Learning Beyond Books – Strategies for Ambient Media to Improve Libraries and Collaboration Spaces as Interfaces for Social Learning

Mark Bilandzic, Marcus Foth
Urban Informatics Research Lab, Queensland University of Technology
mark.bilandzic@qut.edu.au, m.foth@qut.edu.au

Abstract

With the advent of digital media and online information resources, public libraries as physical destinations for information access are being increasingly challenged. As a response, many libraries follow the trend of removing bookshelves in order to provide more floorspace for social interaction and collaboration. Such spaces follow a Commons 2.0 model: they are designed to support collaborative work and social learning. The acquisition of skills and knowledge is facilitated as a result of being surrounded by and interacting with a community of likeminded others.

Based on the results of a case study on a Commons 2.0 library space, this paper describes several issues of collaboration and social learning in public library settings. Acknowledging the significance of the architectural characteristics of the physical space, we discuss opportunities for ambient media to better reflect the social attributes of the library as a place; i.e. amplify the sense of other co-present library visitors and provide opportunities for shared encounters and conversations, which would remain invisible otherwise. We present the design of a user check-in system for improving the library as a physical destination for social learning, sharing, and inspiration for and by the community.

Keywords: Commons 2.0; Library Design; e-Library; Bookless Library; Coworking; Collaboration; Social Learning; Co-presence; Shared Encounters; Serendipity; Urban Informatics; Ambient Media; Embodied Interaction; Locative Media
Introduction

In the digital information age of the 21st century, the significance of library buildings as a physical storage for books and archives is decreasing. Instead, libraries place a stronger focus on providing an information commons place: i.e. an informal learning place that encourages its users to contribute, participate, and engage with the library, its services as well as other library visitors towards a collaborative, social construction, and dissemination of knowledge.

Commons 2.0 [1] refers to a trend that puts a strong emphasis on designing library spaces that accommodate collaborations, meetings, social hangouts, and comfortable work. It suggests spaces that are open, free, convenient, inspiring, and practical; i.e. designed in ways that facilitate open sharing, collaboration, and human interaction, thus fostering the learning principles of social constructivism [cf. 2,3]. Contemporary trends in library building design embrace open architecture approaches such as no walls or only glass between different work spaces, in order to facilitate serendipitous cross-disciplinary discoveries from people who work side-by-side; or reconfigurable furnishing and continuous connectivity through free WiFi to allow flexible formations that suit different modes of interaction and learning, such as individual study, group work, or presentations [4,5].

However, the vision of the library as a public place for collaboration and the co-construction of knowledge is subject to social barriers such as naturally limited interactions between strangers, or simply not knowing “who knows what”. The goal of this paper is to investigate how ambient media can augment the library’s physical manifestation to facilitate shared encounters between library users who could potentially benefit from meeting each other due to shared interests or complementary knowledge.

Over the last couple of decades, an established body of research has been concerned with e-library services, i.e. opportunities by information and communication technologies (ICT) to make library services more efficient (e.g. digital indexing and catalogues) as well as being accessible to anyone at anytime (e.g. e-services, digital archives, e-book loan systems) independent of a user’s location and the library’s opening hours. Other studies show how social learning can be enriched through extended interactions by means of virtual channels [6,7]. However, there is only limited research into how digital technologies can facilitate the sharing, collaboration, and social construction of knowledge in and through a physical place.
This paper aims to fill this gap by identifying untapped potential for ambient media in physical library spaces, in particular “embodied hybrid media” that takes advantage of both digital ICT and the physical architecture of the library. The remainder of the paper is structured as following:

We first present our insights derived from a case study on The Edge at the State Library of Queensland in Brisbane, Australia – a bookless library that was designed with Commons 2.0 in mind. We identify two main challenges for collaboration and social learning as perceived during users’ everyday visits in our case study. In our theoretical framework section, we discuss relevant theories in the domains of place, people, and technology, and shed light on several challenges and barriers for social learning in libraries and collaboration spaces. Based on a discussion of Web 2.0 technologies and locative media, we suggest four design strategies for ambient media to improve library and collaboration spaces as interfaces for social learning. An example scenario is presented to illustrate how ambient media design can bridge social and spatial barriers and enable users to engage in social learning activities, in particular with the ideas of sharing, collaboration, and social constructivism in mind.

