User-Generated Trails in Third Places

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Abstract
This paper describes user-generated trails as a methodology for research and design of technology in 'third spaces' including museums, transport spaces and urban environments. We provide evidence that technology can help to manage the amount of information users encounter, instead of increasing it, through activities which structure the use of technology. Trails are shown to support meaning-making by providing a scaffolding for users to re-contextualise artefacts they encounter in the world, through interpretations which are links between visitors' and artefacts' contexts, and are generally narrative in form. We describe a conceptual framework for the design and analysis of trails, which is grounded in a rich model of context and a methodology derived from activity theory.

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Introduction
The spaces between work, school and home are typically transitional spaces through which people either pass through or spend brief amounts of time in a given day. They are no less important however, since quantitatively, an individual may spend many hours or days over a lifetime in such transitional spaces; and qualitatively, one may have life-changing experiences in museums, galleries, restaurants, cafés, and even various modes of transport. There is such a multiplicity of 'third spaces' that they can be further divided into many sub-categories.

One simple way of researching and designing for such places is based on space and time, the former usually being nonlinear and the latter always linear and unidirectional. Tracing individuals' and groups' paths through a semi-structured information space results in a simple narrative with quantitative data (number of locations, time spent at each, etc) and qualitative data (what they did or said, what data they accessed or created, whom they interacted with, etc). Portable and embedded digital technologies can now enable an experience analogous to web browsing, with conventions such as bookmarking and keeping a historical record now possible in physical spaces.

Trails

Bush (1945) envisioned the Memex, a technology-enhanced desk containing a wealth of information, with effectively unlimited storage capacity for recording more. The essential feature, however, was its indexing capabilities: "The process of tying two items together is the important thing," according to Bush. A researcher could connect records to make a trail, name the trail, and call it up later.

Based on his concept of trails, many researchers regard Bush as 'the father of hypertext,' and the World Wide Web as a realisation of the Memex, albeit in massively distributed form. Its continued exponential growth, however, comes with an increasing need for editing and filtering, according to Darken and Peterson (2002). Peterson and Levene (2003) propose that third spaces such as museums are analogous to digital hypermedia environments, similarly containing a large amount and wide range of information in various forms, organised in a semi-structured information space which can be browsed in a nonlinear fashion. They envisioned an 'experience recorder' to systematically trace and represent users' paths through a physical space.

An initial implementation of an experience recorder relied on automatic tracking of visitors' locations in a museum. As described in Baker, Roussos and Levene (2006), one version of this system exploits the Bluetooth wireless protocol built into most mobile phones; since each phone has a unique identifier, it can be tracked as it moves around a physical space by means of Bluetooth access points in different locations. Papadogkonas et al (2008) applied such a system in an urban environment. A system with such minimal user interaction has been termed 'non-interactive' (Winters et al, 2005), since users generate data without explicitly using a device or system.

Trails in context

Context has become an increasingly important area of technology research. It usually refers to location awareness, but Dourish (2004) has argued for the social context to be included as well, and in fact in the last few years, socially-aware mobile applications have been increasingly developed in parallel with the rise of social networks on the Web.

Personalisation in mobile technology research usually refers to a device's or application's awareness of, and adaptation to, a user's interests and preferences. This does not usually include the whole of an individual's lived experience, although some such as Gemmell, et al (2005) have sought to capture this complete lived experience using technology. They admit, however, that large amounts of largely unstructured data prove impractical for an individual to catalogue. But trails address exactly this type of problem, by providing a structure for selective recording of activity in context, as well as reflection and editing of that experience, aimed at meaning making.

The model of context we have developed for researching and designing trails is adapted from Falk and Dierking's (2008) contextual model of learning, which conceptualises three overlapping spheres of personal, physical and sociocultural context, as shown in Fig. 1.

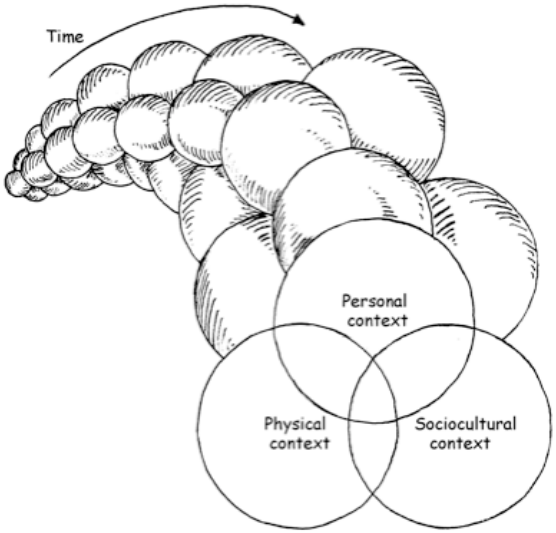

Figure 1. Contextual Model of learning, from Falk and Dierking (2008).

