Supporting Community Participation in Interactive Exhibits

Taylor, Nicholas

Published in:
PerDis '14

DOI:
10.1145/2611009.2611031

Publication date:
2014

Document Version
Peer reviewed version

Supporting Community Participation in Interactive Exhibits

Taylor, Nicholas

Published in:
PerDis '14

DOI:
10.1145/2611009.2611031

Publication date:
2014

Document Version
Peer reviewed version

Supporting Community Participation in Interactive Exhibits

Nick Taylor
Eclectric Research Studio
University of Dundee, UK
n.x.taylor@dundee.ac.uk

ABSTRACT
We describe the Byker Lives Table, an interactive installation that aimed to support user-contributed content in an exhibition of community history around a landmark housing development. As both the history of the development and subsequent social problems in the area are contentious issues, we aimed to support discussion around content that might mean very different things to different people. Based on a yearlong deployment, we reflect on the exhibit in terms of its ability to support community participation, create dialogue representing multiple perspectives on the content and allow lightweight curation.

Categories and Subject Descriptors
H.5.0 [**Information Interfaces and Presentation (e.g., HCI)**]: General.

General Terms
Design.

Keywords
Community; heritage; history; museum; interactive surface; tabletop interface.

1. INTRODUCTION
The museum environment is rapidly changing to take advantage of interactive technologies, part of which has meant creating more participatory, user-generated collections. These might take the form of personal interpretations of existing collections, or even entire collections of content contributed by members of the public. However, community-generated celebrations of heritage are not a new occurrence. A shared heritage is one of the core aspects of a sense of community [7] and sharing that history, even an adopted one, creates a sense of identity that defines the deeper bond that marks a community as more than just a collection of individuals. Communities have always celebrated this history, from oral storytelling traditions to photographs displayed in public places, but new technologies are allowing communities to collect, curate and distribute this heritage in new ways and to new audiences. These converging ways of sharing and celebrating heritage pose a number of design challenges for interactive exhibits.

In our research, we turn our attention to how exhibitions of heritage can move out of the museum and into community spaces, where those with a deep connection to the subject matter can tell their own stories. However, a situated exhibition of this kind has a number of competing requirements, not least around inclusivity and curation. With this in mind, we aim to identify how interactive exhibits of community-generated—and to some extent community-curated—content might support the following qualities:

- *Supporting community participation*. To create an authentic representation of the community, it is important to encourage participation from a wide range of voices, not just from the small proportion who are typically active.
- *Multiple perspectives on shared history*. Heritage means different things to different people and we are unlikely to all remember the past in the same way. An inclusive community archive should reflect these different views and provoke discussion and debate where appropriate.
- *Lightweight and inclusive curation*. Community exhibitions must strike a balance between curation, which implies a careful selection of content to present a specific story or experience, and the desire for an inclusive community archive.

Our work is based around a yearlong installation of the Byker Lives Table, an interactive table in a community heritage exhibition in Byker, a neighbourhood in Newcastle upon Tyne, UK. The community has a colourful past, marked by its complete redevelopment by a renowned architect in the 1960s, but has subsequently been troubled by various social issues. Working with a local charity that aimed to celebrate the community's architectural heritage and enable residents to make the most of this value, we developed an interactive table exhibit designed to collect user-generated content and celebrate the community. In this paper, we discuss this installation in terms of the goals set out above and present implications for the design of interactive displays of community heritage.

2. BACKGROUND
Interactive technologies have already had a huge impact on the way that heritage is presented in traditional museums and other public knowledge institutions. Increasingly, static displays of curated content are being presented alongside interactive exhibits that allow visitors to engage with heritage content in new ways. These might include more playful interfaces, or offer access to a much broader range of content than can be physically displayed. While these are often still curated to present a particular

PerDis '14, June 03 - 04 2014, Copenhagen, Denmark

ACM 978-1-4503-2952-1/14/06…$15.00.
http://dx.doi.org/10.1145/2611009.2611031

perspective, many also now invite user-generated content that offers news perspectives on historical content.

Researchers have been keen to capitalise on this development and the design of interactive exhibitions for museums and public knowledge institutions has been a common theme in HCI research. Typically, this has included deployments 'in the wild' in real museum exhibitions with interaction and often content from members of the public (e.g. [3][4]). Many of these projects have utilised various forms of pervasive displays, such as museum guides [19], public displays and touchscreens [3], although others have explored novel interactions such as augmented reality [4] and virtual reality [5].

