



Accounting for New Technology in Museum Exhibitions

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Introduction

There is growing interest in exploring the ways in which new technologies can be used to enhance participation in museums and galleries. The longstanding commitment to interactivity in science museums and science centres has begun to bear upon developments in the arts and the decorative arts. It is increasingly recognized that carefully designed new technologies may provide visitors with relevant and tailored information and serve to enhance interpretation of and engagement with object-rich collections. We have witnessed, for example, the deployment of digital displays alongside works of art, the development of mobile technologies for visitors to contemporary art galleries, and the introduction of a range of “low-tech” interactive features in leading art and decorative art museums. There remains, however, some debate as to the usefulness of these resources, their contribution to aesthetics and the aesthetic experience, and their ability to facilitate participation and engagement.

The deployment of these new interpretative resources also raises a familiar issue for those involved in museums and galleries, namely how to assess their “value for money” and their contribution. Research in public-sector management and accounting increasingly criticizes the use of conventional financial accounting methods that assess whether museums offer value for money (Landry, 1994; Wu, 2003)

and argue for the development of new methods and techniques for assessing the quality of exhibitions. These discussions correspond to longstanding debates within the social sciences and the distinction between quantitative and qualitative methods – debates that resonate in the literature on museum studies, in particular the analysis of visitor behaviour and interaction (Falk and Dierking, 2000; Hein, 1998).

In this paper, we will briefly explore the ways in which new interpretative resources are used by visitors to museums and galleries. We will focus on two examples: Personal Digital Assistants (PDAs) in a contemporary art gallery, and touch-screen-based information kiosks in a leading decorative art museum. In addressing these two cases, we wish to point to the ways in which the resources have a profound impact on visitors’ behaviour and their ability to explore and discuss exhibits with each other. We also suggest that certain approaches in the social sciences, in particular field observation and video-analysis, enable us to begin to unpack the qualities of interaction that arise with and around exhibits in museums and galleries.

The Use of New Technology in Museums

The growing interest in new technology amongst museum managers is reflected

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in the deployment of multimedia devices in art exhibitions. These devices are viewed as critically important in enhancing the museum's role as an educational venue. They are used to support the interpretation of exhibits and to increase the public appeal of museums. Recent technological developments have encouraged some managers of art museums to deploy novel interpretation devices in their exhibitions, in particular PDAs and touch-screen computers. Researchers and practitioners are exploring the ways in which these devices can be designed to increase the amount of time visitors spend with exhibits, to provide visitors with additional information, and to facilitate social interaction and discussion among visitors (Aoki et al., 2002; Exploratorium, 2001; Fleck et al., 2002; Spasojevic and Kindberg, 2001; Woodruff et al., 2001).

The growing importance of new technology in the design of exhibitions has occasioned debates about whether its deployment in exhibitions offers value for money. In recent years, the suitability of conventional accounting practices and financial indicators for the assessment of the accountability of museums has increasingly been questioned. Scholars in public-sector management and cognate disciplines argue that museum accounting needs to take seriously qualitative features of the museum's mission, such as visitors' learning from exhibits and the museum's agenda for social inclusion and diversity (Carnegie and West, 2003; Carnegie and Wolnizer,

1996; Matarasso, 1997; Rentschler, 1998; Thompson, 1999, 2001).

In museum studies there is longstanding interest in the study of visitor behaviour and learning in museums. Research in this field draws largely on the behavioural and cognitive sciences. It strives to assess the effectiveness of exhibits in attracting and holding visitors and in communicating information to them. The evaluation of exhibits and exhibitions relies largely on quantitative indicators: "stopping power" – the average number of visitors stopping at an exhibit; "dwell time" – the average amount of time visitors spend at an exhibit; and "communication power" – the effectiveness of an exhibit in delivering information to visitors (cf. Serrell, 1998; Shettel, 2001). It has been concerned also with how interpretation devices like labels, PDAs and touch-screen information kiosks can enhance the effectiveness of exhibits. They explore questions such as: Do visitors spend more time at an exhibit when they use a PDA or read a label? Do more visitors stop at an exhibit that is equipped with an information kiosk? Do visitors understand information delivered by such devices? and Do visitors interact with one another when using these devices? Evaluations of different kinds of interpretation devices show that visitors spend considerably more time at exhibits when using them, and appear to engage frequently in discussions and social interaction (Exploratorium, 2001; Keene, 1998; Schulze, 2001; Screven, 1991; Serrell and Raphling,

