Requirements for an In-gallery Social Interpretation Platform: A Museum Perspective

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Abstract: This paper reports findings from expert interviews discussing in-gallery commenting systems with museum professionals. Its main contribution is an exploration of museum perspectives on critical aspects of commenting platforms including content moderation, comment metadata, access and openness, ownership and reuse of comments, backend requirements, deployment and maintenance. The paper relates findings to system requirements and flags up a number of design tensions between visitors' attention to exhibits and their engagement with interpretive resources; visitors' communication behaviours and their contemplative needs; museums' requirements for content moderation and visitors' user experience when submitting comments. The findings will be useful to researchers and practitioners developing in-gallery commenting systems and other platforms collecting and displaying visitor comments in museums.

1 INTRODUCTION

The idea of museums as places for informal learning has been around for some time and is now ubiquitous in the literature. Screven (1969) understands museums as "responsive learning environments" (p.10); Hein (1998) writes about the "constructivist museum" (p.155); Bradburne (2000) studies museums as "support systems" for informal learning (p.19); Falk and Dierking (2000) call exhibitions "design-rich educational experiences" (p.139) and discuss museums as places for "meaning-making", and Forrest (2013) calls exhibitions "interpretive environments" (p.201).

Common to all these views on museums as learning environments is a grounding in social-constructivist (Bruner, 1973; Bandura, 1977; Vygotsky, 1978) and experiential (Kolb, 1984) theories of learning, where visitors encounter learning opportunities and actively construct knowledge by making connections, solving problems, discussing meaning with others and reflecting on their experience. A key requirement for this type of learning is that visitors interact with exhibits and engage in conversations - a "primary mechanism of knowledge construction and distributed meaning-making" (Falk and Dierking, 2000; p.110).

In order to support this distributed meaning making, museums use various platforms enabling visitors to share their views on exhibits, exhibition themes and their visiting experience. These range from traditional analogue mechanisms such as visitor books, comment cards and Post-it® walls to digital platforms such as interactive screens, museum websites and social media platforms. Visitors typically have clear favourites among these mechanisms, based on their specific affordances in relation to abstract qualities such as ease of use, freedom of expression, range of functionality, fit with personal communication preferences, privacy and expected impact when contributing a comment (Winter, 2018). From a museum perspective, important criteria for commenting systems include how they support their pedagogical needs, how they integrate with professional practice and workflows, how affordable they are and how they fit with the design and technical constraints of the gallery space.

The context of this paper is an effort to extend the current range of commenting mechanisms with the development of Social Object Labels (SOLs); an in-gallery commenting system aiming to foster debate

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around exhibits and complement the museum's voice displayed on traditional object labels by enabling visitors to share their own commentary on small, interactive, e-ink screens (Winter, 2014; Winter et al. 2015). SOLs aim to support a particular pedagogical approach to social learning in museums based on the idea of object-centred sociality, which proposes that people find it easier to engage with each other around objects of common interest than to engage directly without such points of reference (Knorr-Cetina, 1997; Engeström, 2005; Simon, 2010).

This paper reports on a series of expert interviews discussing commenting in general and in-gallery commenting systems in particular with museum professionals. It complements a survey exploring visitors' views on commenting in museums (Winter, 2018) and forms part of a wider requirements analysis informing the design of SOLs. The main contribution of this paper is an exploration of museum perspectives on commenting in museums, covering content moderation, comment metadata, access and openness, ownership and reuse of comments, backend requirements, deployment and maintenance. As these aspects are not specific to SOLs but relevant to any platform collecting and displaying visitor comments in museums, it is hoped that the findings are of interest to practitioners and other researchers in this field.

The following sections briefly review related literature before reporting on a series of interviews conducted with museum professionals, explaining the methodology of the study and discussing its findings in the context of high-level requirements that can inform the design of commenting platforms from a museum perspective. The paper concludes with a summary of findings, a discussion of limitations and an outlook on future research.

2 BACKGROUND

As curated spaces with an educational agenda and particular social protocols, museums are complex environments with their own set of requirements and constraints. This section investigates how commenting fits with museums' higher-level educational goals, discusses engagement, interaction and technology use in gallery environments and looks at existing curatorial practices to encourage visitor engagement with exhibits. It also reviews previous research efforts in the literature exploring technologies for visitors to comment on museum exhibits and discusses user-generated content in the contexts of authority and public liability.