Common amongst many of these projects has been the recognition that co-design of exhibitions between various stakeholders is vital to success [4]. Individual exhibitions do not exist in a void, but rather form part of an overall museum experience that has been carefully curated, but there is a delicate balance to be struck between this curatorial voice and the voice of the public [8], in which we strive to be structured and informative, but also to present an authentic representation of the public. One approach has been for user-generated digital content to form an "additional narrative layer" [9] that augments the traditional presentation without changing it. Amongst the issues addressed by researchers has been how to design for greater public participation and engagement in these exhibitions [11].

However, not all interactive displays of heritage take place in the museum context, reflecting the fact that heritage is social produced and very much embedded in a sense of place [14]. As technology increasingly allows us to author content and to embed this content into places and objects, many projects have demonstrated this in practice. For example, TOTeM [12] augmented items for sale in a second hand store with stories told by their former owners. They found that augmented items were more likely to sell, demonstrating that these stories added meaning and value to every day objects.

In particular, research has referred to the role of communities in "taking ownership of what is valuable to them" [10] bv maintaining their own heritage. This has long been apparent in community networks [17] and other similar technologies, which provide digital facilities for existing communities. As shared history plays such an important role in defining and maintaining communities, these technologies have met with enthusiasm for recording and representing their own heritage. For example, the sharing of community history proved to be one of the major uses of the Blacksburg Electronic Village [6], a community-wide network that was used to, amongst other things, create a living history of the town. When the Wray Photo Display [18] was first deployed, seeded with contemporary photos, residents quickly requested the addition of historical photos, prompting residents with private collections of such photos to share them for the first time, creating a resource that was popular with both residents and visitors. In another example, Campiello [1] was used in an area of Venice overwhelmed by tourism, as a means of allowing residents of the area to assert their identity while simultaneously creating a resource that was valuable to visitors. That each of these resources had a secondary audience outside the community shows both the interest in empowering communities to represent themselves and the value of this content to others.

Our work draws together both the trend towards interactive exhibits and user-generated content in museum installations and the potential for displays of user-generated content within communities. We explore the role of user-generated content in curated collections that are located not in museums, but sited within communities themselves, with the aim of supporting them in communicating their personal stories and creating a record of what it means to be part of that community.

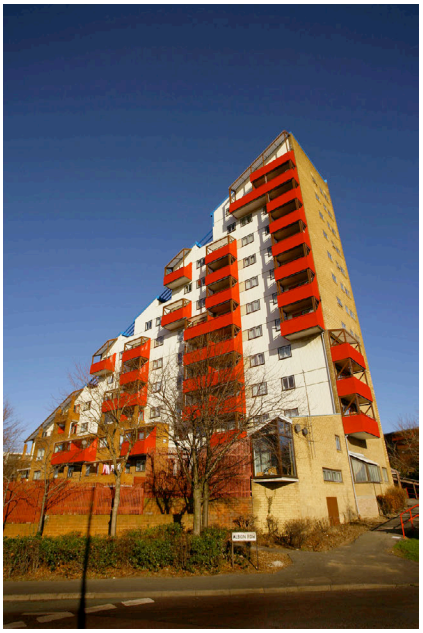

Figure 1. Part of the Byker estate in Newcastle. The estate is notable for its striking architecture.

3. BYKER LIVES

Byker is an area of Newcastle with both historical significance and contemporary social issues. In the 1960s, city planners considered the neighbourhood to be a slum, which was subsequently demolished and replaced with a new estate designed by Anglo–Swedish architect Ralph Erskine [13]. Between 1969 and 1982, he built the Byker estate (Figure 1) designed to stimulate community and, above all, be a pleasant place to live. In contrast to other UK housing developments at the time, Erskine provided public spaces and communal hobby rooms to encourage social interaction and cars were confined to the perimeter road, allowing children to play freely in the streets. Erskine also took a highly participatory approach, setting up his offices in a disused shop on the estate and encouraging members of the public to visit and comment on his designs.