**The Challenges of Collaboration and Social Learning in a Public Library**

The paper presents a design idea that is both theoretically informed and driven by the analysis of empirical data gathered in a previous study at The Edge (http://edgeqld.org.au/), an initiative of the State Library of Queensland (SLQ) in Brisbane, Australia. In order to illustrate the issues addressed by this paper, we briefly outline several core findings of our study at The Edge.

The Edge represents a tangible example and prototype of a new engagement concept as part of SLQ’s evolution in the digital information age. Officially labelled as a ‘Digital Culture Centre’, The Edge maintains the library’s traditional values as a physical hub for knowledge and information, not through books and information archives but as a “hub for both planned and incidental collaboration – people stumble upon each other and create new possibilities that wouldn’t have existed otherwise” [8]. As such, it aims to foster co-creation and the social construction of knowledge.
Much of The Edge’s physical environment was designed according to Commons 2.0 principles [1]. The Edge’s designers explicitly envisioned and designed its environment, services, and programming to facilitate an interactive and collaborative culture with and among its visitors. It provides an open and pleasing physical environment that accommodates group work, meetings, presentations, and social gatherings. In fact, the technical as well as architectural setup and interior furnishings at The Edge were explicitly designed with collaboration and open sharing in mind (Figure 1). The physical space aims to facilitate social interaction, discussion, and collaboration; e.g. lounges and couches, a presentation hall, a coffee and snack bar, and technical infrastructure including networked computers, projectors and projection screens, and free Wi-Fi.

The goal of this carefully-designed place and cutting-edge technical infrastructure is to attract, support, and nourish a community of primarily young people (the target group is 15-25) to meet, explore, experience, learn, and teach each other creative practices in various areas related to digital technology and the arts. The Edge was launched in February 2010 as the first institution of its kind in Australia.
Figure 1: The Edge was designed with collaboration and open sharing in mind. The physical architecture and interior design invite for the collaborative activities and coworking of users.

For our case study at The Edge, we engaged in five months of ethnographic research, resulting in more than 70 informal conversations as well as 30 audio-recorded interviews with selected visitors during their informal everyday visits and activities. The observations and interviews were made at different times and days during the week. Our aim was to understand how people make use of The Edge as a public space that is explicitly dedicated to collaboration and peer-to-peer learning. The findings indicate that The Edge, following a Commons 2.0 concept towards a community-driven centre for digital culture, struggled with two issues: (1) The Edge’s physical environment does not communicate its purpose particularly well; it has a lack of perceived affordances [9] for users to retrieve, access, and benefit from the community of other users as an information resource; and (2) unlike the access to information from a book or Internet resource, approaching co-present library users for conversation or collaboration is subject to social barriers. Figure 2 and the following two sections describe those issues in more detail.
Lack of Perceived Affordances to Gather Information From the User Community

At the beginning of the 20th century, libraries adopted an open access model that allowed users to freely walk around and browse shelves for books according to their interests. As Dahlkild points out, “… the users could find and read the books they were looking for, but they could also stumble upon something unexpected. These possibilities were important aspects of a new type of library and a new library identity that the room itself both expressed and contributed to create” [2, p. 20]. The books, as integral parts of the interior design, communicated the function of and conceived activities within the library as a place. Catalogues and themed signs reveal what digital and physical resources are available, and what topics and domains they cover. Such affordances, as Björneborg observed, enable visitors to engage in convergent (goal-directed) and divergent (exploratory) information behaviour [10].

In contrast, the conceived value of new library approaches around Commons 2.0 spaces is primarily in social interactions within the user community, in human rather than physical or digital resources. The emphasis is on social learning, collaboration, and interaction rather than isolated study. However, in contrast to pointers and affordances that direct users to physical and digital resources [11], the physical environment of most libraries does not communicate much about the user community and the resources it has to offer. Library spaces that went entirely bookless such as The Edge struggle to convey the Commons 2.0
vision. In our study we found that users, in particular first time visitors, are often confused about what The Edge is and what one can do there. Some of the visitors, as we observed, do not even enter the space, but leave half way in. That issue may partly be a PR and marketing problem; the public needs time to understand the concept of information commons being embodied into a physical place, as opposed to the common, traditional perception of the library as a place to grab a book and read, or engage in self-study. However, similar to books, signs, and catalogues in traditional libraries, we argue that the physical environment of future library and collaboration spaces must provide perceived affordances that enable users to retrieve and access information from the community of other library users. It needs to promote and facilitate access to its user base as a social interface for gathering new information and knowledge.

