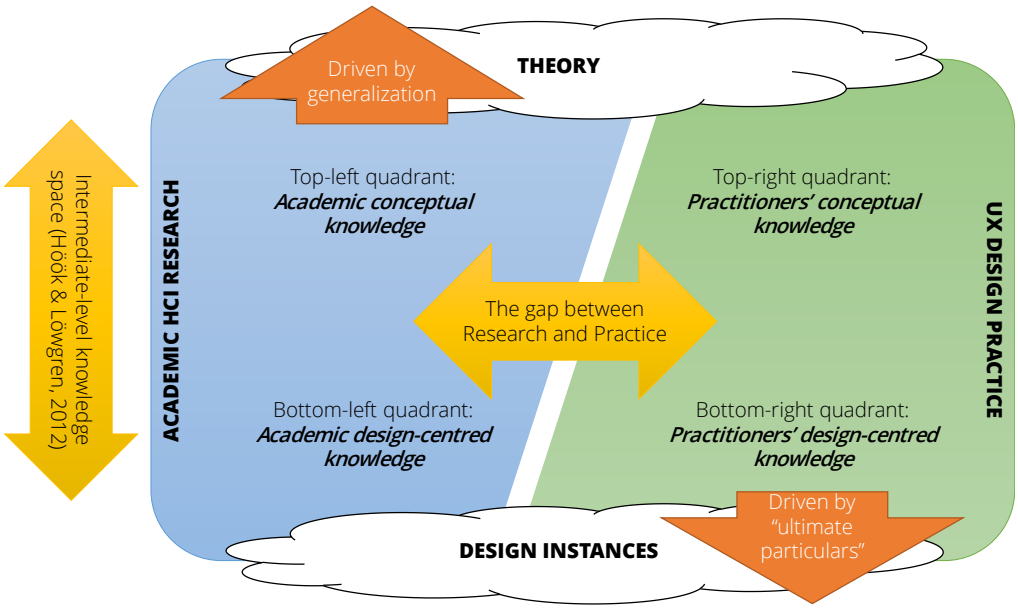

Figure 6.10: The Research-Practice gap and intermediate-level knowledge

6.3.2 Mapping the thesis' findings to this knowledge space

To illustrate the complex dynamics between forms of knowledge found across communities of practice and levels of abstraction, I now trace examples of my diagram with the forms of knowledge discussed in chapters 4 and 5.

To draw these mappings, I locate each form of knowledge involved in the *translation* processes with regards to which practice has produced them – including cases when they spanned both the HCI academic and UX design practice.

The first diagram shows different paths of knowledge sharing with the BBC, where *trajectories* have (1) been translated into *pathways*, which in turn led to the design of *Love Festivals*, and into (2) a pamphlet also inspired by Information Architecture principles, have led to the development (3) of workshop scenarios and (4) a card-based prototype, itself influenced by the BBC's use of personas and used to design *Digital Matchr*.

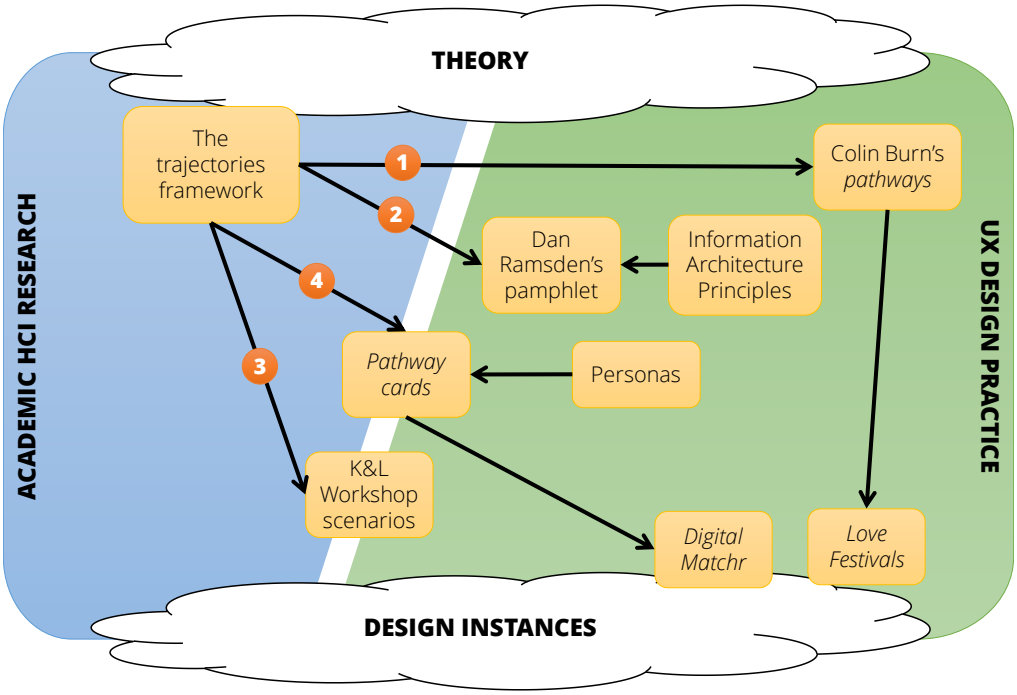

Figure 6.11: Examples of translations in chapter 4

Chapter 5 shows a more complex picture, because the "gap" has been configured in a very different way. The specific approach of this chapter – which might to an extent be labelled as *Research through Design in-the-wild* – has led to working in a form of "mixed practice" in which I was both a researcher and a designer, and worked within the constraints and with the educational background of both practices. The diagram below shows how the development of design instances for the Oxjam Beeston Music Festival and other contributions of this thesis – the

trajectories design lifecycle and design guidelines for *trajectories* in live events – have informed each other and been informed both by *trajectories* and my knowledge as a design practitioner.

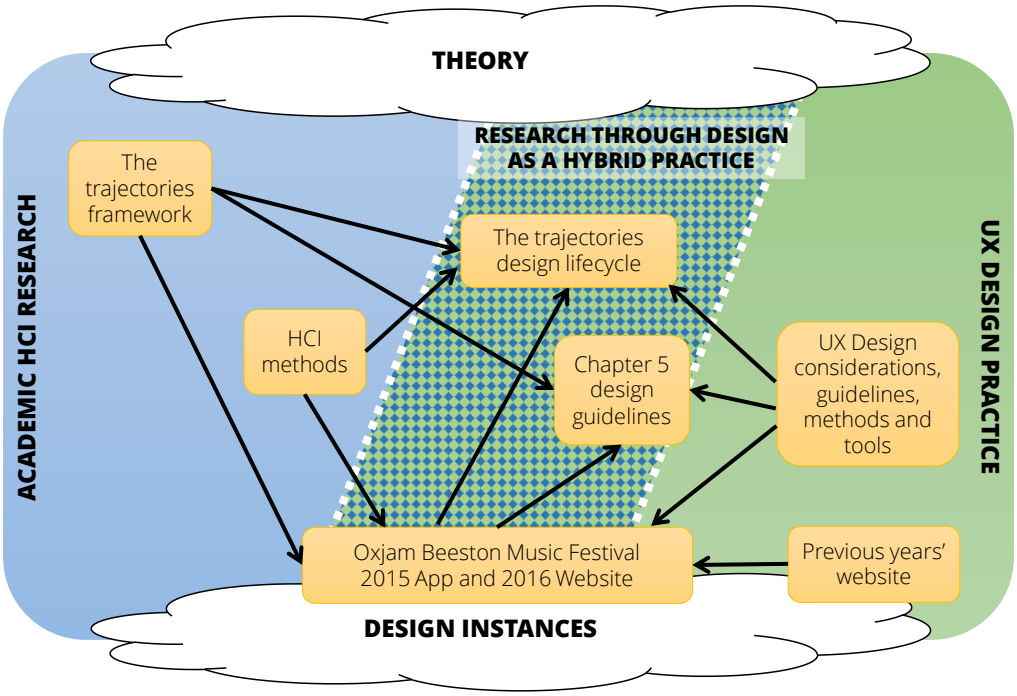

Figure 6.12: Examples of translations in chapter 5

However, this "mixed practice" I describe above may be missing key aspects of UX design practice, most importantly my own position with regards to the "community of practice" of UX Design, of which I am, with only 2 years of professional experience, still a peripheral member, if at all. While Lave and Wenger (1991), widely credited as introducing the concept of "community of practice", consider peripheral participation as a way of learning about practice, our goal of disseminating *translations* of *trajectories* might require me to move towards the core to be considered as legitimate enough to contribute to the shared body of UX design knowledge. One mitigating strategy, still being tried out at the time of writing, may be to reach out to professional design conferences.

6.3.3 Ways of translating theory

This analysis of the *translations* documented in this thesis shows that these may be produced in multiple ways, depending on who leads the *translation* activity. In this heading, I propose a typology of these, and discuss the differences between these modes.

The three possibilities we've encountered were:

1. *Translations* produced or led by academic researchers, for example Steve Benford's seminars, or my *trajectory prototyping tool*. These correspond

to Lucas Colusso and his colleagues' *translational resources* (2017), as their paper is targeted at researchers wishing to develop *translations* of their own findings.

2. *Translations* co-produced by designers and researchers, for example the pathway cards or the five scenarios from the Knowledge and Learning workshops.

3. *Translations* led by design practitioners, for example "pathways" or Dan Ramsden's pamphlet

What I haven't encountered is the equivalent of Don Norman (2010) suggestion that *translation development* should be done by specific practitioners. Our interventions at the BBC did lead us to encounter people whose role involved being a *translation developer*: Knowledge and Learning innovation leaders would read academic papers and create PowerPoint presentations that translate the findings. However, it is not clear whether it constitutes a broader practice beyond these individuals, and their affiliation with an industrial organization, in a department that produces interactive content, and the fact that it was only a part of their role – they also coordinated production projects – makes their position arguably closer to the "interaction design practice" side of the gap.

We now discuss how these types of *translation* represent – in both the semiotic meaning of the term, i.e. "symbolize" or "look like", and in the political sense, i.e. "act or speak on behalf of" – the types of knowledge situated on both sides of the gap, as both Stolterman (2008) and Colusso et al. (2017) suggested that *translations* intended at informing design practice should be aware of the nature of design practice.

Researcher-led *translations* may be informed by practice in multiple ways, from being grounded in studies of practice, to taking into account feedback from practitioners. Co-produced and designer-led *translations*, on the other hand, are directly grounded in practitioners' own experience, and may be more likely, to use Gray et al.'s terms (2014), to address the actual "design practice in-situ" rather than a "projected design practice".

Mirroring this grounding into practice, the grounding in research may differ between types of *translations*: he further they away from academic HCI research, the less control researchers have on the contents of *translations*, and academics may have concerns over whether these are faithful to the original concepts.

The diagram below represents these three types of *translation*, researcher-led, designer-led and co-constructed, on the "knowledge space" defined earlier:

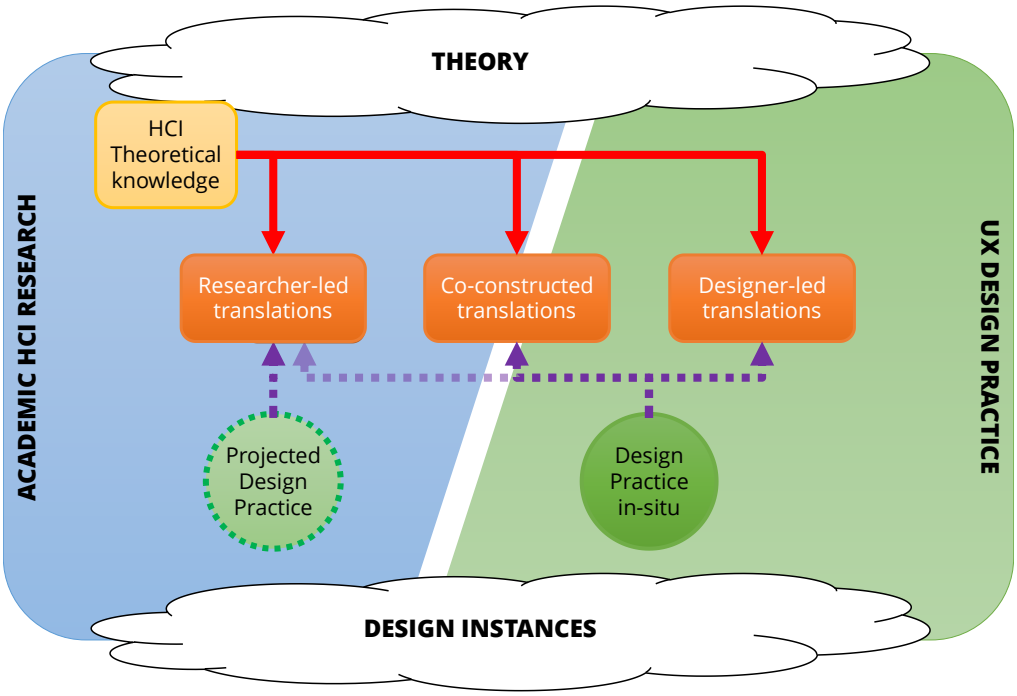

Figure 6.13: Translation possibilities

As I have represented *co-produced translations* on the border between HCI research and UX design practice, I suggest that they may constitute "boundary objects" (Star and Griesemer, 1989).