However, there are differing opinions on the success of the redevelopment and it is widely acknowledged that the estate now suffers from a number of social issues. Sirkka Konttinen's photojournalism [15][16], for example, laments the loss of a cohesive community that did not survive the redevelopment. This sense of community has been further eroded by a high turnover rate of residents, as the estate is comprised of council-owned social housing that is often used to re-house problematic tenants from other areas of the city. The diversifying racial makeup of the estate has caused further tensions. Complicating matters, many of the features of the estate are at odds with modern life: communal refuse facilities cannot accommodate multiple recycling bins, installing telephone lines and Internet connections is difficult and a great number of residents now own cars. Threats of demolition due to these issues prompted activists to secure a protected status for the entire estate.

The unique circumstances surrounding Byker have made it a point of interest for architecture enthusiasts, fans of Erskine's ideals, subcultures drawn to its distinctive style and indeed academic researchers. But to the residents of the estate, Byker is not a curiosity, but a home. This attention is not always welcome and residents rarely see any benefit from this external interest.

Our installation formed part of a project run by Northern Architecture, a local organisation planning to work with residents to develop their own story of the history and heritage of Byker and particularly the Byker redevelopment. This had the ultimate goal of helping residents to both appreciate the architectural significance of the estate and find ways to benefit from it. Part of the project was the development of a community heritage centre in an unused shop on the estate itself, which would bring together content from a variety of sources. These included photographs, maps, videos and physical artefacts. The heritage centre was also used as a space for various activities around this content. However, because the exhibition would not include professional-grade storage and because access to original artefacts could not always be guaranteed, the organisers wanted a digital solution that would allow them to present this content despite not having physical copies.

4. INTERACTIVE EXHIBIT DESIGN

The interactive exhibit needed to be designed before the make-up of the exhibition itself and its content were fully known. Consequently, we opted for an interactive table, which would allow us to deploy quickly on existing hardware, while remaining flexible and taking advantage of the increasing adoption and public understanding of multi-touch gestures. In planning meetings, the organisers reported that maps had been one of their most successful ways of engaging with the public, which matched our own past observations while working with interactive tables and large displays in public spaces. This led us to develop a map-based interface, where content could be 'pinned' onto the map in geographically relevant places. Our intention was that a map interface would also embody content with a sense of place, which was a critical part of this exhibition. As the exhibit organisers wanted to be inclusive and were not prescriptive of the types of content that members of the public could submit, we chose to support images, video, audio and free text, all in a wide variety of popular file formats.

The table showed a map of the estate (Figure 2), which could be navigated using familiar multi-touch gestures, such as pinch-to-zoom. Items of content were marked on the map as red dots that could be touched to open the content and any associated caption in a dialogue box (Figure 3). This dialogue could be rotated using one finger to face users standing on different sides of the table. If multiple items were located close together, they were collapsed into a single marker and the user could navigate between them using left and right controls within the dialogue. The user could also filter on different types of content: images, video, audio and text.

As the exhibition space did not have an available Internet connection, we developed an offline content management application that ran on a laptop in the centre. Content could be authored using this interface and automatically synchronised with the table using a USB flash drive. A member of staff was on hand to help scan photographs and enter the content into this system.

5. USAGE AND CONTENT

At the time that usage logs and content were retrieved, the installation had been in place for 55 weeks. During this time, the

Figure 2. Byker Lives Table in use. Photo by John Hipkins © Northern Architecture.

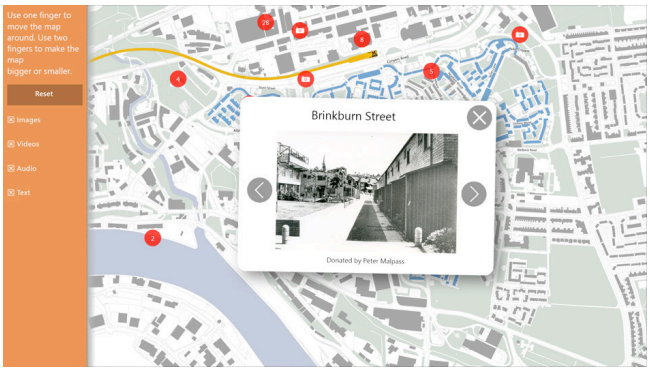

Figure 3. Byker Lives Table user interface.

centre typically opened twice a week for a period of several hours in the late afternoon and early evening. This included a number of special events, such as a launch event when the centre first opened and an exhibition of the accumulated collection a year later. We have logged 2,741 instances of content being viewed by visitors (49.8 per week). Including navigation, we logged 21,478 individual points of interaction (390.5 per week). We approximate that this accounts for 277 individual sessions of use (five per week), where a session is defined as a series of interactions with breaks of not more than five minutes.