The Edge, even though its physical architecture, interior design, and infrastructure are perfectly set up to host collaborations, discussions, presentations, and other forms of peer-to-peer learning interactions, is rather poor with communicating available human resources (e.g. skills, knowledge, experiences, etc.) to the user through other co-present users (i.e. goal-directed behaviour) or providing inspirations (i.e. exploratory behaviour) on a discursive layer; e.g. insights into themes, topics, and ideas through co-present users’ practices and activities in relation to digital technologies and culture. Such information might be partly available through the website and dedicated user groups on social platforms such as local Wikis or Facebook, but is not apparent for users who visit The Edge in its physical building. The space appears to be rather generic, and other than during occasional events, exhibitions, and presentations, it does not provide much food for thought or encourage exploration, like themed bookshelves do in a traditional library.

This gives rise to our first design question (DQ1): **How can the physical environment of a collaboration space better reflect the community of co-present users as a resource for information?**

**Interaction Between Unacquainted Users is Subject to Social Barriers**

Our observations indicate that, even though the interior of the building is open with no walls or physical barriers between different workspaces, a social barrier remains for interaction between visitors. As a space that is open to the general public, hundreds of people walk in and out of The Edge on a daily basis. Hence, the social atmosphere is similar to a public
place, where most of the co-located users are unknown to each other or ‘familiar strangers’ [12,13], with little or no history of interactions. Users tend to work next to each other, rather than with each other. People that collaborate in groups have mostly met each other before and visit The Edge together as a group. Serendipitous encounters and connections between unacquainted Edge visitors, on the other hand, are rare. Our argument is not that every visitor has to engage in social interaction and collaboration, or that books and other information resources should be neglected. However, when many like-minded, creative individuals from various backgrounds and disciplines share a physical space such as The Edge, there is a lot of untapped potential for each individual to be inspired and enriched by the community of fellow users. A Commons 2.0 space that builds on the ideas of social learning and co-construction of knowledge should allow users to bridge natural social barriers. We believe that animating the socio-cultural space with ambient media design interventions must foster direct and indirect social interactions between users that could ultimately lead to a learning experience. This forms our second design question (DQ2): How can collaboration spaces facilitate shared encounters and conversations, hence nourish an interactive, engaging, and collaborative culture amongst its users?

**Theoretical Framework**

The following sections describe relevant theories for our design questions from three different viewpoints: place, people, and technology. The theories in the first two sections (place and people) shed light on the potential spatial and social roots of the challenges described in our case study above.

Informed by those theories, the third section (technology) provides insight into opportunities created by ICT and ambient media to address our two design questions, and suggests design strategies presented in the next chapter.

**Place: Architecture for a Sense of Place**

Our spatial experiences are shaped by both the geometrical characteristics of the spatiality as well as the socio-cultural context of a place.

The goal of architects, when designing buildings and spatial infrastructure, is to facilitate activities, practices, and social interactions particular to the vision and function of a place.
Churches and temples communicate a sense of spirituality, facilitating an engagement in spiritual activities and praying; offices facilitate efficient work; and people often arrange their homes to facilitate relaxation. In this context, Lawson discusses architecture and urban spaces as “containers to accommodate, separate, structure and organize, facilitate, heighten and even celebrate human spatial behaviour” [14, p.4]. John Ruskin [15] emphasises the “eloquence of architecture.” He suggests that there are more abstract things we want from buildings beyond just providing shelter in a physical sense; we want buildings to speak to us. Architecture, from this point of view, can be regarded as an object of design with a goal to communicate a message or, in De Button’s words, to provide “an impression of the psychological and moral attitudes it supports” [16, p. 76]. Alexander et al. [17] proposed patterns guiding the design of physical infrastructure towards supporting particular social activities, such as a city plaza for a relaxing walk or serendipitous social encounters.