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ABSTRACT

Museums of fine and decorative art are increasingly introducing computer-based interpretation devices such as Personal Digital Assistants (PDAs) and information kiosks into their exhibitions. Museum managers hope that such new technology will help raise visitor numbers, attract new audiences and enhance visitors' experience of exhibits. Yet we know little about whether museums' investment in digital resources is "paying off." Conventional accounting methods and techniques largely assess whether investment in exhibitions leads to higher visitor numbers and increased revenue, but ignore the museum's agenda and mission. Studies of visitor behaviour and learning focus on whether visitors attend exhibitions but largely lack methods to examine the quality of the museum experience. This paper is intended to contribute to debates about the adequacy of methods favoured in financial accounting and visitor studies to assess investment in new technology in museum exhibitions. It draws on two cases to explore how PDAs and information kiosks influence the ways in which visitors examine and experience exhibits. The findings are used to assess the deployment of new technology in exhibitions, to provide practical information for managers and designers who plan and develop such technologies for art museums, and to show how ethnographic and video-based methods can contribute to current practice in museum accounting.

KEYWORDS

Museums, interpretation, new technology, accounting, visitor studies

1992). Yet relatively little is known about whether the extended involvement in activities at exhibits contributes to the quality of visitors' experience of the museum.

In visitor studies there is growing concern with the development of methods and techniques for assessing the quality of visitors' experience of museums (Falk and Dierking, 2000; Hein, 1998). Research is increasingly drawing on the cognitive and educational sciences, which have developed an interest in the way in which social interaction and talk impact on people's learning and understanding (Lave and Wenger, 1991; Wenger, 1999; Wertsch, 1991). Researchers are investigating how social interaction and talk impact on the quality of visitors' experience of exhibits and exhibitions (Debenedetti, 2003; Goulding, 2000; Leinhardt, Crowley and Knutson, 2002; McManus, 1994). Despite their interest in the social aspects of the museum experience, these researchers focus largely on individual visitors, striving to assess their experience and learning from the museum. They also show relatively little interest in how interpretation resources like labels feature in social interaction and talk amongst visitors (for a rare exception, see McManus, 1989).

However, a growing number of researchers in visitor studies have begun to use qualitative ethnographic and video-based methods, which are concerned with the ways in which people experience and make sense of exhibits in and through social interaction. They

demonstrate that social interaction is critical for visitors' experience of exhibits. They also have begun to explore visitors' use of labels when examining art works (Heath and vom Lehn, in press; Hensel, 1987; Leichter, Hensel and Larsen, 1989; vom Lehn, Heath and Hindmarsh, 2001). The methodological and analytical framework employed in these investigations provides us with important resources for investigating how visitors use digital interpretation devices when interacting with each other in museums. They offer access to the ways in which visitors examine and make sense of art works when using interpretation resources, thus enhancing our understanding of how new technologies influence the quality of the museum experience.

This paper explores how ethnographic and video-based research methods can enhance our understanding of the impact of new technology on the visitor's experience of exhibits and exhibitions. It draws on two case studies that explore how visitors use a PDA in a contemporary art museum and a touch-screen information system in the Victoria and Albert Museum (both located in London, United Kingdom). The observations and findings provide the basis for assessing the contribution of qualitative research methods to accounting practice in museums. They also are used to develop a number of sensitivities for the design of novel interpretation devices to be deployed in fine and decorative art museums.