2.1 Giving Visitors a Voice

Bradburne (2002) conceptualises interactivity not as a property of the exhibit but of the visitor, and introduces the notion of "user language" as a way for museums to shape visitors' engagement with exhibits. As the museum's user language confers properties on both the exhibit and the visitor, it structures their relationship and controls whether interaction takes place and of what nature it is. Bradburne (ibid) identifies the most common user languages in museums as (1) *authority*, where visitors accept the museum as authority, (2) *observation*, where visitors are their own authority, (3) *variables*, where visitors explore relationships between exhibits, (4) *problems*, where visitors analyse problems and (5) *games*, which extends problem and makes action a condition of the experience. Commenting fits well with the user languages of observation, variables and problems, for instance when posing a question for visitors to answer, however, its intrinsic qualities of allowing visitors to express their own views, share them with other visitors and make them part of the exhibition add another dimension, which might be called the user language of *voice*.

The user language of voice confers on museums the property of being interested in visitors as thinking beings (Adams and Stein, 2004), on exhibits the property of being open to interpretation rather than fully described and interpreted, and on visitors the property of having a voice to engage in public debate and balance the museum's authoritative interpretation.

It expands the range of user languages available to museums and acknowledges that visitors do not come as blank slates to the museum but with a wealth of previously acquired knowledge, interests, beliefs and experiences (Falk and Dierking, 2000). Giving visitors an opportunity to provide their own interpretation and relate concepts and ideas behind exhibits to their personal experiences can help them to "see themselves within an exhibition" (ibid, p.182), addressing the problem that many visitors cannot relate to exhibits based on the information given on object labels (Screven 1992).

2.2 Learning from Label Design

Vom Lehn and Heath (2003) point out that interpretive labels were not always part of the museum experience but only introduced when museums became educational institutions and guided tours gave way to visitors navigating exhibitions on their own. Today, interpretive labels are a standard

tool for museums to bridge the knowledge gap between visitors and objects (Loomis, 1983). Their manifold purposes include to provide information about exhibits, orient and instruct visitors, personalise topics and interpret exhibits (Screven, 1992).

SOLs are in many ways the antithesis of interpretive labels - championing the visitor voice rather than the museum voice, affording many-to-many communication rather than one-way top-down communication and showing unverified, potentially biased or trivial information by visitors rather than authoritative information by the museum. Yet, there are also similarities in that both visitor comments and interpretive labels should be noticeable but not compete with exhibits for visitors' attention (Bitgood, 1996), creating a particular design challenge.

Screven (1992) proposes that visitors' decisions to engage with interpretive labels depend on their perceived value-to-cost ratio, and he offers recommendations to maximise value and minimise costs. Bitgood (1996) contends that attention is selective, involves focusing power and is of limited capacity. He structures design aspects around (1) stimulus salience and traffic flow with regard to attracting visitors' selective attention, (2) minimising distractions and perceived effort while increasing cognitive-emotional arousal with regard to motivating visitors to focus, and (3) taking into account contextual factors to explain museum visitors' decreasing capacity of attention over the course of their visit. Both sets of recommendations incorporate a deep understanding of museum visitors and gallery environments and are highly relevant to the design of commenting systems.

2.3 Museums as Curated Environments

Falk and Dierking's (2000) statement that "people go to museums to see and experience real objects, placed within appropriate environments" (p.139) hints at two key aspects that make the museum experience special. One refers to being in the presence of authentic objects rather than replicas and the other to being in a curated environment specifically designed to heighten the experience with these objects. Latham (2013) uses the term "numinous experiences" to describe the phenomenon of visitors being awestruck, reverential and deeply moved when encountering authentic objects in museums. She contends that regardless of emerging technological trends the authentic physical object is an important aspect of the visitor experience and central to the act of meaning-making.

Tröndle and Wintzerith (2012) discuss the etymological meaning of "museum" as "art temple" and point out that it has contemplative undertones as opposed to the modern conception as a place where visitors socialise and want to be engaged. They quote 19th century art writer Quatremère de Quince complaining about "the conversation-addicted masses" and 20th century art critic Arthur Danto lamenting about the "Disneyfication" of museums. Research suggests that these misgivings are not unfounded: Tröndle and Wintzerith (2012) found that visitors who converse in exhibitions are less affected by displayed artworks than visitors who don't converse and focus on the exhibits; Henkel (2013) found that visitors who take pictures of artworks remember less details of them than visitors who just look at the artworks; vom Lehn and Heath (2003) found that visitors using mobile phones as interpretation tools tend to focus on the device screen rather than the exhibit. As a consequence, "many curators and museum managers are concerned that these new technologies may not only undermine the aesthetic of the gallery but provide resources that distract from, or even displace, the object" (ibid, p.3).