Social and cultural theorists on the other hand remind us that people’s perceptions of a ‘place’ are not only about location, and the spatial infrastructure and characteristics as laid out and designed by architects and other people in ‘power’, but more so socially produced [18-21]. The practices, activities, memories, and meanings that people collectively attach to a space turn it into a place [22,20]. Such social and cultural traditions that define a place establish behavioural norms that are considered appropriate for that place [22], and eventually shape a particular ‘sense of place’ [20].

The infrastructure and characteristics of ‘space’, and the notions of ‘place’ that are socially produced within that space, are often intertwined and impact each other.

Brand [23] provides examples of how the physical appearance of houses, as well as the socio-cultural circumstances and inherent everyday life practices of different generations of people who occupy these houses, affect and shape each other over time. “First we shape our buildings, then they shape us, then we shape them again – ad infinitum” (p. 3). Over time, culture is embodied in the architecture of a place and vice versa.

In contrast to Brand’s observation of how buildings naturally evolve and carry clues about their inhabitants over different generations, in our case study at The Edge, the conceived culture and practices that the building was designed for are not being morphed into the physical environment. Edge users can book dedicated working areas for a designated time, and, as per the house rules, need to tidy the areas afterwards. They take their projects,
materials, and tools with them when they leave. Hence, the physical environment at The Edge is always tidy and does not reveal any interaction history or social cues of other people’s previous activities in the space. For visitors it may feel like a sterile, tidy, clinical-like environment, which can create uncertainties about the purpose of the space and what one can do in it – they lack a ‘sense of place’. There are few opportunities to get inspired, curious, and interested through the physical environment or people’s previous activities (Figure 3).

Figure 3: The house rules in public libraries dictate that users to tidy up before they leave the space – users take their projects, materials, and tools with them, leaving no interaction history or social cues of their activities for other people in the space.

For example, if people could book a working area in which to work on particular projects over a couple of weeks or months rather than hours, the physical environment would presumably look more messy with tools, materials, and project sketches lying around, hence revealing social signifiers [24] about people’s domains of practices and creative activities. Rather than looking sterile, such social signifiers would endow the space with opportunities for inspiration, discovery, and learning, similar to how themed bookshelves and catalogues reveal physical and digital information resources in the library. Allowing the user to take
ownership of the space and leave marks of their interactions, activities, skills, and areas of interest would enable others to gain insights into the community of users at The Edge, hence facilitating practices of mutual inspiration, sharing, and social learning.

**People: Social Behaviour in Public Places**

Social behaviour in public places, especially when it comes to social encounters between strangers, follows established social rules [25]. The transition from people merely being co-present in the same physical space to actually engaging in a face-to-face interaction is a complex social process influenced by preconditions such as acquaintanceship, accessibility, or cognitive and social recognition (pp. 131). The general norm, as Goffman states, is that “acquainted persons in a social situation require a reason not to enter into a face engagement with each other, while unacquainted persons require a reason to do so” (p. 124). Similarly, studies that have explored the spatial behaviour of unacquainted people who share the same physical space, such as in a train [14, p.136] or public library setting [26], have found that people spread out as much as possible, usually occupying the space in a way to maximise distance and minimise eye-contact. Given The Edge is a public place that is open to all members of the general public, it cannot be expected that spontaneous and serendipitous face-to-face collaboration among strangers will naturally become a behavioural norm.

Goffman presents different modes of interaction between strangers in public spaces, i.e. unfocused and focused interaction. Unfocused interaction is “the kind of communication that occurs when one gleans information about another person present by glancing at him, if only momentarily, as he passes into and then out of one’s view.” [25, p.24]. Focused interaction on the other hand involves forms of communication where two people have a “single focus of cognitive and visual attention,” such as a conversation, discussion, or playing a board-game. Such situations, in which two or more people engage in a focused interaction, Goffman refers to as face engagements or encounters (p. 89).