Boundary objects are forms of knowledge that are located at the boundary between several communities and that enable collaboration between these communities without requiring consensus. Later work by Star (2010) clarifies what is and what is not a *boundary object*, as she discusses critical dynamics such as "tacking back and forth" between different forms of an object.

The scenarios from the Knowledge and Learning workshop seem to have acted as boundary objects, and the "tacking" dynamic was present on both sides: while researchers were analysing these scenarios and proposing taxonomies of *trajectories*, BBC stakeholders were using them to identify new assets to commission, then turning again to researchers to ensure that the outcome of their reflections were "rigorous" and faithful to *trajectories*. The card based prototype was also a *boundary object*, which was used in very different ways by myself to study production processes at the BBC, and within BBC Sport to discuss audience behaviour. Finally, the website produced for the Oxjam Music Festival also constituted a *boundary object*, which enabled collaboration between researchers and festival organizers while serving different purposes: a communication tool for stakeholders, and a research and data collection tool for myself.

The dynamics of these *boundary objects* have changed over time, and their lifecycle has followed the dynamics of collaboration between communities. For example, the workshop scenarios ceased to be a *boundary object* when we moved on to create the card based prototype. The card based prototype itself ceased to be a *boundary object* when I started considering it to be insufficiently tied to the *trajectories framework*, and decided to work on other *translational resources*. This logic of "pulling out" mirrors previous worries by academic researchers that the methods they had developed were misappropriated by practitioners (Cockton and Woolrych, 2002), and also connects with the inherent tension between different criteria of rigour between academics and designers.

It also suggests the need for active "maintenance" to keep co-constructed *translations* at the border, form both sides. For example, some of the most lasting interventions at the BBC happened when stakeholders took the role of "*trajectory* champions" and engaged over time with either the *framework* or its translations. This is consistent with previous work highlighting the importance of "disseminating agents" (Gray et al., 2014). One of the ways these "champions" have worked at the BBC was through this *maintenance* activity: the BBC R&D intern who co-created and disseminated the card-based tool also made efforts to ensure that these cards would fit internal use cases over time. A creative director "maintained" pathways by enshrining them into the job description of a "pathways producer", and by assigning projects to that position.

In terms of dissemination of HCI research, co-constructed *translations* or *boundary objects* present the advantage of making sure that the interests of researchers and of designers are both represented, and that both sides engage in making sure these objects are relevant to their practices. To an extent, this is what led Star and Griesemer to depart from Callon's "elements of a sociology of translation" (1984), where one group of actors enrols other groups of actors and speaks on their behalf, a process where "the story [...] is *necessarily* told from [one] point of view" (Star and Griesemer, 1989, p. 390).

One major challenge is to identify candidates resource that may become *boundary objects* and that dissemination partners – on both sides – will choose to engage with on the long term, especially given the mismatch between primary incentives – producing theory and papers for researchers, and producing artefacts for practitioners – and between project timeframes – generally years in research, months in production. Long-term maintenance of *boundary resources* might also yield diminishing returns, as it may bring incremental change – extensions on a framework, new features on a product, as with the second iteration of Oxjam Beeston – which may be less valuable than producing new constructs.

I summarize this model for *maintained boundary resources* in the diagram below:

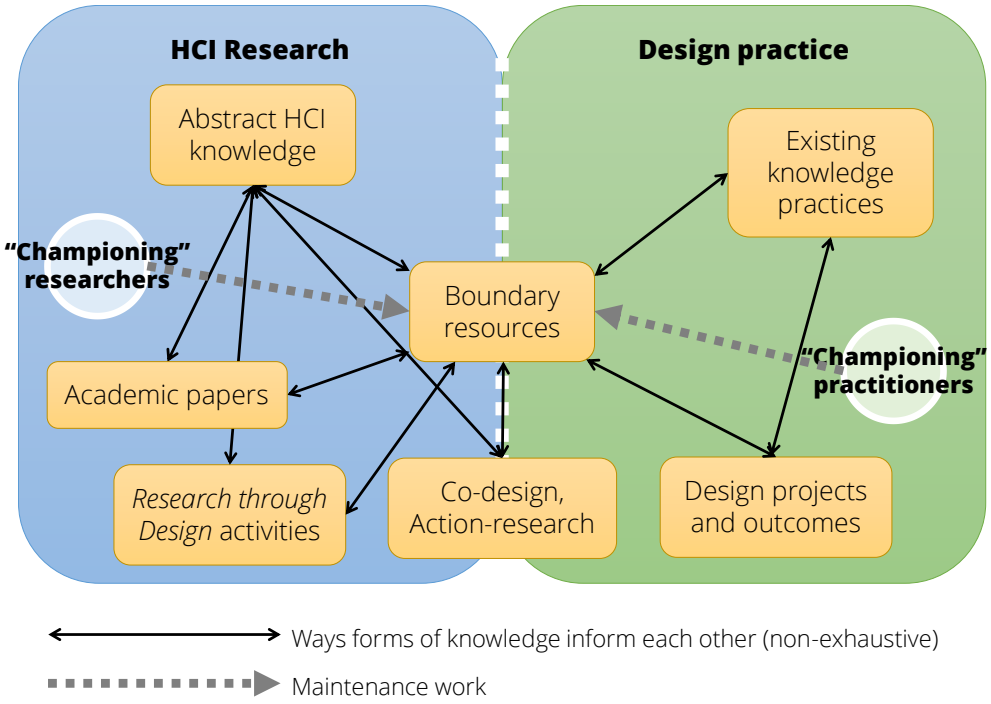

Figure 6.14: The maintained boundary mode of translation

6.3.4 Measuring the impact of translations

Measuring "success" for dissemination interventions is complex, especially when looking at long-term impact. Success could be measured in terms of reach within an organization or, phrased as a simple metric, on how many people are aware of *trajectories*. Alternatively, success could be about the use of *trajectories* in production, for example by counting the actual number of projects inspired by *trajectories*. But in both cases, these metrics may not consider the depth to which the framework is engaged with, nor how faithfully concepts are translated into designs. Analysing design outcomes – when these can be identified – may only be a very rough way of assessing framework use, as design choices are dependent on multiple considerations and, as shown by my experience with Oxjam, identical choices and considerations might be derived from guidelines that have no relationship with *trajectories*. Because of appropriation mechanisms, which involve further *translations* happening down the line after dissemination, the framework may not even be traced within an organization through its vocabulary.

Even if these aspects make the outcome of *translations* hard to measure, the *translation* mechanisms discussed in this thesis suggest ways of measuring the quality of *translation*. The dissemination work done at the BBC suggests that Everett Rogers' (2003) model of the diffusion of innovations may give set of heuristics, describing attributes that *translations* of HCI knowledge should have:

- They must provide an *advantage*, namely making design processes easier, quicker, cheaper, or able to address design situations that stakeholders aren't familiar with yet.
- They must be *compatible* with existing design and production processes. This may also include the capacity of integrating new knowledge at the point of making *design judgement*.
- They shouldn't bring additional *complexity* – informal feedback from designers has shown a strong commitment to simplification.
- Stakeholders should be able to *try out* the use of new HCI knowledge – for example on speculative projects – before integrating them into widespread use.
- Finally, the benefit of bringing in new knowledge should be *observable*.

In the case of *co-produced translations*, documenting the process of engaging with design researchers, as done in this thesis, may be as important as measuring the final impact of the *translations*. The first section in this chapter shows that this engagement can produce other types of outcomes beyond *translations* themselves and design artefacts. In-depth engagement between researchers and designers can foster a reflection on the meaning of HCI s constructs, and lead to a refining of these constructs.

6.4 Conclusion

In this chapter, I have discussed the findings from the research work laid out in the previous chapters and have articulated three classes of contributions. In the first section, I have extended the original *trajectories framework* to take into account open-ended experiences where stakeholders and participants share control. In the second section, I have proposed a process model for integrating *trajectories* and methods adapted to designing and evaluating these types of experiences into a full process that supports design activities around recurring events. Finally, I have discussed the nature of forms of knowledge and how they inform each other across the dual gap between theory and design artefacts and between academic HCI research and commercial interaction design practice.

Chapter 7: Conclusion

I now conclude this thesis by summarizing my research work and the thesis' outcomes. I provide a series of critical reflection on my approach, on the contributions of my thesis, and on the nature of *trajectories*. I also briefly discuss ways in which the work in this thesis might be built upon.

7.1 Summary of research work and contributions

During my doctoral research, I have conducted three groups of studies, whose role was to explore the use of the *trajectories framework* in design situations that are different from those – mixed-reality performances – that the framework was originally derived from. In chapter 3, I have chosen to explore the domain of live events and conducted two studies, a series of interviews with runners, spectators and organisers of running races, and a probe study with spectators of the Glastonbury music festival. That chapter relates the experience of participants in live events with the *trajectories framework* and derives design guidelines from that. Chapter 4 described work done with partners at the BBC, where we have tried to use *trajectories* in the context of actual design and production processes – most of which weren't about live events, though. In chapter 5, I have used *trajectories* by being the designer myself, produced an app and website to support a music festival, and reflected on the process to provide first-hand insight about what it means to use a HCI framework as a designer. This has also led to refining the guidelines described in chapter 3.

Chapter 6 discusses together the research activities, findings and reflections described in the previous three chapters and offers three main contributions – a fourth one being the guidelines presented in chapters 3 and 5:

- Extensions to the *trajectories* framework
- A process model for using *trajectories* in practice
- A model for developing and discussing *translations* of academic theory for design practice.

While the extensions to the framework and the translation model constitute – like *trajectories* – abstract-level knowledge targeted at academics, the process model and the guidelines directly intend to inform practice, with the former being arguably more abstract – or at least less directly linked to specific design situations. The diagram below, based on the representation of the translation

model in chapter 6, summarizes the work and contributions described in this thesis.

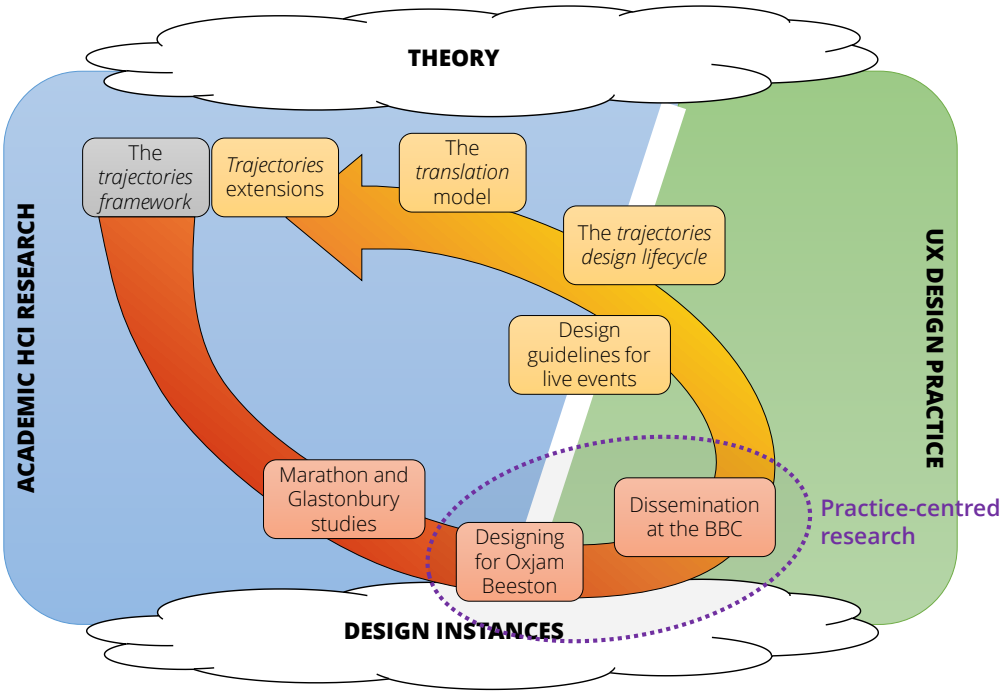

Figure 7.1: A model of this thesis and its contributions

Building upon this summary of the contents of my thesis, I now conclude it by providing a personal and critical reflection upon different facets of this work.

7.2 Reflections on the approach

I now reflect on the approach I've followed throughout this thesis. Although this thesis doesn't intend to contribute new methodologies for HCI research, my reflections in this section explore whether my approach has been novel and useful. I start by discussing it from the perspective of HCI academic research, then turn to UX design practice.