RÉSUMÉ

Les musées des beaux-arts et des arts décoratifs sont de plus en plus nombreux à mettre à la disposition de leurs visiteurs des guides d'interprétation informatisés comme les *Personal Digital Assistants (PDA)* et les kiosques d'information. Leurs directeurs espèrent que cette nouvelle technologie contribuera à accroître la fréquentation, à attirer de nouveaux publics et à rehausser l'expérience des visiteurs. Pourtant nous ne savons pas vraiment s'il est rentable pour les musées d'investir dans des ressources numériques. Les méthodes et techniques comptables classiques arrivent très bien à déterminer si les fonds investis dans des expositions se traduisent par une augmentation des recettes et du nombre des visiteurs, mais ne tiennent pas compte des objectifs et de la mission des musées. Les études sur le comportement et l'apprentissage des visiteurs s'intéressent à la fréquentation des expositions, mais sont largement dépourvues de méthodes permettant d'examiner la qualité de l'expérience des visiteurs. Cet article entend contribuer aux débats sur l'opportunité d'utiliser les méthodes privilégiées en comptabilité financière et dans les études de fréquentation pour estimer l'investissement dans la nouvelle technologie destinée aux expositions des musées. Les auteurs se fondent sur deux cas pour explorer l'influence des *PDA* et des kiosques d'information sur la manière dont les visiteurs examinent les œuvres exposées et en font l'expérience. Les résultats servent à évaluer l'utilisation de la nouvelle technologie dans les expositions, à fournir des renseignements pratiques aux directeurs qui planifient l'introduction de ces technologies dans les musées d'arts et aux concepteurs qui les développent, et à montrer l'apport à la pratique actuelle en matière de comptabilité muséale des méthodes ethnographiques et des méthodes ayant recours à la vidéo.

MOTS CLÉS

Musées, interprétation, nouvelle technologie, comptabilité, études sur les visiteurs

Mobility and Collaboration

Our first case study is based on an experiment conducted by the contemporary art museum, which deployed PDAs in one of its thematic galleries. A PDA is a portable device with a small screen that displays information and can be used to make selections by virtue of a touch-screen interface. PDAs can deliver multimedia content, text, and images as well as sound and video-files. The visual content appears on the screen whilst the audio-information is delivered via headphones.

The gallery where the technology was deployed comprises 14 rooms that house different kinds of exhibits such as paintings, photographs and sculptures. As part of the experiment set up by the museum, the PDAs delivered information about one exhibit in each of the 14 rooms. The purpose of this design was to cover a variety of objects, such as paintings, sculptures and collages, and to offer visitors different kinds of content for the exhibits. Visitors picked up a PDA at the information desk and then explored the gallery. For approximately four weeks we observed visitors in the gallery and videotaped approximately 20 visitors who volunteered to take part in the experiment. Our interest in the PDA is concerned not with its functionality or usability, nor with the user's satisfaction with it, but rather with how its use features in and influ-

ences visitors' examination and experience of the exhibits.

Displacing the Object

Visitors who choose to use the PDA when navigating the exhibition carry the device in their hand and wear headphones. As they enter the first room they wait for the device to display information about an exhibit. They turn towards and stand at the artifact for the duration of the information delivery. Consider the following brief examples:

In the first room, the PDA provides information about a sculpture. The audio-commentary is concerned with the artist and the period of his work. It also mentions a few aspects of the exhibit such as the artist's signature on one side of the sculpture. A man enters the room. He waits for the information about one of the exhibits to be displayed by the PDA and then turns to the sculpture. He stands at the side closest to the entrance of the gallery and looks at the screen. After about 20 seconds he looks up and moves slightly to the side to briefly glance at the signature. He then turns again, to look at the device, and walks around the sculpture.

In the second room, the PDA provides information about a painting. It describes certain features of the art work highlighted by an image on the PDA's screen. The information is designed to encourage the viewer to look at