Both focused and unfocused interactions facilitate the building of a perceived sense of place, and a sense of the community that populates that place. An architecturally open environment with little physical barriers for visual contact between strangers facilitates unfocused interactions. However, unfocused interactions between strangers do not naturally evolve into face-to-face encounters. Unacquainted people in public places need a reason to start a focused interaction. For example, a mutual sense of connectivity to a particular group
provides a socially accepted reason to start a conversation. A person who recognises a fellow compatriot at a distant holiday destination would be in such a situation, or two random strangers that meet at a house party, where it is a mutual understanding that everyone is somehow connected to the host. Another basis for mutual accessibility [25, p.104], such as a person being exposed to a potential encounter with a stranger, is enabled by what Goffman refers to as “open regions” (p. 132); i.e. a physically bounded place (e.g. a bar or discotheque), where the initiation of a face-to-face conversation with strangers is part of the behavioural norm.

The architectural infrastructure of a place can minimise physical barriers and hence encourage open sharing, interaction, and collaboration, but is insufficient to nurture a socio-cultural environment where users feel comfortable starting interactions, collaboration, or even informal chats with co-located others. Similar to the way in which people’s selections of clothes can reveal their social status (expensive brands) or particular interests and preferences (e.g. a music fan shirts or motorcycle jacket), a physical intervention could reveal cues about people’s interests and backgrounds in relation to digital culture, hence providing an ‘ice-breaker’ for conversation with like-minded others.

Gordon and de Souza e Silva [21] illustrate how both the physical and digital space (e.g. geo-tagged content, location-based mobile services, location-based social networks, etc.) contribute to how people make sense of, negotiate their everyday activities and practices in, and attach meaning to a place. How can these two powerful means – architecture and social media – be combined to better facilitate shared encounters that lead to collaboration and peer-to-peer learning activities in library spaces? The goal of a design intervention at a Commons 2.0 place would contribute to it being perceived as an “open region” for finding collaboration and peer-to-peer learning partners.

**Technology: Ambient, Embodied and Hybrid Media**

This section discusses a set of technologies that promises effective tools to tackle several spatial and social challenges of social learning in collaboration spaces, as presented above.

**Web 2.0 and Collaboration**

The term Web 2.0 stands for a second-generation of web services that facilitate collaboration and sharing between users. Web 2.0 platforms and social networks such as blogs, Wikipedia,
YouTube, Flickr, and Facebook are more open, collaborative, personalisable, and therefore participatory than the previous Internet experience [27]. Web 2.0 services provide means for users to engage in a participatory culture that is no longer limited to the technically versed or the civically inclined. This has meant that the strict borderline between information providers and consumers is blurred, which has triggered a trend of entirely community-driven web services [28].

Scholars such as Jenkins [29] and Burgess et al. [30] identified socio-technical trends towards a wider (‘vernacular’) ability of people to participate in digital culture through personal expressions of creativity. According to Kolbitsch & Maurer [31], such participatory qualities of Web 2.0 encourage ordinary users to make their knowledge explicit and develop a collective intelligence [32]. Such participatory design principles that have shaped Web 2.0 as a ‘Social Web’ [33] have been combined with location-based services and translated for mobile user scenarios [34]. Elsewhere [35,27], we provide an overview of studies about people’s use and practices of such mobile and locative media in their everyday lives. Foth et al. [36] argue that such capabilities present diverse possibilities for a profound urban epistemology to evolve in an urban context. For example, mobile users collectively tag, rate, and recommend restaurants, cafés, and other public places, crafting and nourishing a digital information layer that augments the urban physical infrastructure in real-time. The ubiquitous connectivity to this collective intelligence through mobile devices informs and affects people’s socio-spatial practices and interaction patterns in urban environments.

People are enabled to connect, interact, and share knowledge in a local context beyond physical and temporal barriers. In doing so they form what is referred to as ‘net localities’ [cf. 21]. Previous research illustrates the potential of social media to enrich collective place-based social interactions [37], animate place-based engagement among general members of the public [38], or facilitate encounters between people with complementary interests in various contexts; e.g. business [39], dating [40], socialisation [41], conferences [42], or car pooling [43].