During this time, 100 items were uploaded to the table. As we had expected, the vast majority of these (96) were images, most of which (81) were historical photos of the community. These photos included both the original community and the redeveloped estate, including the demolition and building works in between. Other photos focused on the nearby commercial street, particularly a music hall that acted as the community's social hub in the early 20th Century. Photos dated from between the 1890s and 1990s, typical featuring either buildings or portraits of groups and individuals from around the community. A further 12 images were scans of historical newspaper clippings or documents (such as a wartime air raid shelter ticket). Finally, there were two scanned contemporary stories of life on the estate and one drawing of local scenery. The remaining items were a single video, created by children from a local primary school, and three text entries describing individual residents' memories of the community. No audio recordings were uploaded.

6. FINDINGS

The irregular opening hours and sporadic interaction with the installation made direct observations of use difficult. Instead, we have drawn upon interviews with the heritage centre's staff. Throughout the deployment, these staff members had close interaction with visitors and helped them to add their contributions to the collection, gaining valuable insight into how the installation was used. These interviews are supported by logged data and collected content from the installation, summarised above, and by observations at occasional events, such as the centre's official opening, when there was a higher volume of visitors.

6.1 Capturing and Curating

Across the deployment, content added to the table included "donated, found and produced" materials, including newly produced histories from residents of the estate. Prior to the deployment, the project had captured content from a variety of sources, including public archives and events around the community. Initial, the table was used to house this existing content. However, once the exhibition was opened, it quickly because a "receptacle" for new content being brought in by visitors. The table was used much more for the personal stories rather than the architectural material that was being acquired for the rest of the exhibition.

In this role, the table and its authoring tool were used as a structured means of accessing the memories of residents. Staff described this as a "supported process" in which they worked with residents to "*develop their own story of the history and heritage of Byker*". Although we had considered the need for an offline interface for authoring content rather than a web portal to be somewhat unsatisfactory, the reliance on a staff member to guide this process was seen as a positive thing. This meant that the staff could work closely with residents in a process of self-curation. Many evocative memories would be shared while content was being scanned and processed.

> *"You would have missed all this relationship building."*

The exhibition staff stressed their inclusive policy towards content on the table. Although the exhibition itself was a curated collection, there was very little curation of content being uploaded to the table:

> *"If somebody felt that they wanted to bring something in, because it was important to them* […] *that was the criteria for whether it was important or not."*

> *"If we put some pre-defined criteria of our own on what was important and what wasn't, then we actually weren't allowing residents to have control over that process."*

This created a very varied and unfiltered collection that represented a broad range of interests and views. In one sense, this caused problems: the large amount of material collected quickly became overwhelming and difficult to navigate.

6.2 Divisions within the Community

Communities are not homogenous groupings [2], but consist of many with varied opinions. This is especially true in Byker, due to the radical changes that have taken place over the past decades, creating divisions between long-term residents and more recent arrivals. Staff members described *"the invisible boundaries that exist and the territorialism"* as issues facing the exhibition as a whole. Residents in the estate largely grouped around their nearby amenities and were not very mobile within the wider estate. This meant that those visiting the centre tended to be those who lived nearby and were served the nearby shops, rather than those living further away, so even the physical placement of the heritage centre had the potential to be divisive.

Given these differences of opinion over life in the community, we had anticipated that the choice of content to display might be controversial. However, despite this, there was little argument over what should or shouldn't be part of the collection. Instead, debate fell around how the content should be interpreted:

> *"There was no conflict around what was shown, but there was a lot of discussion around what* [it] *meant."*

> *"People were sharing different views and having the opportunity to understand each other's views."*

Much of this discussion was seen as very positive. One of the staff described an image that was particularly evocative, as it showed the area halfway through redevelopment, with both old and new housing stock visible. For some, this was a powerful image of a community being destroyed, while for younger residents, the presence of the new estate in pristine condition captured a sense of place that other historical photos could not while also capturing some of the excitement around the redevelopment in its prime. However, this discussion also prompted more divisive comments:

> *"There are people with quite extreme views* […] *about the changing cultural make-up of the place, people who are quite happy to express quite racist views."*

At the same time, ethnic minority groups in the area made extensive use of the exhibition themselves and activities were specifically designed to capture their views, offering a counterpoint to these sentiments.