7.2.1 The academic perspective

This thesis constitutes a *Research through Design* process whose goal is theory refinement, rather than theory creation, which is more common in classical HCI *Research through Design* as described in chapter 2. It also differs from these approaches as it gives design practitioners – which may include the researcher themselves, as I've done for the Oxjam festival, or their partners, as was the case with BBC R&D – the role of engaging in a conversation with HCI theoretical knowledge in the context of their practice.

This process is not entirely novel, as I have followed Lesley Fosh and Robyn Taylor's footsteps in designing artefacts that embed aspects of *trajectories*,

analysing these artefacts, and proposing theoretical extensions to *trajectories*. What differs from their work though, is first that I am explicitly relating it to *Research through Design*, and secondly my extended reflection on the design process itself, which has led to a contribution about translating HCI theory in general. This process of theory refinement through practice not only enables the creation of expanded and refined theoretical knowledge, but at the same time produces *intermediary-level knowledge* and finally design artefacts as *ultimate particulars* that embed this knowledge. Going "downwards" from theoretical knowledge, this process has generated, at the most abstract level, extensions to *trajectories*, then intermediate-level knowledge in the form of tools, methods and processes, and finally, at the artefact level, actual "products" such as the Oxjam Beeston experience, *Love Festivals* and *Digital Matchr*.

If built into a broader programme, this type of work might help curb HCI's "toothbrush problem" by providing incentives for researchers to work on refining existing theory rather than developing entirely new concepts.

It has enabled me to question and assert the validity of HCI theoretical concepts and has allowed me to try out a variety of ways of engaging with the UX design practice. Although this engagement is not the primary purpose of academic HCI research, it is a valued goal of the discipline, given that design is at the core of HCI's definition (Hewett et al., 1992), and that the practice of designers has been central to building its rhetoric (Cooper and Bowers, 1995). Moreover, specific interests within the discipline focus on such an engagement, such as the "User Experience Research-Practice Interaction" (UXRPI) community. Finally, it is part of a growing trend in broader academic research to promote engagement beyond academia – in the UK, this is evidenced by the share of "impact" within the Research Excellence Framework (REF) assessment, which has grown from 20% to 25% between 2014 and 2021.

All these criteria, being internal to the discipline or to academic research, suggest that engagement between the two communities of practice is viewed as much more useful for academic HCI research than for professional UX practice.

7.2.2 The design practice perspective

I now reflect on my methodological approach from the point of view of professional UX design practice, and consider the limitations of both my engagement with it, and of the impact of my work for practitioners.

In the design activity described in this thesis, I have engaged with the "doing" aspect of design practice by making artefacts. I have also engaged with craft knowledge, to the extent that multiple sources of practitioner-led knowledge, including my own background in UX design and online resources, have fed into

my design work. However, and in particular in the Oxjam work described in chapter 5, I haven't fully engaged with the community of practice of UX design, nor with its economic environment. This is exemplified by a simple question, asked when I was presenting my work at a practitioner conference[5]. I was asked how the design model presented in section 6.2 could be used to persuade or report to clients. Although I had witnessed first-hand a meeting whose purpose was to get BBC stakeholders to work together and agree, I had naively dismissed it as not being a design activity. The autonomy I had when designing for Oxjam meant that I very seldom had to report on or explain my work and its rationale.

Nevertheless, persuading and reporting have been an area where *trajectories* played a key role early on: stakeholders at the BBC wanted us to bring the framework to the company because it provided them with a vocabulary to discuss the design of new services for which they didn't have such a vocabulary.

My point of view on what "design" is has changed over the course of my research and I now consider these "business" processes as being, if not central to design, the framing that makes design happen the way it does in industry. The opportunities and challenges I faced when collaborating with the BBC have shown the importance of an organizational perspective in knowledge exchange. Instead of engaging in depth with this perspective, I had decided to keep it at the periphery, as I was more comfortable with the aspects of HCI research that focus on the design of artefacts, rather than where it intersects with disciplines such as management, communication and the study of institutions.

7.3 Reflections on the contributions

I now discuss each the four main contributions of this thesis: the design guidelines, the extensions to *trajectories*, the design process model and finally the *translation model*.

7.3.1 Reflection on design guidelines

The design guidelines presented at the end of chapters 3 and 5 constitute a contribution that I've set aside from those presented in chapter 6 because I considered them as specific to designing for participatory events, a subject which I do not see as central to my thesis.

[5] EuroIA 2017, which took place between my viva and the final corrections, and therefore isn't described in depth in this thesis.

Should a designer wish to use these, they would not only have to address the case of live events, but they would also have to embrace the values of *trajectories*. Stakeholders such as festival organizers, music producers, media companies or mobile application providers who create experiences around festivals may or may not wish to follow these values. For example, *trajectories'* inclination towards continuity of experience across interfaces may not be a good strategy for a company whose goal is to keep their audience captive in a single platform.

Having gone through the full cycle of conducting studies, deriving guidelines, implementing and refining them, I may now provide a reflection on the gap between Stolterman' recommendation (2008) that forms of design support should not be prescriptive, and Colusso et al.'s point of view (2017) which calls for prescriptive ones. As a UX designer with few commercial constraints and comfortable deadlines, I felt that the kind of resources advocated by Stolterman, being resources that gave me freedom to combine multiple considerations and explore multiple options, empowered my creativity. However, industrial UX design roles are often situated in fast-paced environments, where prescriptive resources support the ability to make a quick judgement and provide authoritative evidence to report on one's decisions.

These two visions of design support may actually be two visions of design itself. In the first one, design is a "way of knowing" whose finality is the creation of artefacts – the *ultimate particular*. In the second vision, design is an activity embedded in broader business activities, and is bound to an organization's processes. Both should be supported, but the second may be harder to support because of the limited availability of in-depth descriptions of UX design workplaces in HCI literature, and because of the variability between organizational contexts.

7.3.2 Reflection on trajectory extensions

I now reflect on the activity of extending an existing framework. One motivation for extending the framework was overcoming what I saw as lack of clarity around the possibility for *trajectories* to be open-ended, and therefore addressing the gap between interpretations of the framework; another one was to clarify how *trajectories* can help describe and design things that are different from *Blast Theory*'s works. In that sense, my intent was not to change the nature or contents of *trajectories*, but to provide refinements and clarifications that support broader uses for the framework.

I note that I haven't so far provided any criteria for deciding what would or would not constitute a "valid" *trajectory extension*, and for discussing the degree of compatibility with the original framework. Making such a judgment is complex

because it involves determining what the nature of *trajectories* is, and what its authoritative expression is, which I expand upon in section 7.4.

This engagement has been fully supported by the context of my thesis, having *trajectories* in the words of the original proposal, and one of the initiators of the framework as a supervisor. Not only did Steve Benford see and communicate the value in extending his theoretical contribution rather than coming up with my own framework, but he helped me "read" *trajectories* in a way that supported these extensions, and become confident that my use and interpretation of the framework was valid.

7.3.3 Reflection on the design model

I now turn to the second part of chapter 6 and reflect upon the nature of the "trajectories design lifecycle" that I've introduced. To put it in perspective, I present three existing design models, the Double Diamond Process, the ISO 9241-210 model, and Google Venture's design sprints, then draw out the specificities of my own model, and reflect on what its process delivers.

1 The Double Diamond Process

The Double Diamond design process was developed by the British Design Council in 2005 and is based on in-depth studies of actual design processes in industry. It divides design activities in four stages (Design Council, 2007) defined by four verbs:

1. "**Discover**", which includes upstream research and leads to "an initial idea or inspiration" then a "project brief"
2. "**Define**", which involves defining project requirements, and leads to the "corporate sign-off", the moment when stakeholders decide whether projects should go ahead.
3. "**Develop**", "where design-led solutions are developed, iterated and tested within the company". This third stage leads to prototypes that should get "as close to an end product or service as possible".
4. "**Deliver**", "where the resulting product or service is finalised and launched"

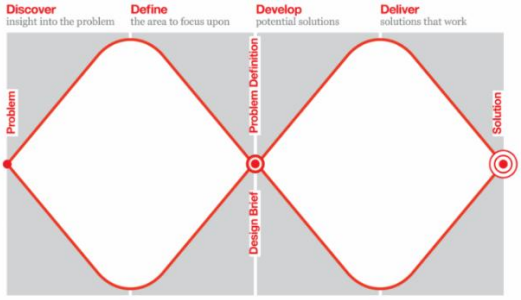

Figure 7.2: The Double Diamond Design Process (© Design Council 2014)

2 The ISO 9241-210:2010 Process

The International Organization for Standardization's standard on "human-centred design for interactive systems" (2010) recommends that "four linked human-centred design activities shall take place during the design of any interactive system". These activities are (1) "understanding and specifying the context of use", (2) "specifying the user requirements", (3) "producing design solutions" and (4) "evaluating the design" against requirements.

The document suggests an iterative process, whereby designs are refined based on the outcome of "user-centred evaluation" – an activity which is described as the driver of the whole process. This iterative nature is represented in the diagram below:

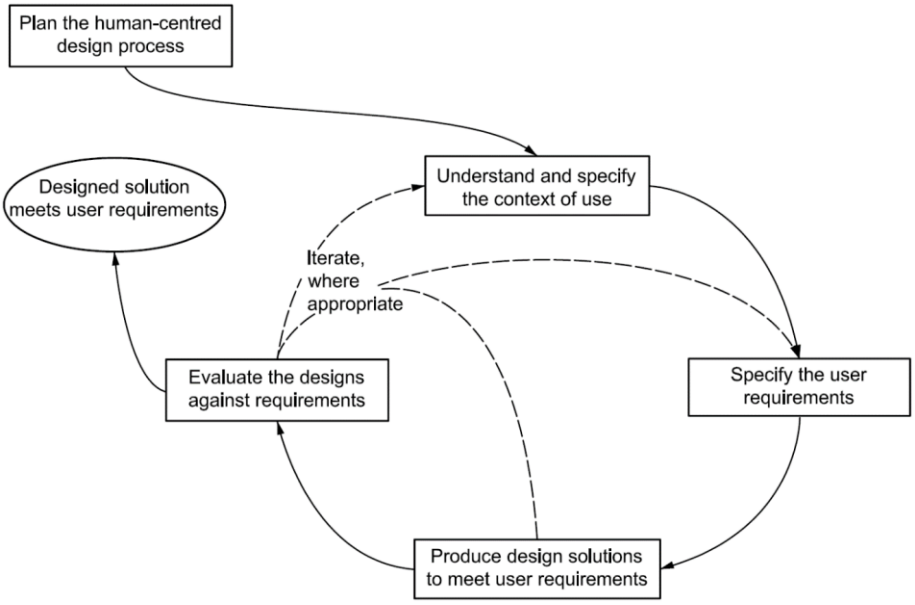

Figure 7.3: The ISO 9241-210 design process © ISO 2010

3 Google' Design Sprint

The last model is described as a "five-day process for answering critical business questions through design, prototyping, and testing ideas with customers" (Google Ventures, 2016), and offers a set of activities for each day of a sprint: (1) mapping out the problem, (2) sketching out solutions, (3) turn these into hypotheses, (4) creating a high-fidelity prototype and (5), testing the prototype. It is also considered a "shortcut to learning without building and launching".

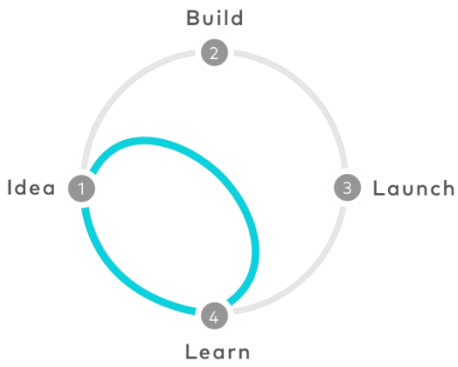

Figure 7.4: The Google Design Sprint (in blue) within the broader production lifecycle.

4 How the *trajectories lifecycle* compares

The *trajectories design lifecycle model*, and the three models above, all differ in how they delineate design as activity, first in terms how it fits temporally within the full lifecycle of creating and delivering a product or service, and secondly in how it fits within the organizational processes. For example, both Double Diamond and ISO consider design to be a self-contained stage of the product lifecycle which ends when a design solution is delivered and considered to meet criteria. Their descriptions hint at the business processes by discussing aspects such as "corporate sign-off" or the writing of specification documents – this disconnect between the *trajectories design lifecycle* and business processes shows how I've developed it within a context where I was free from business constraints and industrial practices.

My model, like the ISO model, presents a list of activities and methods that can be used as part of the process, but unlike the Google Sprint, doesn't offer a constraining and detailed step by step methodology.

5 What is the design outcome?

The *trajectories design lifecycle* also differs from other design process models in that it doesn't have a clear "endpoint" that it delivers, both in terms of the type of knowledge that the outcome constitutes, and in terms of the type of products or services whose creation the process is meant to support.