This is supplemented with activity theory, as interpreted by Kaptelinin and Nardi (2006), which has been used widely in the HCI community. Briefly, it focuses on activities as a unit of analysis, looking at goals and motives; a hierarchy of activities, actions and operations; processes of internalisation and externalisation; the development of activities over time; and perhaps most importantly, the mediation of activities by tools. Objects and artefacts attended to by users, as well as the users themselves, are seen to have their own 'activity contexts' based on their design, use and histories.

Our conceptual model, termed TrACE for Trails of Activity Context Encounters, places the personal, physical and social contexts in concentric circles around individual users and the artefacts they encounter in the world; these encounters are mediated by various tools and resources. Through active or passive means of tracing users' locations, we can construct a trail, and at each discrete location, use qualitative data to study the mediated, contextualised relations between users, places and things. The TrACE model is thus intended to depict a rich context of encounters between users and artefacts, in an activity-centred model. Meaning making seen as the bridging of users' and artefacts' contexts, mediated by tools. This model was developed iteratively in three studies, which are described next.

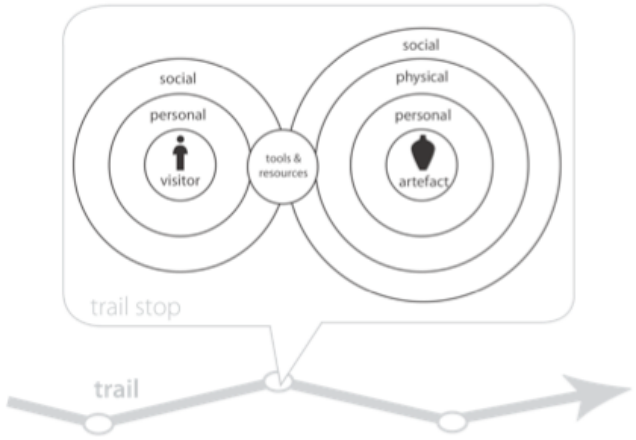

Figure 2. TrACE model for investigating trails in context

Trails through museums

Museums and galleries as third places are regarded as sites of informal learning, and most people go to them expecting to learn something (Falk and Dierking 2000). Most museum visitors are seeking a social as well as

educational experience, with about two-thirds of visitors going to museums with others (Griffiths and King, 2008). Crucial to museum meaning making is linkage — between artefacts and visitors, and between different interpretations and ideas.

Museums are also useful sites for investigating technological interventions, as they are designed and controlled environments, allowing for setup of experimental conditions to a certain degree; and simultaneously they are fluid, 'free-choice' environments in which people move and behave somewhat unpredictably. Embedded and mobile technologies in museums are useful for tracing visitors' trails, and capturing quantitative and qualitative data. Conceptual models such as TrACE provide a framework for evaluating usability, HCI, mediation, meaning making and interpretation in context(s).

We investigated trails created using mobile technologies at several museums of different sizes and types, with visitor groups including adults on casual visits, nine-year-old students on school visits, and teenage students on a group visit. Trails were used not only for data collection but as a design element: visits were explicitly structured as user-created trails, and the mobile technologies, including phones and simple digital audio recorders, were also studied as means of mediating encounters with artefacts. For analysis, we recorded video, audio and stills, observed directly, and conducted post-interviews with students, teachers and garden staff, which were also recorded with video and audio.

The trails were interpreted by participants as resulting from navigation to, identification of, and interpretation of artefacts of interest Handheld tools were seen to embody the trails concept and provoke visitors to externalise their interpretations. Audio was useful for prompting reflection and studying group dynamics.

Having a specific topic lent coherence to the trails constructed. Additionally, within this structure, users were creative in their use of the technology, for example interviewing each other, and capturing a wide range of photographic evidence. They overcame limitations in the technology — for example the inability to upload image and audio simultaneously — by utilising the linear trail structure and constructing trails consisting of, for example, an image containing evidence followed by an audio clip containing en explanation.