In terms of social interaction, such locative media create a digital layer on top of the physical world affording new practices for social interaction that would not be possible otherwise; they bridge spatial, temporal, and social barriers, and hence render the physical world to a more socially translucent space.
Information about co-present people gathered through unfocused interactions is not limited to physical appearance or clothes, but also revealed through location-annotated data from social networks. People can for example identify other co-present people with mutual interests, complementary skills, or shared affiliation with particular social groups or community. Mobile social network applications [44] enable users to ‘check-in,’ i.e. digitally confirm their physical presence at a particular place. People can see where their friends have checked-in as well as any background information of those that have checked-in in their immediate proximity. In relation to Goffman’s theory of encounters in public space, the presentation of such data in the physical space provides a design space to facilitate unfocused interactions between co-located people which, in turn, can lead to focused interactions and potential discoveries of collaboration and peer-to-peer learning opportunities.

*Ambient and Embodied Media*

According to Lugmayr, ambient media are media that “convey knowledge distributed in time and space throughout the natural environment of consumers through a digital overlay morphing with physical daily objects” [45, p.338]. He further distinguishes between different ambient media *forms*, depending on how an ambient medium is manifested in the real world, the ways its digital and physical components are morphed, and how they interplay with the user.

In the context of augmenting the library as a physical place, ambient media that materialise digital information as observable and sometimes interactive parts of the physical environment seem particularly relevant. Informed by previous research on embodied interaction [46], we refer to such ambient media forms as *embodied media*. Embodied media convey a meaning relevant to the situated context of the particular place. Similar to augmented reality [e.g. 47], embodied media enrich the real through the digital, but do this so that the digital layer is made visible and accessible as a shared property of the space itself, rather than rendered through a head-mounted display or other personal mobile device. As such, embodied media are visible and accessible to everyone who is physically present [48], thus having the potential to enrich the *collective* situated experience of people at that place [e.g. 49].
Combining assets and affordances of the physical as well as digital space, we see embodied media creating an *embodied hybrid space* (Figure 4). The embodied hybrid space is manifested in the physical environment, but uses digital assets to enable people to bridge spatial, temporal and social barriers for social interaction. By means of ‘making the invisible visible,’ they can communicate relevant social information (potentially leading to valuable situated interactions) in the real world that would remain invisible otherwise. Social navigation [50-54], serendipity [42], or shared encounters [55] are examples of social interactions that have previously been successfully mediated in virtual and mobile information spaces.

In terms of ambient media, previous research on public display has shown that it can trigger informal conversations [56] and a sense of community in organisational settings [57]. However, research that informs the design of ambient media to facilitate shared encounters in an informal learning context is still rare. We collaborate with a colleague from architecture to inform such ways of designing ‘hybrid’ learning spaces; i.e. spaces that facilitate learning experiences through physical as well as digital means [58].

**Design Strategy**

By way of morphing the digital and the physical space, embodied media can leverage both: (1) the power of social media to provide an asynchronous channel for discourse, and build up and store a collective intelligence within the community of users; and (2) the power of its ambient visibility in the physical world to not only emphasise the user community as the
core function and resource for information gathering and the acquisition of new skills and knowledge, but also provide inspiration about relevant themes, topics, and discussions. For example, it can achieve this by displaying social hints, interaction histories, or the interest profiles of other users in the space. Informed by the above theories and discussion, we suggest the following design strategies (DS) for ambient media towards enriching the human interfaces with libraries and other collaboration places:

- DS 1) Provide means that enable users to share and make their skills, knowledge, and expertise available to fellow users.
- DS 2) Provide means that enable users to retrieve the skills, interests, experiences, and areas of expertise of fellow users (convergent information behaviour).
- DS 3) Provide means that allow users to browse, discover, and serendipitously stumble upon the interest domains, activities and practices of fellow users (divergent information behaviour).
- DS 4) Provide means that lower the social barriers for unacquainted library users to facilitate conversations with each other.