In order to reconcile visitors' communicative needs with their contemplative requirements, Tröndle and Wintzerith (2012) suggest that museums must carefully manage an economy of attention, ensuring that visits can be an aesthetic event as well as a social experience. These views are echoed by vom Lehn and Heath (2003), who call on developers of interpretive resources to "preserve the primacy of the object and aesthetic encounter" (p.3), and by Maye et al. (2014) who report cultural heritage professionals stressing "the need to use technology in ways that do not distract from the exhibition themes" (p.601).

2.4 Social Object Interpretation

Referencing Engeström's (2005) observation that discussions on social networks typically develop around objects such as photos, jobs or shared interests, Simon (2010) describes how visitors tend to engage with each other around social objects in museums. However, while designers of Web-based experiences have a wide range of well-researched mechanisms and tools at their disposal to support object centred sociality and user generated content, curators of physical exhibitions typically rely on traditional commenting systems like visitor books and feedback boards to foster discussions around exhibits, which do not integrate with visitors' digital communication habits.

Technologies supporting visitors' social interpretation of exhibits are rare, although there have been several research efforts. Stevens and Toro-Martell (2003) present VideoTraces and ArtTraces, a kiosk based system enabling museum visitors to select or create images or videos of exhibits or their interaction with them, and to annotate them with speech or gestures. As these 'traces' can be shared with other visitors to communicate interpretations, explanations and questions, the system fosters engagement and social-constructivist learning.

Van Loon et al. (2006) discuss ARCHIE, a handheld game-based interactive museum guide drawing on Falk and Dierking's (2000) contextual model of learning, which proposes that visitors' interaction and learning in museums are influenced by overlapping personal-, physical- and the socio-cultural contexts. Reflecting these ideas, the system involves visitors in collaborative games and stimulates interaction and communication between them around museum exhibits.

Hsu and Liao (2011) describe a mobile application integrating self-guided exploration of an exhibition with social object annotation. The system enables visitors to share their views about exhibits by scanning a RFID tag with their mobile device and adding their personal commentary. Similarly, the QRator (Gray et al., 2012) and Social Interpretation (Bagnal et al., 2013) projects, both based on a common precursor project Tales of Things (Barthel et al., 2010), enable visitors to scan visual or radio-frequency codes attached to exhibits and share their personal commentary. While all these efforts have fundamental usability problems related to the discoverability of digital annotations (Winter, 2014), they support social-constructivist learning in museums in principle by providing a platform for visitors to share and discuss their views about exhibits and exhibition themes.

Girardeau et al., (2015) describe a location-based system where visitors use their mobile phone to listen to audio interpretations of both curators ("museum voices") and other visitors ("community voices"), as well as record their own audio comments in response to prompts. By using visitors' location rather than physical markers to identify and trigger content, and by conceptualising the experience as an immersive soundscape to explore and contribute to, the project explores an attractive alternative way for museums to give visitors a voice and foster their engagement and learning.

These reports offer valuable guidance on how to design, implement, frame and support social object annotation in museums. They describe barriers to participation, ranging from digital literacy and technological issues to usability, learnability and accessibility as well as the wider framing by the organisation, and offer recommendations on how to tackle these problems.

2.5 Authority and User-generated Content

From a museum perspective, a key aspect of user-generated content is quality, as wrong or inappropriate comments not only impact on the visitor experience but also undermine the organisation's authority, which is a distinguishing quality specifically for heritage organisations (Oomen and Arroyo, 2011).

This creates a tension between visitors' user experience when contributing comments and museums' reluctance to yield control over content displayed in their gallery space: On the one hand, research indicates that visitors like to comment on complex and controversial topics (Kelly, 2006), and that they expect comments to be displayed immediately after submission instead of being held in a moderation queue (Gray et al., 2012). On the other hand, there is a deep-seated fear among museum professionals of visitors leaving wrong, inappropriate or offensive comments that might reflect negatively on the museum when displayed unchecked in the gallery (Gray et al., 2012). Commenting systems must therefore implement moderation mechanisms that do not compromise the user experience while enabling museum professionals to block or delete wrong or inappropriate comments.