RESUMEN

Se observa en los museos de bellas artes y de artes decorativas una creciente tendencia a incorporar en sus muestras herramientas computarizadas de interpretación, tales como las computadoras de mano (popularmente denominadas "palmtops", o PDA) o los kioscos de información, con la expectativa de que estas nuevas tecnologías contribuyan a aumentar la afluencia de público, captar la atención de nuevos segmentos y enriquecer la experiencia de quienes asisten a las exposiciones. Pero mal se sabe si la inversión que realizan los museos en los recursos digitales está dando el rédito esperado. Los métodos y técnicas convencionales de contabilización sirven para determinar si la inversión realizada se traduce en un aumento en la cantidad de asistentes y en las recaudaciones, pero no tienen en cuenta los objetivos y la misión de la institución. Por su parte, los estudios sobre el comportamiento y el aprendizaje del público asistente se interesan mayormente por saber si el público acude a las exposiciones pero, por lo demás, carecen de un método capaz de examinar la calidad de la experiencia vivida por el público. Este trabajo pretende aportar al debate para determinar si los métodos actuales de contabilización financiera y estudios de comportamiento son capaces de evaluar los resultados de la inversión en nuevas tecnologías en las exposiciones de los museos. A través del estudio de dos casos concretos, se analiza cómo las computadoras de mano y los kioscos de información influyen en la forma en que el público examina y "vive" la muestra. Los resultados obtenidos se utilizan para evaluar la utilización de las nuevas tecnologías en las exposiciones, ofrecer información práctica a los ejecutivos y diseñadores que planifican y desarrollan estas tecnologías para su uso en los museos de artes, y mostrar cómo los métodos etnográficos y los recursos de video pueden hacer su aporte a la práctica actual de contabilización en los museos.

PALABRAS CLAVE

Museos, interpretación, nuevas tecnologías, contabilización, estudios de comportamiento del público

specific features of the exhibit. A woman using the PDA assumes a position at the painting. She listens to the information whilst looking at the screen. When the image highlights a particular feature of the exhibit, she briefly looks up at the art work. A moment later, she once again orients to the screen until the screen highlights another feature of the exhibit.

Despite the mobility of PDAs, visitors largely use them in stationary positions near the exhibits covered by the information. They tend to choose a centre position at the exhibit, where they can view the artifact face on. They remain in this position for the duration of the commentary provided by the device. The information has a profound influence on how the visitor views the art work. The visitors follow the suggestions given in the audio-commentary and briefly look at features of the art work highlighted by the PDA. However, a moment later they orient again to the screen. The structure of the audio/video-commentary requires visitors to remain attentive to the device if they do not want to miss any interesting information. The content often includes details of exhibits or the process of their production that are unavailable elsewhere in the exhibition. Whilst the visitor stands at the exhibit, therefore, he or she remains oriented to the device, which shows text, images or short films, rather than the art work. The PDA displaces and becomes a substitute for the authentic object (cf. Walter, 1996).

Interaction and Collaboration

The contemporary art museum is very popular with the public and is normally populated by large numbers of visitors. Visitors usually arrive with companions and coordinate their conduct at the exhibition with others present in the same gallery. Often, when given the opportunity to use a PDA, all the members of a group will decide to have one.

A couple explores the exhibition, both parties using a PDA. When they stand at a painting the woman tries to draw her companion's attention to one particular feature of the exhibit. She turns to him to speak. However, the man does not attend to her. The woman then takes off her headphones. He notices this and responds by removing his own head-

phones. Both visitors display a readiness to talk and begin a brief discussion of the art work.

A couple explores the exhibition, both parties using a PDA. When the man turns to leave the painting, his companion remains at the exhibit to complete the information delivery. As she turns around, he has already reached the exit of the gallery. She catches up with him and they engage in a brief exchange. When they arrive in the next room they try to synchronize their PDAs by touching the screen at the same time, which does not work. The man then unplugs the woman's headphones and looks for a second socket in his own device. However, the PDA is not designed for a dual connection of headsets.

The PDA makes it difficult for visitors to talk and engage in discussion. The small screens and headphones do not allow others to view the information displayed or to overhear the audio-commentary. The content is delivered in a single stream that does not encourage visitors to interrupt delivery and engage in discussion. Talk arises either due to a technical problem such as a crash of the computer system or when visitors leave the exhibit and go to the next room. Visitors talk with one another about the exhibit and the information delivered by the devices when they are on the move and do not have access to the art work or the digital information. They often show dissatisfaction with the design of the device and try to engage in interaction with another PDA. They seek ways to overcome the PDA's technical inability to deliver information to more than one visitor at a time. They look for ways to access each other's audio-commentary, try in vain to share images displayed on the screen, and drop one PDA in favour of another – then discuss the content delivered by the one they keep.

Visitors view the exhibition in the presence of many strangers, yet they coordinate their conduct in the exhibition with these people, in order to allow each to view the art work.