When looking at the first aspect – the outcome as a deliverable within a broader process – the Double Diamond and ISO models produce "a design" as the endpoint, in other words a detailed description of a future product or service – which can be in the form of prototypes, drawings and detailed descriptions – that engineering processes can then turn into the actual product. Google Ventures generates design ideas – which correspond to the outcome of stage 3 in the double diamond model – and knowledge about how these ideas work. On the other hand, the *trajectories design lifecycle* delivers three kinds of things: designs (*canonical trajectories*), actual experiences (*participant trajectories*) and

souvenirs (*historic trajectories*). Because of this thesis' focus on design, I have mostly considered the first one as the primary outcome that the *design lifecycle* was created to support, but the other outcomes are equally worthy of delivery and investigation, and may even matter more to different stakeholders.

Regarding the second aspect, the full scope of the types of services that can be designed with my model is unclear. I have originally created it for live events, and it matches their recurring and participatory nature, but it may also work well for a broader range of "cultural experiences", and possibly whenever designers want to embrace the values and qualities of *trajectories*, as its inspiration from *action-research* also supports these values. It is harder, though, to argue that it may work for any interactive product or service. This contrasts with ISO's aim to address "computer-based interactive systems" in general or the Double Diamond's ambitions to address "design across disciplines".

Finally, the *trajectories design lifecycle* has no clear starting point, allows "gearing in and out" of the cycle, and is flexible enough to enable interventions at multiple stages of a design process, continuous improvement of an existing service, or creating a new one from scratch.

7.3.4 Reflection on the translation model

The fourth reflection in this section looks at the last contribution, namely the translation model introduced at the end of chapter 6.

This model intends to cover the many ways in which knowledge relating to the *trajectories framework* was propagated, adapted and appropriated with the aim of making it inform design practice. In doing so it highlights – as to some extent the review in chapter 2 and my 2017 CHI paper do – the richness with which multiple forms of design-related knowledge interact, inform each other, and combine into new forms of knowledge. It is both a descriptive model, which draws upon how I've tried to apply *trajectories* in practice, and a prescriptive model, as it strongly advocates for in-depth engagement between researchers and practitioners.

This *translation model* has a few weaknesses. First, it is an overly simplistic description of the gap between research and practice, as there are multiple communities of practice, which do not fit as clearly in two separate categories. Although some have an arguably stronger attachment to academic workplaces and others are fully situated in industry, they all have different ways of engaging with design activities and with design knowledge. For example, on the research side, the *Designing Interactive Systems* (DIS) conference differs from other venues in that it attends to design-centred forms of expression through its

"pictorials" track[6]. On the industrial side, design is done differently in start-ups and in large corporations, in research and development departments and in production ones, and there is a broad variety of role descriptions and of possible divisions of labour for people who do design.

This model shouldn't be read as showing how industry in general engages with academia, because then there wouldn't be a single easily identifiable gap but many "researcherly" and "designerly" practices on a continuum. It works, however, by providing a background to individual examples for engagement between two sets of actors, one that is "more academic" and one on the practice side – for example, the Mixed Reality Lab and BBC Research and Development, a department whose practices are in some respects halfway between academia and other departments – and may need to be adapted for specific configurations of engagement.

A weakness of this contribution could be my choice of the word "translation", as it suggests that there is a single original source of knowledge that is being translated, and that translations are less worthy, or distorted versions of the original[7]. I believe that this narrow reading of the word "translation" does not fit the work described in this thesis, as there has been a constant conversation between multiple sources of knowledge throughout my research, which has led to constant recombination and creation of new knowledge – a process which is also how *trajectories* were created in the first place. My use of the word "translation" should be interpreted in a way that is closer to Callon's "sociology of translation" (1984), in that it is process-centred and that its purpose it to get multiple actors to understand each other and work together.

7.4 Reflections on the nature of trajectories

Following my reflections on the contributions of my thesis, I now return to its central subject, the *trajectories framework*, and reflect on its nature.

7.4.1 Trajectories beyond the framework

My first reflection makes me reconsider my assumptions on what constitutes the authoritative expression of *trajectories*. As suggested by earlier discussions,

[6] Jonathan Grudin's history of HCI (2017) offers an overview of the complexity of subdisciplines and their historical background.

[7] As suggested by the Italian saying "traduttore, traditore", whose translation as "translator, traitor" lacks the original pun.

intermediate-level knowledge – including *trajectories* – involve a high churn of adaptations, appropriations, and combinations. The *Interactional Trajectories* CHI paper is therefore just one form of knowledge among others, and was created by combining Blast Theory's work, literary criticism and HCI forms of knowledge – the body of knowledge present in its references.

My initial assumptions were to consider the academic *trajectories* sources in isolation from the interactive performances that they refer to. These assumptions were made partly because it was easier for me to engage with these sources than with *Blast Theory*'s works. First, being part of an academic community of practice, rather than a performance artist, meant that I had access to more resources to help me read CHI papers and understand HCI researchers' point of view, rather than basing my understanding on the performances themselves. Secondly, these CHI papers are more readily accessible through online libraries than performances. I have not been able to attend any of the works cited in the *trajectories* sources; although *Blast Theory* tour each work multiple times and some of them allow online participation[8], they continually produce new ones and stop touring the old ones. Therefore, the documentation produced by researchers was often the only way for me to access these performances, and this documentation was always provided alongside the interpretive framework that shaped my reading of these performances.

However, from the point of view of a designer, there may be more value in engaging directly with the original performance. For example, one may find it more useful to identify how Blast Theory have practically handled issues GPS coverage – for example, through Martin Flintham's technique of colouring a map of a city with Photoshop (2005) – rather than being able to label it as a "seam in the infrastructure". For designers, it might therefore be useful to consider Blast Theory's works as an essential aspect of *trajectories*, alongside more abstract expressions of the framework.

7.4.2 Trajectories as theory

Bearing in mind this description of *trajectories* as more than just the conceptual framework but also comprising the performances whose craft knowledge they vehiculate, it now becomes harder to argue that *trajectories* are a form of theory. In that sense, only a part of *trajectories*, which – in line with Gaver and Bowers' discussion of theory (2012) – can be described in terms of "annotations" on *Blast Theory*'s original mixed reality performances, may have theoretical qualities.

[8] I attended a performance of *I'd hide you*, a work posterior to *Interactional Trajectories*, as an online player.

Returning to Yvonne Rogers' taxonomy of theory, I've used *trajectories* as theory in multiple ways throughout the work described above, covering most of her proposed categories: I've been using *trajectories* in a **descriptive** way to discuss the experience of people going to festivals and how the Oxjam app has addressed that; the framework has been **generative** when its qualities and values have helped me choose what I should design and how I should address festival experiences; it has been an **explanatory** framework when it has helped me reflect on how the Oxjam festival went; it has been to an extent **prescriptive** when it has helped develop guidelines and supported design decisions, but the degree of freedom it affords design has made it more **informative** than predictive; its **ethnographic** character has made it useful as an interpretive framework for fieldwork data; finally, it has been **critical** as I have used it to engage in a conversation with cultural productions.

But none of Rogers' categories seems to fully capture the broader way in which *trajectories* have worked as a **design theory**, or in other terms a form of knowledge that, even though it doesn't directly "do" design, supports it by facilitating a conversation between past designs, the current design situation, and other forms of knowledge.

7.4.3 Towards a vehicle for craft knowledge

I now return to one of *trajectories'* initial ambition, that of being a "vehicle for compiling craft knowledge" and try to assess whether it has fulfilled this ambition. I propose that the answer depends on whether *trajectories* are engaged with as an isolated set of concepts, or whether the full context of the conversation between forms of knowledge is considered.

Academic publication practices encourage a reading that focuses on abstract concepts and, even though the original *Blast Theory* works are described or cited in CHI papers, the conceptual framework and its vocabulary are showcased as the main contribution. This makes academic papers a form of expression that doesn't fully work as a vehicle for craft knowledge.

This thesis suggests there is a need for better forms of vehicles for craft knowledge, which I propose should be resources that combine multiple forms of intermediate-level knowledge. Such resources would allow for easy traversals between forms of knowledge, for example moving from the definition of a concept to guidelines that help translate the concept into practice as well as to diverse instantiations – created by researchers, artists or professional designers – and the other way around.

7.4.4 Trajectories and technology requirements

Finally, I note that this thesis hasn't fulfilled another of *trajectories'* ambition, that of providing technology requirements – which was also unaddressed in my review of works citing the framework. The only example I know of an attempt to set out requirements for technology that supports *trajectories* – predating the publication of the framework, but also related to *Blast Theory*'s works – is Martin Flintham's thesis (2008), which explores tools for authoring and orchestration. The main contribution of Flintham's work, beyond the actual tools he built, is to elicit a framework that shows the diversity of authoring and orchestration activities.

Creating technology with the aim of addressing *trajectories* in general, rather than starting with specific examples of *trajectories* – which are incredibly diverse when collating all uses of the framework so far – may not be a realistic, nor a desirable way of addressing designers' needs and delivering an actual experience.

Rather, a more useful way of supporting the technological aspects of *trajectories* might be to publish reusable parts of technologies that have been produced to support individual experiences, possibly alongside design resources. I note that, in 2017, while I was writing this thesis, I had been intending to make the technical infrastructure for Oxjam Beeston more modular and reusable for other events, but I have failed to do so due to my lack of time and the amount of work this would have required.

7.5 Future work

I conclude by discussing potential ways the work done on this thesis could be expanded: first, by reaching out again to practitioners to disseminate its findings and contributions, then by expanding the palette of knowledge forms that translate *trajectories*, both consolidating those proposed here and exploring new forms of translations

7.5.1 Disseminating *trajectories*

In this first group of future works, I explore two ways that the outcomes of my research may benefit practitioners. The first route involves research projects that refine the *trajectories design lifecycle* iteratively, and the second route is about exploring a route for dissemination that hasn't been addressed in this thesis, namely through formal education.

1 Bringing the trajectories design lifecycle model to practice

Although the *trajectories design lifecycle* is strongly grounded in practice and has been applied for two major iterations – as well as minor iterations if Oxjam sub-events are considered – this model may still benefit from further validation and refining by being used either in different domains or by professional practitioners.

This process may take multiple forms. First, it may be led by researchers, in a similar *Research through design* process, but by selecting another class of design settings. However, as discussed before, there are few incentives for HCI researchers for the iterative refinement of conceptual knowledge, unless the conceptual contribution is a "by-product" of the research process – like Lesley Fosh's *trajectory* extensions, developed as part of a thesis whose main research question was to investigate digital technology in museum visits (2016, p.3).

Another model would be to disseminate the *trajectory design lifecycle* to practitioners – or would-be practitioners, such as design students, as discussed in the next heading – and study how it is appropriated and used in practice. Bringing the *trajectory design lifecycle* to professional organizations would have the added benefit of getting experienced practitioners – which I'm not – with a good knowledge of the design practice community to validate how this process model fits with their own practice, and propose their own refinements.

2 Trajectories in design education

I now suggest another strategy, unexplored in this thesis, for making *trajectories* available "at the point of use" and support *design judgment*, which is to disseminate them even further upstream of design in professional settings, and target future professionals when they go through formal design education. This strategy, in turn, involves two actions: making *trajectories* part of "studio"-type education, and creating curricula that include the framework.

The *studio* model is popular in design education, and has been described as a way of fostering reflective practice (Schön, 1983) by enabling conversations with design situations. Design studios also include "crits" (for "critiques"), whereby students and their tutors discuss designs in depth. Disseminating *trajectories* within the context of studios and crits would enable the use of the framework to shape tentative solutions developed in studio sessions, as well as to analyse and critique these solutions. This would make students involved in critical discussions with *trajectories*, akin to how I used the framework to design a music festival app, and would lead them to a situated appropriation of the framework and its concept.

This would need to be complemented by making *trajectories* part of foundational knowledge upstream, and included in curricula and textbooks. Following Andrea Peer's suggestion for "the future of User Experience education" (2017) and her discussion of the difference between curricula for UX practitioners and for HCI researchers, *trajectories* may need to be reframed in "HCI-sensible" rather than "HCI-centric" ways, something which the *trajectories design lifecycle* and other translations discussed here may do. Building *trajectories* into broader curricula that include multiple other design considerations would also require coordinating the framework with other sets of concepts to form a coherent view of the domain being taught, be it *interaction design*, *user experience*, *web design*, *information architecture*, or any other design field.

The *trajectories framework* is already part of formal curricula, including at the University of Nottingham as part of the "G54MRT Mixed Reality Technologies" module, and at Edinburgh Napier University (Turner et al. 2011), where it is taught as part of a user experience module alongside other theoretical work. It may be taught elsewhere, but we have found no evidence of it.

Google Scholar, although it does reference textbooks, hasn't helped us identify any citing *trajectories*, which doesn't mean there aren't any. As far as we're aware, only David Benyon's "Designing Interactive Systems" (2013) is citing *trajectories*, but it is only cited in passing, as part of a discussion on "blended spaces" in a side box within the "Ubiquitous Computing" chapter.