6.3 Types of Visitor

Organisers reported that visitors to the exhibition and users of the installation fell into a number of distinct categories. Many of these were local residents who lived close to the exhibition and passed it on a regular basis. This included an unexpectedly high number of children, which proved to be somewhat problematic (see below). Although many of these visitors were simply curious about the exhibition, others came with specific content that they wanted to contribute. Often, those who had visited once would return with content at a later date. Visitors from outside the estate were typically either those with a personal interest, such as those who had grown up on the estate, people with an interest in architecture, or people interested in the social development of the area.

These different types of visitors arrived with very different goals—curiosity, a desire to reminisce, or an intention to contribute content—and consequently engaged with the exhibit in very different ways. This highlights the dual nature of a community exhibition, which plays the role of any normal museum exhibition to some visitors, while acting as a means of self-expression for community members. Consequently, there is a need to appeal to and support both these forms of visitor.

6.4 Engaging Children

Organisers highlighted the complicated role that children played in the exhibition, but also their interesting relationship with the technology. The exhibition itself immediately became popular with groups of children who saw it as an activity that could occupy them after school. Community events in the area typically place an emphasis on entertaining children, which had not been taken into account when designing the exhibition. Although this

was initially seen as a problem by the organisers, they were later able to engage children in constructive activities that contributed to the exhibition's content, such as conducting interviews.

> *"It's incredible the shift that I've seen in having them being quite disruptive and challenging* […] *to actually teaching them to scan the photographs."*

They were particularly engaged with the interactive table, and played a role in showing visitors how it worked, and also in scanning photos brought by residents.

> *"They were doing things with it that I didn't realise were possible* […] *they did take ownership of it."*

This was supported by our own observations: one child who was able to work around safeguards to stop the application being exited was also seen demonstrating the application to visitors and speaking fluently about how to use multitouch gestures.

6.5 Maps as Interfaces

The map proved to be a popular interface, which offered a familiar artefact that was enjoyable to browse, even without content. This was despite problems with the table's sensitivity that meant navigation was not as effortless as might be expected. However, in terms of actually displaying content, the map proved to be a limiting factor by requiring all additions to be geographically tagged. This was not necessarily the most logical way to browse the collection, which might have been better served by a chronological interface. Furthermore, as the content was very varied, not all of it could be placed geographically:

> *"If it's an oral history* [people] *talk very naturally about their experiences and life and therefore they would jump from one story and make connections to another and these are not geographically bound at all."*

Even for content that could be clearly placed geographically, the redevelopment of the estate often made this difficult, as the modern street plan was radically different to original neighbourhood. However, reconciling the old and the new seemed to be en enjoyable activity, prompting discussion and debate.

> *"Locating things geographically was quite an interesting process in itself, because we did only have the current map, so the historic stuff we were actually working out,"*

> *"Because there was such a lot that people got out of looking at the historic maps, it would have been nice to somehow build two or three different chronological stages into it."*

One member of staff reported that maps predating the redevelopment were frequently placed on the table alongside the contemporary map and used to identify where photos were taken.

7. DISCUSSION

Across a yearlong deployment, the Byker Lives Table demonstrated a capability to capture content from the community, but also to inspire discussion around a range of issues in the area. In this section, we return to our goals stated in the introduction and discuss how and how these goals might be better supported by future interactive technologies.

7.1 Supporting Community Participation

Critical to the success of an interactive exhibit in a community is encouraging participation from the community. This means not just small, active segments of the community, but attempting to engage a broad range of community members in contributing their voices. In our deployment, it was the environment that appeared to have the greatest effect on participation. For example, the location of the exhibition within the community had both positive and negative effects on participation. For those who had reason to pass by, it was an attractive space, particularly for children who had no other community space to visit, but those in other parts of the estate had little reason to visit the centre. We see a number of ways that future community exhibits might take advantage of these effects.