One approach to address this problem is discussed by Stevens and Toro-Martell (2003), who suggest that wrong or misleading comments should be addressed by other visitors posting opposing views as well as the museum directly responding to such content and thereby demonstrating their expertise in a hands-on manner rather than through distanced authority. With respect to inappropriate or offensive comments, both Russo (2008) and Gray et al. (2012) refer to Fichter's (2006) concept of "radical trust", which accepts abuse and vandalisms as being part of society but places (radical) trust in the community and its members to deal with these issues and safeguard continued operation.

Moderation mechanisms implementing these ideas typically combine community moderation to monitor and flag wrong or inappropriate comments with post-moderation by museum staff to scrutinise flagged comments and eventually remove them, as described for instance in Gray et al. (2012) and

Bagnal et al., (2013). The advantage of this approach is that it improves the user experience by allowing content to be displayed instantly while also providing a certain level of control and being operable with limited resources.

2.6 Summary

The literature suggests that offering visitors an opportunity to share their commentary around exhibits and exhibition themes can foster engagement and learning in the gallery space and help museums towards their higher-level educational goals. Commenting extends the range of "user languages" (Bradburne, 2002) available to curators and can lead to higher levels of participation by emphasising social and communicative aspects of the museum experience and signalling that museums value their visitors' views.

Developers of in-gallery commenting platforms can draw on a rich body of design guidelines for interpretive labels, which reflect a deep understanding of museum environments and are highly relevant to both engaging visitors to contribute comments and displaying visitor comments in the gallery space.

They can also draw on previous research designing, developing and deploying commenting technologies in museums. Besides discussing technical and design aspects, these studies give insights into barriers to engagement and provide recommendations how to overcome them.

Several authors point out that sociality and technology in museums must be balanced with the contemplative needs of visitors, stressing the "primacy of the object" (vom Lehn and Heath, 2003) and challenging developers of new applications to not disturb the aesthetic experience in museums.

Regarding the quality of visitor-generated content, research suggests that involving visitors in monitoring and flagging inappropriate or offensive comments strikes a good balance between response time, editorial control and required resources. Furthermore, museum staff openly opposing wrong or misleading comments on the system can be an effective way to assert their authority.

Overall, the literature supports the idea of commenting as an effective way to support participation and learning in museums, and offers valuable insights that can inform the design of commenting systems and their integration with museum environments, while balancing visitors' social and contemplative requirements and maintaining museums' editorial control without impacting on user experience.

3 METHODOLOGY

In order to explore a museum perspective on commenting in museums, with a particular focus on SOLs as an instance of an in-gallery commenting system, seven in-depth interviews were carried out with museum professionals from Science Gallery Dublin, Regency Town House and Phoenix Gallery Brighton. In order to cover a broad spectrum of views concerning the design, deployment, maintenance and integration of SOLs into existing practices and workflows, interviewees with different responsibilities were selected, with roles including Technical Manager, Web & IT Manager, Programme Manager, Marketing and Communications Manager, Researcher, Director and Co-Chair. Interviewee identifiers, used in the following sections to attribute specific answers, together with their organisational roles for context are listed in Table 1.

Table 1: Interviewee identifiers and their roles.

Interviewee	Role in organisation
I1	Gallery Director
I2	Programme Manager
I3	Researcher
I4	Technical Manager
I5	Marketing and Communications Mgr
I6	Web & IT Manager
I7	Co-Chair

The interviews were semi-structured, discussing a fixed set of 15 starter questions relating to the moderation (2), attribution (2), conservation and reuse of content (3), openness of the system (2), backend requirements (2), deployment aspects (3) plus a final open question (1) inviting participants to address any relevant points not covered in the interview. Related aspects for each topic were further explored with follow-up questions as they emerged during the interviews.

The interviews were carried out by email (I1), video link (I2, I3, I4, I5) and in person (I6, I7). Interviews by video link and in person lasted between 32 and 54 minutes. Video interviews were recorded and then transcribed, while interview answers in person were captured through note-taking and reviewed immediately afterwards to supplement and clarify notes as recommended in Valenzuela and Shrivastava (2008). The different data collection methods necessarily led to differences in data

granularity, with video transcriptions (4) yielding richer data than both note-taking during interviews (2) and email responses (1), however, all three methods recorded participants' answers in sufficient detail to be analysed as a single dataset for the purpose of this study.