The TraCE model helped conceptualise trails as a social re-contextualisation of artefacts from a physical to a virtual context, a process equivalent to the practice of curators, resulting in an emergent narrative. The phenomenon of 'multiple mediation' was evident when, for example, the phone's camera was used to capture information from a printed label. Artefacts were studied not for their own sake, but mediated the topic of the trail — a topic which equated with artefacts' shared social context, as defined by the goal of the activity. Personal roles were shaped by social conditions of the activity, as well as by the capabilities of the technology. The separation of artefact contexts into personal, social and physical was validated, with artefacts' social context for example being defined as their relation to humans. Conversely, personalisation of a trail was defined as the linkage of an artefact's personal context with a user's. And the technology changed the way users experienced the physical context, for example by

prompting them to look closely at plant attributes in order to photograph them, or to articulate descriptions carefully

The specification of a clear goal and product, along with a narrow scope, contributed to understanding of the trails concept, with both dialogue and activity linked to the goal and product. Narrative played a prominent role, linkeing all parts of the conceptual model, and resulted in trails which were both personalised and collaborative.

The TrACE model locates meaning making in the bridging of contexts between users and artefacts. It was found that technology can help bridge the contexts of people and artefacts through a two-way contextualisation. An artefact's personal context was defined as the individual history of its creation, use, collection, preservation and display; its social context is its relation to its original culture in which it was created and used; this generally related it to other artefacts. Artefacts are regarded as having their own fixed physical contexts which visitors move through, though in other instances artefacts can also move across contexts.

In terms of technical development, the main implication from this research is to focus on the design of activities, not technologies. This goes beyond the study of technologies-in-use, as has previously been done in activity theory. The goal-oriented activity of trail construction was embodied in simple, user-carried technologies, which were used, in turn, to construct narrative-oriented products. The use of existing technologies brings flexibility, but also usability challenges, even when technology use is situated in a clearly-defined activity. Thus, scope exists for application design which aids in personalised and collaborative recording, reflection, editing, constructing and sharing of narrative-oriented products such as trails. The museum trails studies are described further in [x]

Trails in transport spaces

We conducted research in various transport spaces as part of an investigation into redesigning the airport security space, for one of the government security services. The design of technological and environmental features was tied to relevant personal, social and physical contexts. We found, for example, that traveller anxiety is more often related to time pressures, procedural issues, or simple fear of flying than to specific security threats, and that reassurance is related more to the environment than to informational messaging. We thus focused not on designing a physical artefact or space, but in effect, human behaviour. Our research thus included not only activity theory and models of context, but also encompassed information theory, cognitive psychology, and research on risk perception.

Specifically, the previous findings from museums were useful in conceptualising what makes a space reassuring and 'programmable.' We conducted research in other transport spaces and found, for example, that travellers unsure where to go often mimic the behaviour of ants, sometimes blindly following other travellers; this related to user-generated trails and informed, for example, design solutions on queuing and personalised navigation on mobile phones. Trails helped focus on the close relation between information and action – a finding echoed by Gibson (1979) in his

theory of affordances. In transport spaces moreso than museums, the journey can be a metaphor for moving through informational space.

Again from the museum research, we learned that designing structured activities is equally important to designing artefacts and environments. However, more relevant in this research was the concept of 'gamification'; this does not necessarily imply making airport security into a game, rather taking key concepts from game structures, such as intrinsic motivation and providing clear and visible goals, feedback and results. Give people credit for thinking, and engage their attention by making the experience active, and interactive. Games also utilise proven structures for experienced users to help novices.

We used methods from the HCI community including the Activity Checklist, which helped us focus on airport users' goals, the physical context, and change over time. We also used experience prototyping (Buchenau and Suri, 2000) to mock up lo-fi solutions.

Trails were useful in planning for the flow of travellers through the airport, conceptualising the journey as a narrative, focusing on activities, actions and operations, and one design solution focused on personalised 'scripts' including scenes with well-defined dialogue as well as more improvised scenes. This was conceived as a mobile application using visual narrative for end-to-end journey planning.

Another solution conceived the journey through the airport as a trail record which could be reflected back to travellers, in this case using narrative scenarios to inform a programming of the space by applying roles to various 'actors' on the security stage and playing out common situations for insight into future needs and developments.

As in museums, fixed and mobile technologies enable tracking of users' paths through airports. So too do they in urban spaces, which we discuss next.

Trails in urban environments

Our current work seeks to build on ongoing work around trails in urban spaces, including 'reality mining' [] and sensory threads []. Using mobile technologies combined with 'reality analytics' [] enables precise tracking, modelling and prediction of people's movements and behaviour in the urban environment. Datasets in this area are not only becoming bigger but richer, for example with gait detection, biometric data including heart rate, EEG and motion data, indoor location sensing, and the capture and sharing of content on social networks. Using context-centric trails models such as TrACE, as well as anthropological approaches such as PolySocial Reality [] and pattern recognition algorithms [] open many opportunities as well as ethical and privacy issues, which we are exploring in experimental, research-grounded design practice

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