7.5.2 Expanding the palette of *translational resources*

The contributions of this thesis focus on one main *translation* of the *trajectories* framework, which is the *trajectories design lifecycle*, but future work may develop more *translational resources*. I now discuss how resources which were partially developed in this thesis may be further expanded, and introduce the idea of "trajectory templates". I conclude by discussing how these resources connect with *trajectories'* ambitions to become "a vehicle for compiling craft knowledge".

1 Consolidating and refining the tools introduced in this thesis

Chapters 4 and 5 have described two tools that were designed as part of this thesis, implemented as prototypes, and might be further developed in the future.

a The pathway cards

The *pathway cards* developed at BBC R&D may be further developed in several directions: first, the deck itself, which was centred on BBC assets, may be turned into a generic design tool that addresses design situations that are relevant for other organizations. Secondly, the browser based user interface might be fully developed into a design workflow that starts from designing and printing cards, continues with card-supported workshops and finishes with capturing, annotating and sharing the outcome of workshops. One step towards implementing the full workflow has been conducted with the creation of "CardMapper"[9], a tool to annotate images of ideation cards. Another option would be a complete overhaul to make the *trajectories framework* and design considerations derived from the framework more prominent in the cards – for example, through inspiration from Eva Hornecker's *Tangible Interaction Cards* (2010) or Floyd Mueller and his colleagues' *exertion cards* (2014).

b The "protojourneys" prototyping tool

Another tool developed as part of my research, *protojourneys* hasn't seen any further development since it was used for Oxjam Beeston in 2015. It has, however, been presented informally both to academics and BBC staff, who have provided feedback on it. Amongst potential improvements, the variety of evaluation scenarios – for example, by *bodystorming* the *canonical trajectory* or following it in-situ, or as a semi-structured diary to report an emergent *participant trajectory* – should be clearly visible to designers using the tool, and translated into a variety of playback modes – one of which could be a simple slideshow; authors should also be able to create multi-level, or nested *trajectories*, that enable designing and prototyping experiences at varied levels of granularity. Conversations with researchers working on creating mixed-reality games suggested that the authoring features in *protojourneys* may cross the border from prototyping experiences to automatically generating the technology that supports them. Future work involves first extensively testing *protojourneys* in its current state to extend the "wishlist" of requirements above, then developing the corresponding features.

c *Trajectory* tools as commercial services

Both *pathway cards* and *protojourneys* might be turned into commercial services. Future work therefore also includes the assessment of these tools from a business perspective, and identifying potential "client" organizations, which may include the BBC. The web-based nature of the cards' browser interface and

[9] A copy is available on https://github.com/raphv/cardmapper/

of *protojourneys* suggests a potential subscription-based model. Example of commercial tools used for user experience design include interface prototyping tools AxureRP, Framer, UXPin, but Experience Fellow, a "mobile ethnography tool" to document customer journeys through services, whose features resemble those of *protojourneys*[10].

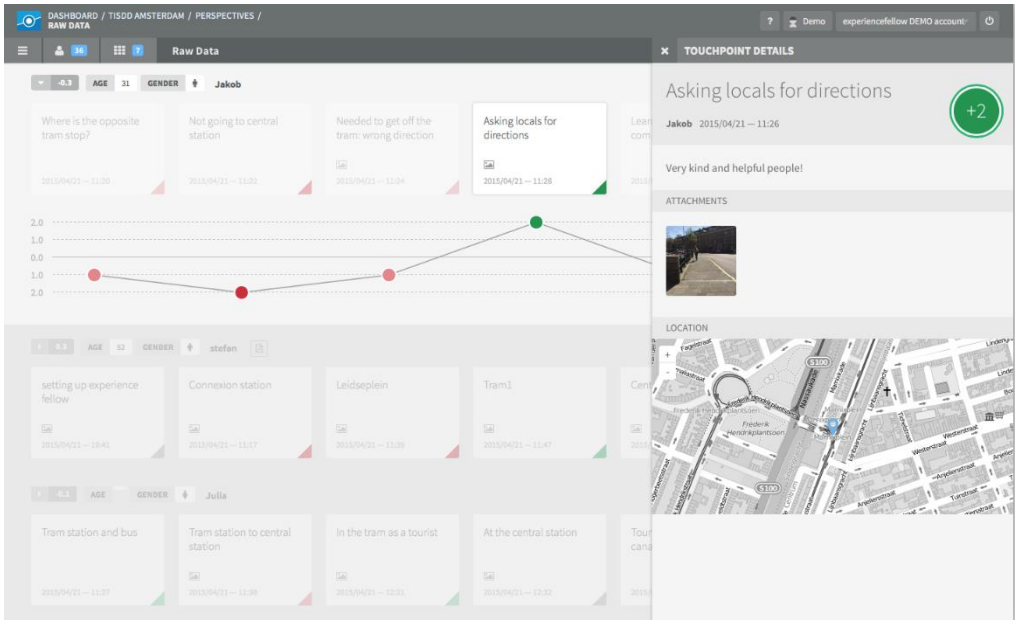

Figure 7.5: A screenshot of ExperienceFellow, from experiencefellow.com

Another commercial model would involve building these tools into a series of workshop formats, and either establishing myself as a UX consultant organizing workshops on behalf of clients or creating training material and selling the format to UX design practitioners.

2 Trajectory templates

Another form of *translational resources* for *trajectories* may be "templates" or "sequence patterns" that describe the dynamics of interaction along a *trajectory*. To use a visual analogy based on representations of *trajectories* that may show branches, loops, and gaps between episodes, these *templates* describe the "shape" of the *canonical trajectory*. Examples of sequences of interactions that might be turned into *templates* include:

- Lesley Fosh's (2013) discussion of *local trajectories* in five stages: approach, engage, experience, disengage, reflect.
- Having different degrees of freedom between the local and global stage (Fosh et al., 2013).

[10] Interestingly, Experience Fellow is also a spin-off from academic research work, conducted by Marc Stickdorn and Jakob Schneider, two *service design* scholars.

- Offering repeat opportunities for onboarding or beginning a *trajectory* (this was the case in the marketing-centred approach in the *Digital Matchr* workshop)
- "Enticing" strategies scaffolded by facilitators for turning passive audiences into active ones (Taylor et al., 2014; Taylor et al., 2015)
- The "honeypot effect" and "dropout trajectories" described by Niels Wouters and his colleagues (2016).

Protojourneys, as it allows the authoring and visual representation of *trajectories*, may support creating and collating such templates as well as turn them into reusable blueprints.

3 A resource that constitutes a "vehicle for compiling craft knowledge"

Following the final reflection on the nature of *trajectories*, future work might lead to consolidate a resource that acts as a vehicle for compiling craft knowledge. This might take the form of a publicly accessible online database that compiles multiple forms of knowledge around *trajectories*, from descriptions of designs to abstract concepts, methods and tools, with easy ways of traversing the database and moving across levels of abstraction. An extended version of that resource may also include reusable technological components.

Bibliography

Adams, A., Fitzgerald, E., Priestnall, G., 2013. Of Catwalk Technologies and Boundary Creatures. ACM Trans. Comput.-Hum. Interact. 20, 15:1–15:34. doi:10.1145/2491500.2491503

Adourian, G., 2017. Refermer des portes pour mieux en ouvrir d'autres. Gayané Adourian.

Anstead, E., Benford, S., Glancy, M., Rasul, Y., Valentine-House, E., 2013. Trajectories Through Multiscreen Television Experiences (Submitted to the EuroITV 2013 conference).

Anstead, E., Flintham, M., Benford, S., 2014. Studying MarathonLive: Consent for In-the-wild Research, in: Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication, UbiComp '14 Adjunct. ACM, New York, NY, USA, pp. 665–670. doi:10.1145/2638728.2641678

Arrigoni, G., Zics, B., 2016. Fiction and curatorial practice: developing alternative experiences for digital artistic prototypes. International Journal of Performance Arts and Digital Media 12, 82–94. doi:10.1080/14794713.2015.1133960

Back, J., 2016. Designing Public Play : Playful Engagement, Constructed Activity, and Player Experience.

Balabanović, M., Chu, L.L., Wolff, G.J., 2000. Storytelling with Digital Photographs, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '00. ACM, New York, NY, USA, pp. 564–571. doi:10.1145/332040.332505

Bannon, L., 1992. Design at Work, in: Greenbaum, J., Kyng, M. (Eds.), . L. Erlbaum Associates Inc., Hillsdale, NJ, USA, pp. 25–44.

Barba, E., 2014. A theory of meaning for Mixed Reality walking tours, in: 2014 IEEE International Symposium on Mixed and Augmented Reality - Media, Art, Social Science, Humanities and Design (ISMAR-MASH'D). Presented at the 2014 IEEE International Symposium on Mixed and Augmented Reality - Media, Art, Social Science, Humanities and Design (ISMAR-MASH'D), pp. 43–50. doi:10.1109/ISMAR-AMH.2014.6935437

Barba, E., MacIntyre, B., 2011. A Scale Model of Mixed Reality, in: Proceedings of the 8th ACM Conference on Creativity and Cognition, C&C '11. ACM, New York, NY, USA, pp. 117–126. doi:10.1145/2069618.2069640

Bardzell, J., 2009. Interaction Criticism and Aesthetics, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '09. ACM, New York, NY, USA, pp. 2357–2366. doi:10.1145/1518701.1519063

Barkhuus, L., Jørgensen, T., 2008. Engaging the Crowd: Studies of Audience-performer Interaction, in: CHI '08 Extended Abstracts on Human Factors in Computing Systems, CHI EA '08. ACM, New York, NY, USA, pp. 2925–2930. doi:10.1145/1358628.1358785

Bartindale, T., Valentine, E., Glancy, M., Kirk, D., Wright, P., Olivier, P., 2013. Facilitating TV Production Using StoryCrate, in: Proceedings of the 9th ACM Conference on Creativity & Cognition, C&C '13. ACM, New York, NY, USA, pp. 193–202. doi:10.1145/2466627.2466628

BBC, 2013. BBC Audience Information Context and Glossary.

Benford, S., 2010. Performing Musical Interaction: Lessons from the Study of Extended Theatrical Performances. Computer Music Journal 34, 49–61. doi:10.1162/COMJ_a_00025

Benford, S., Crabtree, A., Reeves, S., Sheridan, J., Dix, A., Flintham, M., Drozd, A., 2006. The Frame of the Game: Blurring the Boundary Between Fiction and Reality in Mobile Experiences, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '06. ACM, New York, NY, USA, pp. 427–436. doi:10.1145/1124772.1124836

Benford, S., Crowther, B., 2013. The View From the Other Side: Being a Visiting Professor at BBC R&D [WWW Document]. BBC R&D Blog. URL http://www.bbc.co.uk/rd/blog/2013/04/steve-benford-being-a-visiting-professor-at-bbc-rd (accessed 9.26.14).

Benford, S., Giannachi, G., 2011. Performing Mixed Reality. MIT Press, Cambridge, Mass.

Benford, S., Giannachi, G., 2008. Temporal Trajectories in Shared Interactive Narratives, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '08. ACM, New York, NY, USA, pp. 73–82. doi:10.1145/1357054.1357067

Benford, S., Giannachi, G., Koleva, B., Rodden, T., 2009. From interaction to trajectories: designing coherent journeys through user experiences, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '09. ACM, New York, pp. 709–718. doi:10.1145/1518701.1518812

Benford, S., Greenhalgh, C., Crabtree, A., Flintham, M., Walker, B., Marshall, J., Koleva, B., Rennick Egglestone, S., Giannachi, G., Adams, M., Tandavanitj, N., Row Farr, J., 2013. Performance-Led Research in the Wild. ACM Trans. Comput.-Hum. Interact. 20, 14:1–14:22. doi:10.1145/2491500.2491502

Benford, S., Hazzard, A., Chamberlain, A., Glover, K., Greenhalgh, C., Xu, L., Hoare, M., Darzentas, D., 2016. Accountable Artefacts: The Case of the Carolan Guitar, in: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, CHI '16. ACM, New York, NY, USA, pp. 1163–1175. doi:10.1145/2858036.2858306

Benford, S., Lindt, I., Crabtree, A., Flintham, M., Greenhalgh, C., Koleva, B., Adams, M., Tandavanitj, N., Farr, J.R., Giannachi, G., 2011. Creating the spectacle: Designing interactional trajectories through spectator interfaces. ACM Transactions on Computer-Human Interaction 18, 1–28. doi:10.1145/1993060.1993061

Benyon, D., 2012. Presence in Blended Spaces. Interact. Comput. 24, 219–226. doi:10.1016/j.intcom.2012.04.005

Benyon, D., Höök, K., Nigay, L., 2010. Spaces of Interaction, in: Proceedings of the 2010 ACM-BCS Visions of Computer Science Conference, ACM-BCS '10. British Computer Society, Swinton, UK, UK, p. 2:1–2:7.