Answers from all interviews were aggregated under their respective question headings and analysed in a two-stage emergent coding process described in Miles and Huberman (1994), involving first data reduction and then a data visualisation. In the data reduction stage, responses were read several times and categorised according to key points in answers, disregarding differences in data granularity and in individual terminology and formulations. In the data visualisation stage, the reduced and coded data was structured after emerging themes for interpretation and synthesis to summarise and qualify key findings. Both raw data and annotated reduced data from the emergent coding process were archived for further analysis and scrutiny in the future.

4 RESULTS

4.1 Content Moderation

When asked the question "How should we deal with inappropriate or offensive comments?", interviewees' answers ranged from cautious and restrictive to tolerant and open. For instance, one interviewee (I7) pointed out that there is an issue with public liability. As most galleries are publicly funded, they might have an obligation to pre-moderate comments before showing them in the gallery. However, as this requires someone to do it, which in turn costs the museum money, the same interviewee argued that from this point of view post-moderation might also be acceptable. Several interviewees questioned how much of a problem inappropriate content actually would be when running a commenting system in the gallery space, with some participants pointing out that visitors act more responsibly in the gallery space than when online, and others arguing that offensive content is "not the end of the world" (I4) as long as it is removed in a reasonable time frame. The former is supported to some extent by literature indicating that museum visitors actually post less offensive content in the gallery space than expected (Gray et al., 2012).

Against this backdrop, most interviewees spoke out in favour of a post-moderation model, i.e. moderating and removing inappropriate content after it was made publicly available on the system, supported by users flagging offensive content. A key argument in favour of post-moderation was that it requires fewer resources and offers a better user experience as it eliminates the inevitable delay in pre-moderation between posting a comment and it becoming visible on the system. It was pointed out that user-supported post-moderation follows best practice on large social networks and discussion sites on the Web and therefore should be familiar to most users. Another argument in favour of post-moderation was that it integrates well with current workflows in museums, where staff keep an eye on the gallery space and routinely check user-generated content once or twice a day. This process can be supported by users flagging up comments they find objectionable and thereby directing moderators' attention to problematic content.

Rather than having a dedicated content moderator, responsibility to react to user-flagged content is likely to be distributed among a team of moderators on call. In larger institutions this is likely to include technical, IT and communications staff whereas in smaller places this is likely to include the gallery manager and volunteers. In order to shorten response times and eliminate the need for moderators to repeatedly check whether content was flagged, the system should notify relevant staff when content is flagged. Ideally, notifications should be delivered not only to staff's desktop but also to their mobile device so that they can react quickly even when not at their desk.

As suggested in particular by interviewees with IT backgrounds (I4, I6), technical measures already used on museum websites could be used to help avoid inappropriate content being posted on the system. These include automated screening of submitted content to block spam and offensive posts and logging IP addresses of contributors in order to be able to block sustained abuse by specific users. However, as both of these measures focus more on spam and automated attacks than on offensive content, they might be less relevant for content generated in-situ and less effective for mobile devices which are dynamically assigned a new IP address each time they connect to a different mobile or WiFi network.

4.2 Content Metadata

Content metadata associated with a comment, such as the contributor's name, age, gender, etc. can play an important role from both the contributor's and the reader's point of view. From a contributor's perspective, identifying marks such as a name or username denote authorship and go some way to acknowledge moral rights to the comment. From a

reader's perspective, such metadata can potentially help to contextualise comments by providing background information about the author that might explain their espoused views.

When asked whether comments should include author-related metadata, none of the interviewees brought up the aspect of establishing authorship and moral rights of the contributor. Instead, answers discussed the actual merits of metadata from a reader's perspective and considered the user experience of providing such data. With regard to the former, it was pointed out that author-related metadata often gives only "an illusion of context" (I2) but in fact does little to help our understanding of a statement and might possibly even hinder interpretation by bringing into play prejudice based on stereotypes, e.g. ageism. With regard to the latter, most interviewees emphasised that entering additional metadata should be optional and not a barrier to submitting comments. It was also pointed out that visitors should not feel that the institution is collecting data about them as this might prevent them from engaging, and that identifying markers (e.g. name, age, where from) are expected only in certain cultures but might not be seen as necessary or even appropriate in others. Several interviewees suggested that an optional name and the comment itself would strike an appropriate balance between satisfying the convention of identifying marks associated with a comment and streamlining the user experience.