Firstly, community exhibits should aim to be a place where local residents might want to go—not to visit or participate in the exhibit or interact with a novel technology, but because the location is pleasant, or a hub of community activity. In our own project, this effect was most commonly seen with children, but combining such exhibits with services such as cafés might attract a wider audience. Alternatively, we might instead make elements of the exhibit mobile. During the deployment, exhibition organisers had discussed using tablet computers to run the table software and visit different locations within the community. In the earlier stages of the project, events around the community were used to collect initial content. Using a combination of these methods might encourage higher levels of participation for a broader cross-section of the community.

7.2 Multiple Perspectives on Shared History

History is fluid and subjective, while communities are diverse. Naturally, this leads to differences in opinion over how the community's heritage should be interpreted and celebrated. Even in Byker, where community identity is strong, there were significant differences of opinion over how the area's redevelopment and subsequent changes. A community exhibit should reflect these differences of opinion in a way that is positive and constructive, potentially paving the way for a reconciliation of these different perspectives. Evidence from the Byker Lives Table suggests that it was capable of supporting this positive dialogue, with little negativity observed despite differences of opinion being apparent.

Our experience with this deployment leads us to ask how these multiple perspectives might be captured and represented in an interface. Much of the interaction around the table took the form of conversation and storytelling between different visitors, but much of this fleeting conversation was lost despite being a valuable resource in itself. Therefore, one approach that we had not considered might be to offer some way of recording this discussion and associating it with content in the collection. This meta-data might offer a counter-narrative to that which is portrayed in the exhibition and prompt further valuable debate and discussion.

7.3 Lightweight and Inclusive Curation

Our final issue was how to support curation of a meaningful and comprehendible collection of content in a way that remained inclusive. This goal is naturally at odds with traditional forms of curation, and invites us to explore how a balance might be struck between requirements that appear to be at odds. However, in our case, the exhibition organisers did not have a strong agenda other than to celebrate the local area's unique traits and history, and were themselves aiming to be as inclusive as possible. This led to a very varied collection of content, but one that was somewhat difficult to navigate and comprehend. The final collection had little organisation beyond its geographic tagging and had no real narrative. This was not necessarily an impediment in this case, but other similar exhibitions might aim to tell a more coherent story.

Our main finding in this regard was the value of dialogue between curators and the public. Having volunteers from the community and staff members from the organisers, acting in the role of curators, help visitors upload their content proved to be one of the most successful ways of managing content. As such, we would advise that community exhibits attempt to foster this dialogue both through the design of the exhibits and through the process of participation. We would also consider how this process might be combined with our previous suggestions of capturing dialogue around content and making exhibits community hubs where people go to spend time and discuss local issues.

8. SUMMARY

Based on the Byker Lives deployment, we have been able to gain insights into the role of an interactive tabletop exhibit in capturing valuable memories of a housing estate's rich history, while encouraging participation and inclusive curation. We anticipate that these lessons will be valuable both to designers of interactive exhibitions for museum environments and to developers of technologies and exhibits intended to showcase the lives and heritage of individual communities.

9. ACKNOWLEDGMENTS

This research was conducted at Newcastle University's Culture Lab in partnership with Northern Architecture. We would like to thank Lowri Bond at Northern Architecture, Clara Crivellaro and the Byker Lives staff.

10. REFERENCES

[1] Agotini, A. and Snowdon, D. 2002. Design and deployment of community systems: reflections on the Campiello experience. *Interact. Comput.* 14, 6 (Dec. 2002), 689–712. DOI=10.1016/S0953-5438(02)00016-4.

[2] Akama, Y. and Ivanka, Y. 2010. What community? Facilitating awareness of 'community' through Playful Triggers. In Proceedings of the 11th Biennial Participatory Design Conference (Sydney, Australia, November 29 – December 3, 2010). PDC '10. ACM, New York, NY, 11–20. DOI=10.1145/1900441.1900444.

[3] Bartindale, T., Clarke, R., Shearer, J., Balaam, M., Wright, P., and Olivier, P. 2011. Bridging the gap: implementing interaction through multi-user design. In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (Vancouver, Canada, May 7 – 12, 2011). CHI EA '11. ACM, New York, NY, 2071–2076. DOI=10.1145/1979742.1979922.