Benyon, D., Mival, O., 2015. Blended Spaces for Collaboration. Comput Supported Coop Work 24, 223–249. doi:10.1007/s10606-015-9223-8

Benyon, D., Mival, O., Ayan, S., 2012. Designing Blended Spaces, in: Proceedings of the 26th Annual BCS Interaction Specialist Group Conference on People and Computers, BCS-HCI '12. British Computer Society, Swinton, UK, UK, pp. 398–403.

Benyon, P.D., 2010. Designing Interactive Systems: A Comprehensive Guide to HCI and Interaction Design, 2 edition. ed. Addison Wesley, Harlow, England; New York.

Bisbort, A., 1999. Escaping Flatland [WWW Document]. URL https://www.edwardtufte.com/tufte/advocate_1099 (accessed 8.23.17).

Blast Theory, 2016. Biography [WWW Document]. URL https://www.blasttheory.co.uk/wp-content/uploads/2013/10/Blast_Theory_Biography.pdf (accessed 9.18.17).

Blomkvist, J., 2016. Benefits of Service Level Prototyping: The Design Journal: Vol 19, No 4. The Design Journal 19, 545–564. doi:10.1080/14606925.2016.1177292

Blomkvist, J., Åberg, J., Holmlid, S., 2013. Formative Evaluation of IT-based Services: A Case Study of a Meal Planning Service. Interact. Comput. iwt052. doi:10.1093/iwc/iwt052

Bonsignore, E., Moulder, V., Neustaedter, C., Hansen, D., Kraus, K., Druin, A., 2014. Design Tactics for Authentic Interactive Fiction: Insights from Alternate Reality Game Designers, in: Proceedings of the 32Nd Annual ACM Conference on Human Factors in Computing Systems, CHI '14. ACM, New York, NY, USA, pp. 947–950. doi:10.1145/2556288.2557245

Bowser, A.E., Hansen, D.L., Raphael, J., Reid, M., Gamett, R.J., He, Y.R., Rotman, D., Preece, J.J., 2013. Prototyping in PLACE: A Scalable Approach to Developing Location-based Apps and Games, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '13. ACM, New York, NY, USA, pp. 1519–1528. doi:10.1145/2470654.2466202

Buie, E., Dray, S., Instone, K., Jain, J., Lindgaard, G., Lund, A., 2010. How to Bring HCI Research and Practice Closer Together, in: CHI '10 Extended Abstracts on Human Factors in Computing Systems, CHI EA '10. ACM, New York, NY, USA, pp. 3181–3184. doi:10.1145/1753846.1753951

Buie, E., Hooper, C.J., Houssian, A., 2013. Research-practice Interaction: Building Bridges, Closing the Gap, in: CHI '13 Extended Abstracts on Human Factors in Computing Systems, CHI EA '13. ACM, New York, NY, USA, pp. 2493–2496. doi:10.1145/2468356.2468813

Button, G., 2000. The ethnographic tradition and design. Design studies 21, 319–332.

Buxton, B., 2007. Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

Byrne, R., Marshall, J., Mueller, F.F., 2016. Designing the Vertigo Experience: Vertigo As a Design Resource for Digital Bodily Play, in: Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction, TEI '16. ACM, New York, NY, USA, pp. 296–303. doi:10.1145/2839462.2839465

Callon, M., 1984. Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. The Sociological Review 32, 196–233. doi:10.1111/j.1467-954X.1984.tb00113.x

Calori, I.C., Rossitto, C., Divitini, M., 2013. Understanding Trajectories of Experience in Situated Learning Field Trips. IxD&A 16, 17–26.

Carroll, J.M. (Ed.), 1995. Scenario-based Design: Envisioning Work and Technology in System Development. John Wiley & Sons, Inc., New York, NY, USA.

Carter, S., Mankoff, J., 2005. When Participants Do the Capturing: The Role of Media in Diary Studies, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '05. ACM, New York, NY, USA, pp. 899–908. doi:10.1145/1054972.1055098

Cerratto-Pargman, T., Rossitto, C., Barkhuus, L., 2014. Understanding Audience Participation in an Interactive Theater Performance, in: Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational, NordiCHI '14. ACM, New York, NY, USA, pp. 608–617. doi:10.1145/2639189.2641213

Clarke, R., Wright, P., 2012. Evocative of Experience: Crafting Cross-cultural Digital Narratives Through Stories and Portraits, in: Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design, NordiCHI '12. ACM, New York, NY, USA, pp. 318–321. doi:10.1145/2399016.2399066

Colusso, L., Bennett, C.L., Hsieh, G., Munson, S.A., 2017. Translational Resources: Reducing the Gap Between Academic Research and HCI Practice, in: Proceedings of the 2017 Conference on Designing Interactive Systems, DIS '17. ACM, New York, NY, USA, pp. 957–968. doi:10.1145/3064663.3064667

Cooper, G., Bowers, J., 1995. Representing the user: Notes on the disciplinary rhetoric of human-computer interaction, in: Thomas, P.J. (Ed.), The Social and Interactional Dimensions of Human-Computer Interfaces, Cambridge Series on Human-Computer Interaction. Cambridge University Press, Cambridge, pp. 48–66.

Coughlan, T., Adams, A., Rogers, Y., 2010. Designing for Balance: Out There and In Here, in: Proceedings of the 24th BCS Interaction Specialist Group Conference, BCS '10. British Computer Society, Swinton, UK, UK, pp. 468–473.

Cross, N., 2007. Designerly ways of knowing. Birkhäuser, Basel.

Cross, N., 2001. Designerly ways of knowing: design discipline versus design science. Design issues 17, 49–55.

Cross, N., 1999. Design Research: A Disciplined Conversation. Design Issues 15, 5–10. doi:10.2307/1511837

Dalsgaard, P., Dindler, C., Halskov, K., 2011. Understanding the Dynamics of Engaging Interaction in Public Spaces, in: Proceedings of the 13th IFIP TC 13 International Conference on Human-Computer Interaction - Volume Part II, INTERACT'11. Springer-Verlag, Berlin, Heidelberg, pp. 212–229.

Darzentas, D.P., Brown, M.A., Flintham, M., Benford, S., 2015. The Data Driven Lives of Wargaming Miniatures, in: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI '15. ACM, New York, NY, USA, pp. 2427–2436. doi:10.1145/2702123.2702377

Dena, C., 2007. Patterns in Cross-Media Interaction Design: It's Much More Than a URL, in: Proceedings of 1st International Conference on Crossmedia Interaction Design. Presented at the International Conference on Cross-Media Interaction Design, Hemavan, Sweden.

Design Council, 2015. The Design Process: What is the Double Diamond? [WWW Document]. Design Council. URL http://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond (accessed 8.12.17).

Design Council, 2007. Eleven lessons: managing design in eleven design brands. London.

design, n., n.d. . OED Online.

Dezfuli, N., Günther, S., Khalilbeigi, M., Mühlhäuser, M., Huber, J., 2013. CoStream@Home: Connected Live Event Experiences, in: Proceedings of the 2Nd International Workshop on Socially-Aware Multimedia, SAM '13. ACM, New York, NY, USA, pp. 33–36. doi:10.1145/2509916.2509927

Dourish, P., 2006. Implications for Design, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '06. ACM, New York, NY, USA, pp. 541–550. doi:10.1145/1124772.1124855

Downe, L., 2016. What we mean by service design [WWW Document]. Government Digital Service. URL https://gds.blog.gov.uk/2016/04/18/what-we-mean-by-service-design/ (accessed 7.10.17).

Duncan, M., 2004. Autoethnography: Critical Appreciation of an Emerging Art. International Journal of Qualitative Methods 3, 28–39. doi:10.1177/160940690400300403

Durrant, A., Kirk, D.S., Benford, S., Rodden, T., 2011a. Pursuing Leisure: Reflections on Theme Park Visiting. Comput Supported Coop Work 21, 43–79. doi:10.1007/s10606-011-9151-1

Durrant, A., Rowland, D., Kirk, D.S., Benford, S., Fischer, J.E., McAuley, D., 2011b. Automics: souvenir generating photoware for theme parks, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '11. ACM, New York, pp. 1767–1776.

Engström, A., Esbjörnsson, M., Juhlin, O., 2008. Mobile Collaborative Live Video Mixing, in: Proceedings of the 10th International Conference on Human Computer Interaction with Mobile Devices and Services, MobileHCI '08. ACM, New York, NY, USA, pp. 157–166. doi:10.1145/1409240.1409258

Esbjörnsson, M., Brown, B., Juhlin, O., Normark, D., Östergren, M., Laurier, E., 2006. Watching the Cars Go Round and Round: Designing for Active Spectating, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '06. ACM, New York, NY, USA, pp. 1221–1224. doi:10.1145/1124772.1124955

Fallman, D., 2008. The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration. Design Issues 24, 4–18. doi:10.1162/desi.2008.24.3.4

Faste, H., 2017. Intuition in Design: Reflections on the Iterative Aesthetics of Form, in: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, CHI '17. ACM, New York, NY, USA, pp. 3403–3413. doi:10.1145/3025453.3025534

Fischer, J.E., Reeves, S., Rodden, T., Reece, S., Ramchurn, S.D., Jones, D., 2015. Building a Birds Eye View: Collaborative Work in Disaster Response, in: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI '15. ACM, New York, NY, USA, pp. 4103–4112. doi:10.1145/2702123.2702313

Flintham, M., 2005. Painting the Town Red: Configuring Location-based Games by Colouring Maps, in: Proceedings of the 2005 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology, ACE '05. ACM, New York, NY, USA, pp. 9–18. https://doi.org/10.1145/1178477.1178479

Flintham, M., 2008. Supporting mobile mixed-reality experiences (Thesis (PhD)). University of Nottingham.

Flintham, M., Reeves, S., Brundell, P., Glover, T., Benford, S., Rowland, D., Koleva, B., Greenhalgh, C., Adams, M., Tandavanitj, N., others, 2011. Flypad: Designing trajectories in a large-scale permanent augmented reality installation, in: ECSCW 2011: Proceedings of the 12th European Conference on Computer Supported Cooperative Work, 24-28 September 2011, Aarhus Denmark. Springer, pp. 233–252. doi:10.1007/978-0-85729-913-0_13

Fosh, L., 2016. Gifting personalised trajectories in museums and galleries (Thesis (PhD)). University of Nottingham.

Fosh, L., Benford, S., Koleva, B., 2016. Supporting Group Coherence in a Museum Visit, in: Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing, CSCW '16. ACM, New York, NY, USA, pp. 1–12. doi:10.1145/2818048.2819970

Fosh, L., Benford, S., Reeves, S., Koleva, B., Brundell, P., 2013. See Me, Feel Me, Touch Me, Hear Me: Trajectories and Interpretation in a Sculpture Garden, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '13. ACM, New York, NY, USA, pp. 149–158. doi:10.1145/2470654.2470675

Frantzis, M., Zsombori, V., Ursu, M., Guimaraes, R.L., Kegel, I., Craigie, R., 2012. Interactive Video Stories from User Generated Content: A School Concert Use Case, in: Oyarzun, D., Peinado, F., Young, R.M., Elizalde, A., Méndez, G. (Eds.), Interactive Storytelling, Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 183–195.

Frayling, C., 1993. Research in Art and Design. Royal College of Art Research Papers 1.

Freeth, B., Bowers, J., Hogg, B., 2014. Musical Meshworks: From Networked Performance to Cultures of Exchange, in: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS '14. ACM, New York, NY, USA, pp. 219–228. doi:10.1145/2598510.2598583

Friederichs-Büttner, G., Walther-Franks, B., Malaka, R., 2012. An Unfinished Drama: Designing Participation for the Theatrical Dance Performance Parcival XX-XI, in: Proceedings of the Designing Interactive Systems Conference, DIS '12. ACM, New York, NY, USA, pp. 770–778. doi:10.1145/2317956.2318072

Frohlich, D.M., Rachovides, D., Riga, K., Bhat, R., Frank, M., Edirisinghe, E., Wickramanayaka, D., Jones, M., Harwood, W., 2009. StoryBank: Mobile Digital Storytelling in a Development Context, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '09. ACM, New York, NY, USA, pp. 1761–1770. doi:10.1145/1518701.1518972

Fulton Suri, J., Howard, S.G., 2006. Going Deeper, Seeing Further: Enhancing Ethnographic Interpretations to Reveal More Meaningful Opportunities for Design. Journal of Advertising Research 46, 246–250. doi:10.2501/S0021849906060363

Garfinkel, H., 1967. Studies in ethnomethodology. Prentice-Hall, Englewood Cliffs, N.J.

Garrett, J.J., 2002. The elements of user experience: user-centered design for the Web, 1st ed. ed. New Riders, Indianapolis.