In digital systems, author-related metadata is often drawn from user profiles and therefore closely linked to logins and online identity. A second interview question in this context was therefore whether people should login in order to submit comments. Interviewees broadly agreed that any login should be optional and no barrier to participation. Even third-party logins, which do not require users to create an account on the system but still uniquely identify them, were seen as problematic. While they give instant access to a user's profile information and allow conversations to be easily carried over to their social network, they exclude people who do not use these services and might alienate those who would rather not connect their social network identity with their in-gallery commenting.

4.3 Openness

From a visitor perspective, the openness of an in-gallery commenting system is largely defined by the degree to which it supports content export and import. Users posting comments to the system might want to be able to forward and reuse them on other platforms and networks, e.g. their social network. Vice versa, users might want to post comments relating to exhibits while not present in the gallery space, e.g. when they visit the museum's website. The latter opens up interesting use cases that mix in-situ and remote commenting, but it also entails numerous problematic issues ranging from content quality to users' conceptual models of the system.

When asked whether people should be able to post their comments not only to the gallery system but also to their social network, most interviewees agreed that social media integration is generally welcome as it might help drive traffic to the gallery's website. Some pointed out that this is how public discourse happens these days and that most museums rely on social media to engage audiences and disseminate news. However, it was also pointed out that social network integration could turn the process of commenting on the gallery system into a relatively complex interaction, and that some visitors might prefer to use their default social network applications for this process rather than built-in functionality in a custom commenting application. Several interviewees concluded that social network integration would be nice to have but was not strictly necessary. One interviewee (I4) suggested that propagation to social media, specifically the museum's social media feed, should happen automatically without requiring additional user interaction.

The idea of remote content creation, where online visitors are able to post comments to an in-gallery system, received mixed responses from interviewees. On the positive side, some interviewees pointed out that it could help to bridge the gallery- and online-experience of an exhibition, potentially leading to live conversations between people on the website and in the gallery. With suitable in-gallery notifications when someone posts a comment online, this could be exploited to stir interest and increase visitor participation in the gallery space. Furthermore, remote commenting would give repeat visitors, who might develop an informed opinion on the subjects in an exhibition, an opportunity to discuss them more in-depth than would be possible with in-situ commenting using a mobile device. On the negative side, some interviewees warned that it might lead to more spam and offensive content as people are less inhibited online than in the gallery space. Overall there might be limited returns from implementing such functionality as people are more likely to comment on their social network than on the institution's website. Returning to the original idea of an in-gallery commenting system, some interviewees

emphasised that its purpose is to increase engagement while visitors are physically in the space and that commenting should therefore require visiting the gallery and experiencing the work there. This view was summed up in the statement that "A system specialised on in-gallery commenting should not dilute that purpose by trying to be a Swiss Army Knife" (I6).

4.4 Content Ownership and Reuse

Ownership, storage and potential reuse of user-generated content are important aspects from both legal and motivational perspectives. Like any original work, user-generated content is automatically covered by copyright and has associated moral rights (IPO, 2015). While attribution goes some way to acknowledge authorship and moral rights, and thereby to address motivational aspects of visitors submitting comments, actual control over content can lead to de-facto ownership. This aspect has been pointed out by Benkler (2002) with regard to the co-production of content and is supported by research showing that many visitors link ownership of user-generated content to ownership of the medium in which content was submitted (Winter, 2018). The same study also found considerable uncertainty and variation among visitors' views on how museums might store and reuse comments.

Concerning the storage and possible reuse of user-generated content, some interviewees suggested that comments should be archived together with exhibitions and become part of their online documentation. One interviewee (I7) suggested they could even be stored on a small USB stick and attached to the physical exhibit when archived. While there were concerns as to how relevant archived comments would be once an exhibition has ended, some interviewees suggested that their main value post-exhibition would be as a data source for evaluation and reporting, especially as such data is required when applying for funding. In this context any data related to engagement and impact would be useful, including analytics data from related web sites.

Several interviewees pointed out that because they could not anticipate how they might want to use comments in the future they ideally should have a license to reuse comments in whatever context and format they think is suitable. With regard to touring exhibitions, some interviewees suggested that comments should travel with an exhibition while others pointed out that they probably would not because the exhibition would be presented as something new and showing comments from a previous instantiation would destroy that perception.