[4] Bowers, J., Bannon, L., Fraser, M., Hindmarsh, J., Benford, S., Heath, C., Taxén, G., and Ciolfi, L. 2007. From the disappearing computer to living exhibitions: shaping interactivity in museum settings. In *The Disappearing Computer*. Springer, Berlin, 30–49. DOI=10.1007/978-3-540-72727-9_2.

[5] Brown, B., MacColl, I., Chalmers, M., Galani, A., Randell, C., and Steed, A. 2003. Lessons from the lighthouse: collaboration in a shared mixed reality system. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Fort Lauderdale, FL, USA April 5 – 10, 2003). CHI '03. ACM, New York, NY, 577–584. DOI=10.1145/642611.642711.

[6] Carroll, J.M., Rosson, M.B., Cohill, A.M., and Schorger, J.R. 1995. Building a history of the Blacksburg Electronic Village. In *Proceedings of the 1st Conference on Designing Interactive Systems* (Ann Arbor, MI, USA, August 23 – 25, 1995). DIS '95. ACM, New York, NY, 1–6. DOI=10.1145/225434.225435.

[7] Chavis, D.M., Hogge, J.H., McMillan, D.W., and Wandersman, A. 1986. Sense of community through Brunswik's lens: a first look. *J. Community Psychol.* 14, 1 (Jan. 1986), 24–40. DOI=10.1002/1520-6629(198601)14:1<24::AID-JCOP2290140104>3.0.CO;2-P.

[8] Ciolfi, L., Bannon, L., and Fernstrom, M. 2008. Including visitor contributions in cultural heritage installations: designing for participation. *Museum Manage. Curator.* 23, 4 (Dec. 2008), 353–365. DOI=10.1080/09647770802517399.

[9] Ciolfi, L. and McLoughlin, M. 2012. Designing for meaningful visitor engagement at a living history museum. In *Proceedings of the 7th Nordic Conference on Human–Computer Interaction* (Copenhagen, Denmark, October 14 – 17, 2012). NordiCHI '12. ACM, New York, NY, 69–78. DOI=10.1145/2399016.2399028.

[10] Ciofli, L. 2013. The collaborative work of heritage: open challenges for CSCW. In *Proceedings of the 13th European Conference on Computer Supported Cooperative Work* (Paphos, Cyprus, September 21 – 25, 2013). ECSCW '13. Springer, London, 83–101. DOI=10.1007/978-1-4471-5346-7_5.

[11] Dalsgaard, P., Dindler, C., and Eriksson, E. 2008. Designing for participation in public knowledge institutions. In *Proceedings of the 5th Nordic Conference on Human–Computer Interaction* (Lund, Sweden, October 20 – 22, 2008). NordiCHI '08. ACM, New York, NY, 93–102. DOI=10.1145/1463160.1463171.

[12] De Jode, M., Barthel, R., Rogers, J., Karpovich, A., Hudson-Smith, A., Quigley, M., and Speed, C. 2012. Enhancing the 'second-hand' retail experience with digital object memories. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing* (Pittsuburgh, PA, USA, September 5 – 8, 2012). UbiComp '12. ACM, New York, NY, 451–460. DOI=10.1145/2370216.2370284.

[13] Egelius, M. 1990. *Ralph Erskine, Architect*. Byggförlaget, Stockholm, Sweden.

[14] Giaccardi, E. and Palen, L. 2008. The social production of heritage through cross-media interaction: making place for place-making. *Int. J. Herit. Stud.* 14, 3 (May 2008), 281–297. DOI=10.1080/13527250801953827.

[15] Konttinen, S. 1983. *Byker*. Jonathan Cape, London, UK.

[16] Konttinen, S. 2009. *Byker Revisited*. Northumbria Press, Newcastle, UK.

[17] Schuler, D. 1994. Community networks: building a new participatory medium. *Commun. ACM* 37, 1 (Jan. 1994), 38–51. DOI=10.1145/175222.175225.

[18] Taylor, N. and Cheverst, K. 2012. Supporting community awareness with interactive displays. *IEEE Computer* 45, 5 (May 2012), 26–32. DOI=10.1109/MC.2012.113.

[19] Wakkary, R. and Hatala, M. Situated play in a tangible interface and adaptive audio museum guide. 2007. *Pers. Ubiquit. Comput*. 11, 3 (Mar. 2007), 171–191. DOI=10.1007/s00779-006-0101-8.