Gaver, B., Bowers, J., 2012. Annotated Portfolios. interactions 19, 40–49. doi:10.1145/2212877.2212889

Gaver, B., Dunne, T., Pacenti, E., 1999. Design: Cultural Probes. interactions 6, 21–29. doi:10.1145/291224.291235

Gaver, W., 2012. What Should We Expect from Research Through Design?, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '12. ACM, New York, NY, USA, pp. 937–946. doi:10.1145/2207676.2208538

Ghellal, S., Morrison, A., Hassenzahl, M., Schaufler, B., 2014. The Remediation of Nosferatu: Exploring Transmedia Experiences, in: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS '14. ACM, New York, NY, USA, pp. 617–626. doi:10.1145/2598510.2600881

Goodman, E., Stolterman, E., Wakkary, R., 2011. Understanding interaction design practices, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, pp. 1061–1070. doi:10.1145/1978942.1979100

Google, n.d. Glossary - Analytics Help [WWW Document]. URL https://support.google.com/analytics/topic/6083659 (accessed 9.15.17).

Google Ventures, 2016. The Design Sprint [WWW Document]. URL http://www.gv.com/sprint (accessed 10.17.16).

Gray, C.M., Stolterman, E., Siegel, M.A., 2014. Reprioritizing the Relationship Between HCI Research and Practice: Bubble-up and Trickle-down Effects, in: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS '14. ACM, New York, NY, USA, pp. 725–734. doi:10.1145/2598510.2598595

Hamilton, W.A., Tang, J., Venolia, G., Inkpen, K., Zillner, J., Huang, D., 2016. Rivulet: Exploring Participation in Live Events Through Multi-Stream Experiences, in: Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video, TVX '16. ACM, New York, NY, USA, pp. 31–42. doi:10.1145/2932206.2932211

Hansen, D., Bonsignore, E., Ruppel, M., Visconti, A., Kraus, K., 2013. Designing Reusable Alternate Reality Games, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '13. ACM, New York, NY, USA, pp. 1529–1538. doi:10.1145/2470654.2466203

Hassenzahl, M., 2013. User Experience and Experience Design, in: The Encyclopedia of Human-Computer Interaction. The Interaction Design Foundation.

Hayes, G.R., 2011. The Relationship of Action Research to Human-computer Interaction. ACM Trans. Comput.-Hum. Interact. 18, 15:1–15:20. doi:10.1145/1993060.1993065

Heeter, C., 1992. Being There: The Subjective Experience of Presence. Presence: Teleoper. Virtual Environ. 1, 262–271.

Hewett, T.T., Baecker, R., Card, S., Carey, T., Gasen, J., Mantei, M., Perlman, G., Strong, G., Verplank, W., 1992. ACM SIGCHI Curricula for Human-Computer Interaction. ACM, New York, NY, USA.

Hill, R., Hansen, D.A., 1960. The Identification of Conceptual Frameworks Utilized in Family Study. Marriage and Family Living 22, 299–311. doi:10.2307/347242

Holmlid, S., Blomkvist, J., 2015. A visual tool to create common ground for service design rationale. Presented at the 11th International European Academy of Design Conference, Paris.

Höök, K., Löwgren, J., 2012. Strong concepts: Intermediate-level knowledge in interaction design research. ACM Transactions on Computer-Human Interaction 19, 1–18. doi:10.1145/2362364.2362371

Hornecker, E., 2016. The To-and-Fro of Sense Making: Supporting Users' Active Indexing in Museums. ACM Trans. Comput.-Hum. Interact. 23, 10:1–10:48. doi:10.1145/2882785

Huang, C.-C., Stolterman, E., 2011. Temporality in Interaction Design, in: Proceedings of the 2011 Conference on Designing Pleasurable Products and Interfaces, DPPI '11. ACM, New York, NY, USA, p. 62:1–62:8. doi:10.1145/2347504.2347572

Huang, E.M., Mynatt, E.D., Trimble, J.P., 2006. Displays in the Wild: Understanding the Dynamics and Evolution of a Display Ecology, in: Proceedings of the 4th International Conference on Pervasive Computing, PERVASIVE'06. Springer-Verlag, Berlin, Heidelberg, pp. 321–336. doi:10.1007/11748625_20

Hughes, J., King, V., Rodden, T., Andersen, H., 1995. The Role of Ethnography in Interactive Systems Design. interactions 2, 56–65. doi:10.1145/205350.205358

Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B.B., Druin, A., Plaisant, C., Beaudouin-Lafon, M., Conversy, S., Evans, H., Hansen, H., 2003. Technology probes: inspiring design for and with families, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. pp. 17–24.

Jacucci, G., Oulasvirta, A., Ilmonen, T., Evans, J., Salovaara, A., 2007a. Comedia: Mobile Group Media for Active Spectatorship, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '07. ACM, New York, NY, USA, pp. 1273–1282. doi:10.1145/1240624.1240817

Jacucci, G., Oulasvirta, A., Salovaara, A., 2007b. Active Construction of Experience Through Mobile Media: A Field Study with Implications for Recording and Sharing. Personal Ubiquitous Comput. 11, 215–234. doi:10.1007/s00779-006-0084-5

Jenkins, H., 2003. Transmedia Storytelling. MIT Technology Review.

Kan, A., Gibbs, M., Ploderer, B., 2013. Being Chased by Zombies!: Understanding the Experience of Mixed Reality Quests, in: Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration, OzCHI '13. ACM, New York, NY, USA, pp. 207–216. doi:10.1145/2541016.2541038

Kimbell, L., 2012. Rethinking Design Thinking: Part II. Design and Culture 4, 129–148. doi:10.2752/175470812X13281948975413

Kimbell, L., 2011. Rethinking Design Thinking: Part I. Design and Culture 3, 285–306. doi:10.2752/175470811X13071166525216

Knemeyer, D., Svoboda, E., n.d. User Experience - UX [WWW Document]. The Glossary of Human Computer Interaction. URL https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/user-experience-ux (accessed 8.23.17).

Koleva, B., Taylor, I., Benford, S., Fraser, M., Greenhalgh, C., Schnädelbach, H., vom Lehn, D., Heath, C., Row-Farr, J., Adams, M., 2001. Orchestrating a Mixed Reality Performance, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '01. ACM, New York, NY, USA, pp. 38–45. doi:10.1145/365024.365033

Koskinen, I., Binder, T., Redström, J., 2008. Lab, Field, Gallery, and Beyond. Artifact 2, 46–57.

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., Wensveen, S., 2011. Design Research Through Practice: From the Lab, Field, and Showroom, 1st ed. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

Latour, B., 2005. Reassembling the Social: An Introduction to Actor-Network-Theory, Clarendon Lectures in Management Studies. Oxford University Press, Oxford, New York.

Leitner, M., Wöckl, B., Subasi, Ö., Tschelgi, M., 2010. Towards the Use of "Negative Effects" in Technology Design and Evaluation, in: Proceedings of the 24th BCS Interaction Specialist Group Conference, BCS '10. British Computer Society, Swinton, UK, UK, pp. 443–447.

Lidwell, W., Holden, K., Butler, J., 2003. Universal principles of design. Rockport, Gloucester, Mass.

Lindinger, C., Mara, M., Obermaier, K., Aigner, R., Haring, R., Pauser, V., 2013. The (St)Age of Participation: audience involvement in interactive performances. Digital Creativity 24, 119–129. doi:10.1080/14626268.2013.808966

Loke, L., Khut, G.P., 2014. Intimate Aesthetics and Facilitated Interaction, in: Candy, L., Ferguson, S. (Eds.), Interactive Experience in the Digital Age. Springer International Publishing, Cham, pp. 91–108. doi:10.1007/978-3-319-04510-8_7

Lu, F., Tian, F., Jiang, Y., Cao, X., Luo, W., Li, G., Zhang, X., Dai, G., Wang, H., 2011. ShadowStory: Creative and Collaborative Digital Storytelling Inspired by Cultural Heritage, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '11. ACM, New York, NY, USA, pp. 1919–1928. doi:10.1145/1978942.1979221

Luckin, R., 2010. Re-designing learning contexts: technology-rich, learner-centred ecologies. Routledge, Abingdon.

Ludvigsen, M., Veerasawmy, R., 2010. Designing Technology for Active Spectator Experiences at Sporting Events, in: Proceedings of the 22Nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction, OZCHI '10. ACM, New York, NY, USA, pp. 96–103. doi:10.1145/1952222.1952243

Lundgren, S., 2013. Toying with Time: Considering Temporal Themes in Interactive Artifacts, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '13. ACM, New York, NY, USA, pp. 1639–1648. doi:10.1145/2470654.2466217

Lundgren, S., Fischer, J.E., Reeves, S., Torgersson, O., 2015. Designing Mobile Experiences for Collocated Interaction, in: Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, CSCW '15. ACM, New York, NY, USA, pp. 496–507. doi:10.1145/2675133.2675171

Marshall, J., Benford, S., Pridmore, T., 2010. Deception and Magic in Collaborative Interaction, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '10. ACM, New York, NY, USA, pp. 567–576. doi:10.1145/1753326.1753410

Marshall, J., Mueller, F. "Floyd," Benford, S., Pijnappel, S., 2016. Expanding exertion gaming. International Journal of Human-Computer Studies 90, 1–13. doi:10.1016/j.ijhcs.2016.02.003

Martin, R.L., 2009. The design of business: why design thinking is the next competitive advantage. Harvard Business Press, Boston, Mass.

Massimi, M., Odom, W., Banks, R., Kirk, D., 2011. Matters of Life and Death: Locating the End of Life in Lifespan-oriented Hci Research, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '11. ACM, New York, NY, USA, pp. 987–996. doi:10.1145/1978942.1979090

Maxwell, D., Speed, C., Monsen, K., Zamora, D., 2015. Creating a Collaborative Space for Creativity Through a Pervasive User Experience, in: Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition, C&C '15. ACM, New York, NY, USA, pp. 255–264. doi:10.1145/2757226.2757234

McCarthy, J., Wright, P., 2004. Technology as experience. MIT Press, Cambridge, Mass.

McCurdy, M., Connors, C., Pyrzak, G., Kanefsky, B., Vera, A., 2006. Breaking the Fidelity Barrier: An Examination of Our Current Characterization of Prototypes and an Example of a Mixed-fidelity Success, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '06. ACM, New York, NY, USA, pp. 1233–1242. doi:10.1145/1124772.1124959

Miettinen, S., 2009. Designing Services with Innovative Methods, in: Miettinen, S., Koivisto, M. (Eds.), Designing Services with Innovative Methods: Perspectives on Service Design. University of Art and Design, Helsinki, Finland, pp. 10–25.

Moggridge, B., 2007. Designing interactions. MIT Press, Cambridge, Mass.

Montola, M., 2005. Exploring the Edge of the Magic Circle: Defining Pervasive Games, in: CD-ROM Proceedings of Digital Arts and Culture. Copenhagen. pp. 1–3.

Moritz, S., 2005. Service Design: Practical access to an evolving field. Köln International School of Design, London.

Mosleh, S.S., Schmidt, N., Teisanu, T., Lucero, A., 2015. EgoFlecto: Stimulating Being Calm and in Control Through Self-reflection in the Context of Driving, in: Proceedings of the 19th International Academic Mindtrek Conference, AcademicMindTrek '15. ACM, New York, NY, USA, pp. 92–97. doi:10.1145/2818187.2818276

Mostafa, A.E., Inkpen, K., Tang, J.C., Venolia, G., Hamilton, W.A., 2016. SocialStreamViewer: Guiding the Viewer Experience of Multiple Streams of an Event, in: Proceedings of the 19th International Conference on Supporting Group Work, GROUP '16. ACM, New York, NY, USA, pp. 287–291. doi:10.1145/2957276.2957286

Mueller, F. "Floyd," Edge, D., Vetere, F., Gibbs, M.R., Agamanolis, S., Bongers, B., Sheridan, J.G., 2011. Designing sports: a framework for exertion games. ACM Press, p. 2651. doi:10.1145/1978942.1979330

Mueller, F., Gibbs, M.R., Vetere, F., Edge, D., 2014. Supporting the Creative Game Design Process with Exertion Cards, in: Proceedings of the 32Nd Annual ACM Conference on Human Factors in Computing Systems, CHI '14. ACM, New York, NY, USA, pp. 2211–2220. doi:10.1145/2556288.2557272

Nelson, H.G., Stolterman, E., 2012. The Design Way: Intentional Change in an Unpredictable World, Second edition. ed. The MIT Press, Cambridge, Mass.