Some interviewees acknowledged that content ownership and reuse are sensitive points and suggested there should be a clear signal of intent on the part of the institution to make it "crystal clear" (I2) to visitors what is being done with their information. In particular this should clarify if there are any plans for commercial uses, for how long comments are archived and who will have access to submitted information, including whether comments are seen by curators or given to the artist. The majority of interviewees, however, were less concerned with these issues and emphasised the need for lightweight approaches. Suggestions in this line included having a sign at the entrance, displaying a Creative Commons logo in mobile applications, integrating an unobtrusive notice into the visitor prompt and generally doing only the "absolute minimum" (I4) so as not to create a barrier to participation.

4.5 Backend Requirements

Backend requirements are based on functional needs of institutions and users of the system. While some of these have been discussed above (e.g. the requirement to notify moderators when users flag comments), this part of the interview focused specifically on content moderation and syndication via an administration interface (dashboard).

As one interviewee put it, the dashboard should be a "one-stop-shop for non-technical people to moderate comments" (I3). There was broad agreement that it should have functionality to quickly and easily browse, read, hide, delete and reset comments flagged by users. One interviewee (I6) suggested additional functionality in the form of a live feed that would enable moderators to scan comments as they are submitted, while at the same time acknowledging that the usefulness of such a feature would depend on the regularity and volume of content submissions.

Most interviewees agreed that the user-generated content should be available for export and integration into websites in open, simple and commonly used formats such as RSS or JSON. Some pointed out that it would be good to have access to comments at exhibition level (i.e. comments for a whole exhibition) and object level (i.e. comments for a specific exhibit).

4.6 Deployment and Maintenance

Deploying a commenting system in the gallery space is a critical aspect with wide-ranging design implications. Not only does it have to comply with health and safety regulations and the policies of the institution, but it also needs to fit with curators' visions for an exhibition and technicians' views on what is viable and practical in the gallery space.

When asked how peripheral or prominent a commenting system should be in the gallery space, most interviewees indicated that exhibit-level commenting points in particular should be unobtrusive and discrete so as not to distract from exhibits but not be so discrete that they completely disappear. One interviewee suggested that in his experience there would be no problem with visitors not engaging with inconspicuous commenting points as they are "naturally inquisitive and explore technology bits in exhibitions" (I3). Others suggested putting up signage explaining the purpose of the system, which again should be as discrete as possible.

Look and feel was pointed out as one of the most important aspects with one interviewee warning that commenting points must not look like a "tablet in a box" (I4) and another urging to "make sure it looks as slick as it possibly can" (I3). Ideally, commenting points should look "like a continuation of the signage to read some comments" (I2), with several interviewees suggesting e-ink technology in this context. One interviewee pointed out that a slanted display mount would be more ergonomic to use for people of different heights (e.g. children).

While interviewees from a larger organisation were clear that they would develop their own display enclosures that fit in with the exhibition design, others from smaller organisations preferred displays to come complete with an enclosure ready to mount. Similarly, interviewees from the larger organisation were positive that they would plug the display into a mains power supply, while interviewees from smaller organisations preferred them to be battery operated as installation is one of their main concerns.

4.7 Summary of Findings

With regard to content moderation, most interviewees supported the idea of post-moderation supported by visitors flagging content they find inappropriate. The system should notify moderators when content is flagged by users, with notifications sent to both moderators' desktops and mobile devices so that they can react quickly even when away from their desk. Once notified, moderators should be able to browse user-generated content without the need to be present at the related exhibit and to easily find, read, block or un-block flagged content.

Interviewees were generally cautious with regard to collecting or displaying additional information about comment authors, with some questioning its added value when interpreting comments and others seeing it as a potential barrier to participation. There was broad consensus that any provision of metadata should be optional at the point of submission and that no registration or login should be required, including third-party logins that would tie comments to the author's online profile.

Openness of a commenting system in terms of access to comments was discussed by participants mainly in the context of social media integration, which was seen as potentially beneficial for the museum but not an essential requirement, with some interviewees stressing that it should not complicate the interaction or exclude visitors without a social media presence. Openness with regard to allowing remote commenting as opposed to requiring physical presence in the gallery to submit comments was seen by some participants as an intriguing idea with interesting new use cases, but overall not a core quality of an in-gallery commenting system.