In the following we outline a first draft of an ambient information system that embodies these strategies. We expect this plan to be further shaped or even changed through the iterative process of action planning, action taking, and evaluation on site.¹

The system enables visitors to virtually ‘check-in’ at The Edge and a network of different working areas at The Edge (e.g. using their swipe-card ID or a mobile phone application). Visitor can complete an online form with their interests, skills, areas of expertise, and other profile information that they would like to share (DS 1). Keeping track of ‘checked-in’ visitors, the system displays a visual patchwork of aggregated information: for example, who are the people who currently hang out at The Edge? What are their backgrounds, interests, and key areas of expertise? What projects are they working on and what questions are they currently struggling with? Who of the users is busy, and who is happy to be approached with a question? Public screens and projections feed such social information from the check-in

¹ We describe the process and nuances of combining such iterative participatory design and action research cycles in the context of designing for members of the general public in a methodology framework that we call Participatory Action Design Research [59].
system, and dynamically display the available knowledge and social capital at The Edge in real-time (Figure 5).

Figure 5: A “check-in” system feeds ambient displays and projectors with information about currently co-present users, using their profile information such as skills or areas of expertise.

Every time a new user checks-in, the visualisations update according to the knowledge and assets that the particular user possesses (DS 2). Interactive visualisations aggregate the areas of expertise, knowledge, skills, and current projects by all users and adapt to the interests of the particular user who approaches the display, allowing for serendipitous discoveries and in-situ encounters (DS 3). Visitors who check-in at The Edge can specify whether they are happy to be approached or if they prefer to work alone. Ambient façades [60,61] installed in the user’s work area or wearable displays [e.g. 62,63] worn by users glow in green or red, depending on the option that was selected. This helps fellow users to identify fellow users with complementary interests, skills, or knowledge, and ice-break conversations according to the users’ availability (DS 4).
Figure 6: Ambient and public displays mediate a sense of co-present users at The Edge and facilitate shared social encounters and serendipitous discoveries.

The focus is set on the visitor base, promoting The Edge as a hub of creative people and their knowledge and expertise in topics relevant to any form of digital culture. Rather than highlighting the infrastructure and technical equipment, it promotes The Edge as a space that is socially produced by and through visitors [19]. New visitors who enter The Edge get a glimpse of the profiles and knowledge of other visitors who are or who have recently been at The Edge (Figure 7). The items can, for example, be presented in a tag-cloud while the size of keywords is determined by the number of people and level of expertise these people have in their given fields (Figure 6). Such visualisations give visitors a sense of the dormant capabilities available at the place in the form of people’s skills, experiences, know-how, and other intangible assets and resources. They also strengthen the identity of The Edge as a place defined through the diversity of its visitors and their activities, illustrating new opportunities that originate from this diversity.

In contrast to most previous work on digital projections onto physical buildings [e.g. 64], the focus of this study is not simply on digitally augmenting the building in an artistic way, but rather enlivening it to convey relevant information about its current status, activities, people, social encounters, and the like which are happening inside the building. The design of the
installation would follow the paradigms of public and ambient displays [65-70], conveying information in an unobtrusive, non-distracting, yet visually appealing way.

Combining the in-situ advantages of the physical space with the benefits and ‘social translucence’ of digital ICT and social media, the overall aim is to explore how ambient media can augment the notion of The Edge as a place-based knowledge community. The aim is to increase the advantage of being physically present at The Edge by visually articulating the diversity of what has so far only been an imagined community [71]: i.e. increasing exposure to a variety of topics embodied in the community, affording links to particular individuals within this community, and highlighting points of commonality and difference (Figure 7).

Figure 7: A projector displays background information about currently checked-in visitors at The Edge. The visualisations present the in-situ social capital available in real-time.
Use Scenario

As Johnny enters The Edge, he briefly touches the check-in terminal with his membership card at the entrance. The RFID chip inside the card transfers his ID to the check-in system, confirming his presence at The Edge.

Digital wallpapers and public displays within The Edge update their content with Johnny’s profile information, showing for example that he has expertise in digital photography, especially high dynamic range (HDR) and Photoshop (DS1). As he walks through the corridors, he proudly checks the wallpapers that now display several example shots that he uploaded last week onto his Flickr profile page, as well as links to his blog and YouTube videos describing the basics of the techniques used in each shot.