Nielsen, J., Molich, R., 1990. Heuristic Evaluation of User Interfaces, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '90. ACM, New York, NY, USA, pp. 249–256. doi:10.1145/97243.97281

Nisi, V., Costanza, E., Dionisio, M., 2016. Placing Location-Based Narratives in Context Through a Narrator and Visual Markers. Interact. Comput. doi:10.1093/iwc/iww020

Nissen, B., Bowers, J., Wright, P., Hook, J., Newell, C., 2014. Volvelles, Domes and Wristbands: Embedding Digital Fabrication Within a Visitor's Trajectory of Engagement, in: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS '14. ACM, New York, NY, USA, pp. 825–834. doi:10.1145/2598510.2598524

Norman, D.A., 2010. The Research-practice Gap: The Need for Translational Developers. interactions 17, 9–12. doi:10.1145/1806491.1806494

O'Kane, A.A., Rogers, Y., Blandford, A.E., 2014. Gaining Empathy for Non-routine Mobile Device Use Through Autoethnography, in: Proceedings of the 32Nd Annual ACM Conference on Human Factors in Computing Systems, CHI '14. ACM, New York, NY, USA, pp. 987–990. doi:10.1145/2556288.2557179

O'Keefe, B., Benyon, D., 2015. Using the blended spaces framework to design heritage stories with schoolchildren. International Journal of Child-Computer Interaction 6, 7–16. doi:10.1016/j.ijcci.2016.02.001

Oulasvirta, A., Kurvinen, E., Kankainen, T., 2003. Understanding Contexts by Being There: Case Studies in Bodystorming. Personal Ubiquitous Comput. 7, 125–134. doi:10.1007/s00779-003-0238-7

Oxjam: Mastermind a massive night of music in your town | Press releases [WWW Document], n.d. . Oxfam GB. URL http://www.oxfam.org.uk/media-centre/press-releases/2016/02/oxjam-mastermind-a-massive-night-of-music-in-your-town (accessed 8.8.17).

Parasuraman, A., Zeithaml, V.A., Berry, L.L., 1985. A Conceptual Model of Service Quality and Its Implications for Future Research. Journal of Marketing 49, 41–50. doi:10.2307/1251430

Peer, A., 2017. The Future of User Experience Education. interactions 24, 66–69. doi:10.1145/3095710

Ramsden, D., 2016. Trajectories for UX designers [WWW Document]. This Is DanRamsden.com. URL http://danramsden.com/wp-content/uploads/2016/05/Trajectories_danRamsden.pdf (accessed 7.20.17).

Ramsden, D., 2015. Taxonomies, tags and trajectories: Designing information architecture at the BBC. Presented at the EuroIA.

Reeves, S., Benford, S., O'Malley, C., Fraser, M., 2005. Designing the Spectator Experience, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '05. ACM, New York, NY, USA, pp. 741–750. doi:10.1145/1054972.1055074

Rennick-Egglestone, S., Brundell, P., Koleva, B., Benford, S., Roussou, M., Chaffardon, C., 2016a. Families and Mobile Devices in Museums: Designing for Integrated Experiences. J. Comput. Cult. Herit. 9, 11:1–11:13. doi:10.1145/2891416

Rennick-Egglestone, S., Knowles, S., Toms, G., Bee, P., Lovell, K., Bower, P., 2016b. Health Technologies "In the Wild": Experiences of Engagement with Computerised CBT, in: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, CHI '16. ACM, New York, NY, USA, pp. 2124–2135. doi:10.1145/2858036.2858128

Rennick-Egglestone, S., Roussou, M., Brundell, P., Chaffardon, C., Kourtis, V., Koleva, B., Benford, S., 2013. Indoors and outdoors: designing mobile experiences for Cité de l'espace, in: Proceedings of NODEM 2013. NODEM, Kista, Sweden.

Resmini, A., Lacerda, F., 2016. The Architecture of Cross-channel Ecosystems: From Convergence to Experience, in: Proceedings of the 8th International Conference on Management of Digital EcoSystems, MEDES. ACM, New York, NY, USA, pp. 17–21. doi:10.1145/3012071.3012087

Resmini, A., Lindenfalk, B., 2016. Blended Spaces, Cross-Channel Ecosystems, and the Myth That Is Service, in: Service Design Geographies. Proceedings of the ServDes2016 Conference. Linköping University Electronic Press, pp. 551–556.

Resmini, A., Rosati, L., 2009. Information Architecture for Ubiquitous Ecologies, in: Proceedings of the International Conference on Management of Emergent Digital EcoSystems, MEDES '09. ACM, New York, NY, USA, p. 29:196–29:199. doi:10.1145/1643823.1643859

Rittel, H.W., Webber, M.M., 1973. Dilemmas in a general theory of planning. Policy sciences 4, 155–169.

Rogers, Y., 2012. HCI Theory: Classical, Modern, and Contemporary. Synthesis Lectures on Human-Centered Informatics 5, 1–129. doi:10.2200/S00418ED1V01Y201205HCI014

Rogers, Y., 2004. New theoretical approaches for human-computer interaction. Ann. Rev. Info. Sci. Tech. 38, 87–143. doi:10.1002/aris.1440380103

Rossitto, C., Barkhuus, L., Engström, A., 2016. Interweaving Place and Story in a Location-based Audio Drama. Personal Ubiquitous Comput. 20, 245–260. doi:10.1007/s00779-016-0908-x

Salen, K., Zimmerman, E., 2003. Rules of Play: Game Design Fundamentals. The MIT Press, Cambridge, Mass.

Schnädelbach, H., Rennick Egglestone, S., Reeves, S., Benford, S., Walker, B., Wright, M., 2008. Performing Thrill: Designing Telemetry Systems and Spectator Interfaces for Amusement Rides, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '08. ACM, New York, NY, USA, pp. 1167–1176. doi:10.1145/1357054.1357238

Schofield, G., Bartindale, T., Wright, P., 2015. Bootlegger: Turning Fans into Film Crew, in: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI '15. ACM, New York, NY, USA, pp. 767–776. doi:10.1145/2702123.2702229

Schön, D.A., 1983. The reflective practitioner: how professionals think in action. Basic Books, New York.

Sheridan, J.G., Bryan-Kinns, N., Bayliss, A., 2007. Encouraging Witting Participation and Performance in Digital Live Art, in: Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI...But Not As We Know It - Volume 1, BCS-HCI '07. British Computer Society, Swinton, UK, UK, pp. 13–23.

Shneiderman, B., Bederson, B.B., 2003. The Craft of Information Visualization: Readings and Reflections. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

Shostack, G.L., 1984. Designing Services That Deliver. HBR 62, 133–139.

Stals, S., Smyth, M., Ijsselsteijn, W., 2014. Walking & Talking: Probing the Urban Lived Experience, in: Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational, NordiCHI '14. ACM, New York, NY, USA, pp. 737–746. doi:10.1145/2639189.2641215

Star, S.L., 2010. This is Not a Boundary Object: Reflections on the Origin of a Concept. Science Technology Human Values 35, 601–617. doi:10.1177/0162243910377624

Star, S.L., Griesemer, J.R., 1989. Institutional Ecology, "Translations" and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social Studies of Science 19, 387–420.

Stolterman, E., 2008. The Nature of Design Practice and Implications for Interaction Design Research. International Journal of Design 2, 55–65.

Sundström, P., Baumgartner, A., Beck, E., Döttlinger, C., Murer, M., Randelshofer, I., Wilfinger, D., Meschtscherjakov, A., Tscheligi, M., 2014. Gaming to Sit Safe: The Restricted Body As an Integral Part of Gameplay, in: Proceedings of the 2014 Conference on Designing Interactive Systems, DIS '14. ACM, New York, NY, USA, pp. 715–724. doi:10.1145/2598510.2600882

Tang, J.C., Venolia, G., Inkpen, K.M., 2016. Meerkat and Periscope: I Stream, You Stream, Apps Stream for Live Streams, in: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, CHI '16. ACM, New York, NY, USA, pp. 4770–4780. doi:10.1145/2858036.2858374

Tassi, R., 2009. Service Design Tools: Communication methods supporting design processes [WWW Document]. URL http://www.servicedesigntools.org/

Taylor, N., Bartindale, T., Vines, J., Olivier, P., 2014. Exploring Delegate Engagement with an Augmented Conference, in: Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing, UbiComp '14. ACM, New York, NY, USA, pp. 833–843. doi:10.1145/2632048.2632068

Taylor, R., Bowers, J., Nissen, B., Wood, G., Chaudhry, Q., Wright, P., Bruce, L., Glynn, S., Mallinson, H., Bearpark, R., 2015. Making Magic: Designing for Open Interactions in Museum Settings, in: Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition, C&C '15. ACM, New York, NY, USA, pp. 313–322. doi:10.1145/2757226.2757241

Taylor, R., Schofield, G., Shearer, J., Wright, P., Boulanger, P., Olivier, P., 2014. Nightingallery: theatrical framing and orchestration in participatory performance. Pers Ubiquit Comput 18, 1583–1600. doi:10.1007/s00779-014-0763-6

Turner, P., Turner, S., Flint, T., 2011. Enlightened trial and error. Interaction Design and Architecture(s) IxDetA 13/14, 64–83.

Underwood, J., Luckin, R., Winters, N., 2011. Retelling Stories: Setting Learner Narratives in Resource Ecologies, in: Proceedings of the 9th International Computer-Supported Collaborative Learning Conference, CSCL 2011. ISLS, Hong Kong, pp. 611–615.

van der Linden, J., Rogers, Y., Coughlan, T., Adams, A., Wilson, C., Haya, P., Martín, E., Collins, T., 2013. Evocative Computing – Creating Meaningful Lasting Experiences in Connecting with the Past, in: INTERACT 2013, Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 529–546. doi:10.1007/978-3-642-40483-2_38

van der Linden, J., Rogers, Y., Oshodi, M., Spiers, A., McGoran, D., Cronin, R., O'Dowd, P., 2011. Haptic Reassurance in the Pitch Black for an Immersive Theatre Experience, in: Proceedings of the 13th International Conference on Ubiquitous Computing, UbiComp '11. ACM, New York, NY, USA, pp. 143–152. doi:10.1145/2030112.2030133

Vargo, S.L., Lusch, R.F., 2004. Evolving to a New Dominant Logic for Marketing. Journal of Marketing 68, 1–17. doi:10.1509/jmkg.68.1.1.24036

Velt, R., Benford, S., Reeves, S., 2017. A Survey of the Trajectories Conceptual Framework: Investigating Theory Use in HCI, in: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, CHI '17. ACM, New York, NY, USA, pp. 2091–2105. doi:10.1145/3025453.3026022

Velt, R., Benford, S., Reeves, S., Evans, M., Glancy, M., Stenton, P., 2015. Towards an Extended Festival Viewing Experience, in: Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video, TVX '15. ACM, New York, NY, USA, pp. 53–62. doi:10.1145/2745197.2745206

Vines, J., Clarke, R., Wright, P., McCarthy, J., Olivier, P., 2013. Configuring Participation: On How We Involve People in Design, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '13. ACM, New York, NY, USA, pp. 429–438. doi:10.1145/2470654.2470716

Waern, A., Back, J., 2017. Activity As the Ultimate Particular of Interaction Design, in: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, CHI '17. ACM, New York, NY, USA, pp. 3390–3402. doi:10.1145/3025453.3025990

Wetzel, R., 2017. Developing ideation cards to support the design of mixed reality games (Thesis (PhD)). University of Nottingham.

Wharton, C., Bradford, J., Jeffries, R., Franzke, M., 1992. Applying Cognitive Walkthroughs to More Complex User Interfaces: Experiences, Issues, and Recommendations, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '92. ACM, New York, NY, USA, pp. 381–388. doi:10.1145/142750.142864

Wolf, T.V., Rode, J.A., Sussman, J., Kellogg, W.A., 2006. Dispelling "Design" As the Black Art of CHI, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '06. ACM, New York, NY, USA, pp. 521–530. doi:10.1145/1124772.1124853

Wouters, N., Downs, J., Harrop, M., Cox, T., Oliveira, E., Webber, S., Vetere, F., Vande Moere, A., 2016. Uncovering the Honeypot Effect: How Audiences Engage with Public Interactive Systems, in: Proceedings of the 2016 ACM Conference on Designing Interactive Systems, DIS '16. ACM, New York, NY, USA, pp. 5–16. doi:10.1145/2901790.2901796

Woźniak, P., Knaving, K., Björk, S., Fjeld, M., 2015. RUFUS: Remote Supporter Feedback for Long-Distance Runners, in: Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services, MobileHCI '15. ACM, New York, NY, USA, pp. 115–124. doi:10.1145/2785830.2785893

Yule, D., MacKay, B., Reilly, D., 2015. Operation Citadel: Exploring the Role of Docents in Mixed Reality, in: Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play, CHI PLAY '15. ACM, New York, NY, USA, pp. 285–294. doi:10.1145/2793107.2793135

Zangouei, F., Gashti, M.A.B., Höök, K., Tijs, T., de Vries, G.-J., Westerink, J., 2010. How to Stay in the Emotional Rollercoaster: Lessons Learnt from Designing EmRoll, in: Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries, NordiCHI '10. ACM, New York, NY, USA, pp. 571–580. doi:10.1145/1868914.1868978

Zimmerman, J., Forlizzi, J., Evenson, S., 2007. Research Through Design As a Method for Interaction Design Research in HCI, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '07. ACM, New York, NY, USA, pp. 493–502. doi:10.1145/1240624.1240704

Zimmerman, J., Stolterman, E., Forlizzi, J., 2010. An Analysis and Critique of Research Through Design: Towards a Formalization of a Research Approach, in: Proceedings of the 8th ACM Conference on Designing Interactive Systems, DIS '10. ACM, New York, NY, USA, pp. 310–319. doi:10.1145/1858171.1858228