Most interviewees recognise that ownership and reuse of comments is a sensitive topic and support the idea of informing visitors about how their comments might be used, in particular with respect to access, archiving and potential commercialisation. Overall there was support for the idea of displaying information about content ownership and reuse at the point of submission, however, some interviewees stressed that any such notice should be unobtrusive and not create a barrier to participation. With regard to technical aspects, participants pointed out that the system should store comments and interaction statistics in an open format to support data analysis and unspecified future uses.

Backend requirements for an in-gallery commenting system were largely informed by preceding discussions concerning the moderation and reuse of content. Most participants suggested a dashboard-like administration interface that should be easy to use and suitable for content moderation by non-technical staff. The dashboard should offer functionality to browse, read, block, delete and reset comments flagged by users. It should also provide access to comments in open and commonly used format such as RSS or JSON, ideally supporting syndication at both exhibition and exhibit level to allow integration with the museum web site.

With regard to deployment and maintenance, there was broad agreement among participants that commenting points should not distract from the exhibit and be presented in a way that is visually pleasing and integrates with the exhibition design. On a practical note, they should be provided to museums with or without casings, depending on the preferences of the host organisation, and support both mains- and battery-powered operation to widen the range of deployment options.

Together, these findings offer valuable insights from museum professionals that can inform critical design aspects of commenting systems including content moderation, metadata, ownership and reuse, openness and integration with other systems, backend requirements and technical capabilities concerning deployment and maintenance.

5 LIMITATIONS

With regard to validity, the main limitation of this study is that findings are based on only seven in-depth interviews. While this weakness is mitigated to some extent by the range of participants' backgrounds, roles and organisations, the study makes no claim to exhaustively treat the discussed topics or to quantify any results. Rather, it uses the issues, concerns and preferences raised by museum staff as an indication for required design features and functionality. Given the formative character of the study, this approach is supported to some extent by research in the field of Human Computer Interaction, where Nielsen and Molich (1990) found that in heuristic evaluations five to seven participants typically find 75% to 85% of problems in a system. While not directly transferable, it indicates that even a small sample of seven participants can flag up a large proportion of relevant aspects to inform system design from a museum perspective. It is also worth noting that a larger sample size would be likely to add to further qualify but not invalidate identified requirements.

Other limitations include that data was collected through a mix of interview methods including email, video link and in person, resulting in answers being recorded at different levels of granularity, and that the data was coded by a single researcher, leaving the analysis open to potential investigator bias when interpreting answers and identifying themes. The study tries to mitigate both of these aspects by employing a two-stage data analysis process, which seeks to level out differences in data granularity in an initial data reduction stage and overall aims to reduce subjectivity and bias by separating low-level emergent coding from higher-level interpretation (Miles and Huberman, 1994).

With regard to transferability, many of the findings reflect general concerns and constraints of gallery environments with regard to commenting in museums. While the interviews aimed in first place to inform the design of SOLs, the findings are also relevant to the design of other commenting systems, particularly ones that collect and display comments in the gallery space.

6 CONCLUSIONS

This paper contributes a professional perspective on commenting in museum based on interviews with museum staff from a range of institutions and roles. It complements a survey of visitor perspectives on commenting in museums (Winter, 2018) with a view to identifying requirements for an in-gallery commenting system that meets the needs of both museums and their visitors.

After a brief review of literature on related topics, including learning, participation and "user languages" in museums, design guidelines for interpretive resources, museums as curated environments, social interpretation by visitors and moderation approaches for user-generated content, the paper discusses the methodology and findings of seven in-depth interviews with museum professionals. The interviews offer a spectrum of museum perspectives reflecting the different organisational roles of participants and draw on a deep understanding of relevant museum practice. They cover a broad range of aspects relating to in-gallery commenting in museums, including content moderation, comment metadata, conservation and reuse of comments, system access and openness, backend requirements and deployment and maintenance, which are discussed in the context of high-level requirements that can inform system design and development from a museum perspective.

The range of topics and views is not exhaustive and certainly could be extended with a larger sample size and more extensive interviews, however, this limitation does not invalidate the identified issues and expressed views, which provide useful pointers for the development of in-gallery commenting systems. While carried out in the context of developing SOLs as a particular instance of an in-gallery commenting system, it is hoped that the findings will be useful to other researchers in this field and to practitioners who design platforms collecting and displaying visitor comments in museums.

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