His entry on the digital wallpaper is among a patchwork of pictures, videos, descriptions, and links posted by other visitors of The Edge. As he browses through the posts, he discovers an entry by someone about a project with Arduino microcontrollers (DS3). Johnny has heard of Arduino, and the new possibilities that this open-source hardware platform provides to high-speed photography. In one of Johnny’s projects as a freelancer he is working for a still water distributor, and for a poster advertisement he imagined taking a shot of a water drop hitting a still water surface. Such fast movements cannot be captured manually, and that is where an Arduino microcontroller can help trigger an automatic flash. He has read tutorials and descriptions in online forums, but as a photographer without previous programming experience, it has been hard for him to fully grasp the required knowledge. Tapping the Arduino post on the digital wallpaper opens additional information about Angie, the author of the post (DS2). It indicates that Angie usually visits The Edge every Tuesday around 5pm. Through the contact form he writes Angie a message describing his interest in Arduino, and if it is okay to catch up next Tuesday for a chat (DS4). Johnny also subscribes to Angie’s blog and Twitter feed to obtain her latest updates.

Later, Johnny discovers a check-in system post on the wall saying that there are two people currently checked-in from the HDR photography fan group on Facebook (DS3). Being a member of this group himself, he wonders who the other person is. Tapping on the group’s name, a little green light indicates that Ana is currently checked-in at work desk 5 (DS4). Johnny decides to approach desk 5 and ask Ana about her software of choice for creating
HDR photos. He has worked with Photoshop but is interested to see what alternatives people use these days. The fact that Ana’s light was green and not red gives him confidence that he will not disturb her in an important task.

After talking to Ana, Johnny moves on to another work desk to work on his assignment for university. After a while he receives an instant chat message from The Edge check-in system which notifies him of an incoming call through the conference system at his desk: “Someone would like to talk to you in regards to your expertise in Photoshop. Would you like to receive the call?” Johnny remembers that he has ticked the box on his Edge profile that he is happy to be tracked when at The Edge and provide help for others in relation to his areas of expertise (DS2). The check-in system logged the check-in at his desk and published his areas of expertise live on The Edge website. Visitors of The Edge website can, if they are interested, click the “Call now” button to establish a live conference call to the respective work area.

Johnny, always happy to share his knowledge and nurture the Photoshop community, clicks on “Yes”. It is Andy, a high-school student on the other end of the line, who has a question about a Photoshop assignment for school. Johnny gives him a quick introduction to the layering system to help him complete the assignment. He also gives him a reference to a good Photoshop introductory book and a couple of links to introductory Photoshop videos on YouTube (DS1).

**Conclusion and Further Work**

Public libraries in their traditional role as public living rooms, i.e. open, free, and shared physical spaces for people from various backgrounds, skills, and interests, have a huge potential to facilitate spill-over effects and the cross-fertilisation of ideas, knowledge, and creativity between their users.

The point of departure for this research was to investigate how ambient media can facilitate shared encounters between users of public libraries. Based on a case study environment, we outline two main barriers for users in library spaces to engage in collaborative practices along the vision of Commons 2.0. Firstly, the physical environment has a lack of perceived affordances for users to retrieve and access skills, knowledge, and experiences that other co-present users might possess. Secondly, approaching co-present library users for conversation or collaboration is subject to social barriers.
Based on Goffman’s theory of social behaviour in public places, and theories on the role of architecture as part of what people perceive as a ‘place’, we suggest four design strategies for ambient media designers to tackle those barriers. We outline the system overview and use the scenario of a user ‘check-in system’, incorporating the strategies and describing ways for ambient media to facilitate shared encounters and a better sense of the presence of other library visitors.

We will continue this work by implementing the check-in system and evaluating it ‘in the wild’ at our case study environment. We will attempt to answer several questions: how will the system impact interactions of unacquainted, co-located users in the library space? Will it trigger shared encounters, conversations, and interactions between people that would not happen otherwise? How will the system affect people’s perceptions and awareness of the user community in the library? Is it capable of providing serendipitous discoveries and inspirations based on other users’ interests and activities in the space? We also expect the evaluation to provide insights into new issues as a result of introducing such a system; e.g. users’ privacy or distraction. Further work will require continuous participatory design and iterative cycles of action and design research to organically shape the system towards an embodied element of libraries’ physical and social space.

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