A visitor stands at the sculpture in the first room. He looks at the PDA screen and listens to the information. His posture and tilted head display his orientation to the device. After a few moments, other visitors approach him from behind. They stop and glance first at the man and then at the exhibit before deciding to leave this part of the gallery. The visitor

does not respond to the presence of others in his domain.

A visitor stands at a painting oriented to her device as others huddle behind her to view the art work. After a few moments she turns around in order to walk away, almost bumping into the other visitors, whom she had not noticed.

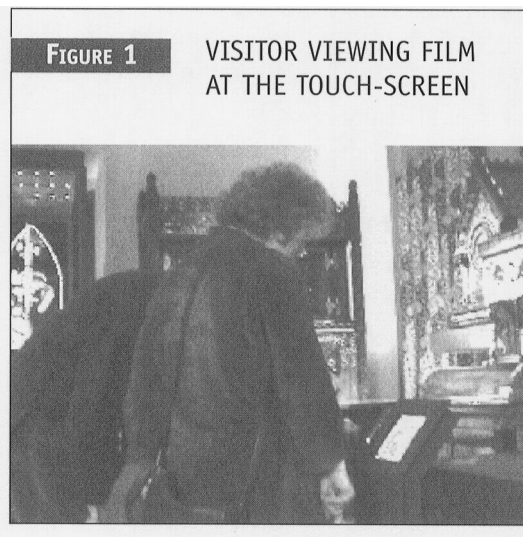
Visitors concentrate on the exhibit as they listen to the information delivered via their PDAs. As long as they stand in front of the exhibit, other visitors hesitate to approach it. Visitors with PDAs normally stand at the exhibit with their head tilted forward, looking at the screen. Frequently, the sensory seclusion of visitors using PDAs and the size of the art work on display hamper coordinated access to the exhibits. Visitors with PDAs are often desensitized to their immediate environment, apparently unaware of the arrival of others. They do not seem to sense the presence of others and become an obstacle for them and for the natural flow of visitors to the exhibition. They obstruct access to the art work, often causing others to move on without being able to examine it.

Creating Audiences

Aside from the deployment of mobile information devices in museums, there is growing interest in using fixed, digital displays in art and decorative art museums, to provide information concerning particular exhibits. Such displays have important advantages over conventional labels: content can easily be restructured and changed, text can be accompanied by more complex materials, including pictures and short films, and visitors can be provided with various opportunities to select different types of information via different media (Schulze, 2001; Thomas and Mintz, 1998; Wohlfromm, 2002).

The British Galleries at the Victoria and Albert Museum in London have installed a small number of these "information kiosks" in order to enhance information concerning particular exhibits. A case in point is a splendid 19th-century washstand by William Burges. To one side of the exhibit is a monitor that features a film lasting about two minutes on

the design and function of the washstand. The film consists of a series of interconnected but continuous pieces of information on particular aspects of the exhibit. Each includes one or two subtitles summarizing a feature of the washstand – for example, "the bowl is emptied into the container underneath." The monitor sits on a low stand to the right of the Burges washstand. The film is begun by touching the screen and continues without interruption until the end.



There is significant variation in whether and how people use the interactive. It is largely dependent on the presence and behaviour of others – both their companions and other visitors who happen to be in the same space. For example, if the gallery has few visitors it is not unusual for an individual to look at the washstand, watch the video and then re-examine aspects of the piece in light of the information presented in the video (Figure 1); but when the gallery is relatively crowded it becomes increasingly difficult for visitors to view the Burges piece and then watch the film – for example, it is not unusual for them to glance at the piece and, seeing people watching the video, simply move on rather than wait for their turn. The angle at which visitors approach the washstand also bears upon how they use the information displayed. For example, if visitors approach from the right, where the monitor is positioned, then – if the monitor is accessible – they will watch the video before looking at the object. Indeed, it is not unusual for visitors to watch the video, occasionally glancing at the exhibit, and, as the

film comes to end, momentarily glance at the piece before moving on (Figure 2). The quality of the film and the complexity of the images provide details about the washstand that the visitor will not have access to by viewing the object itself. It is not surprising, therefore, to find that the display becomes a substitute for looking at the object and does not necessarily encourage people to examine the piece in detail. In a sense, therefore, the video extends “dwell time” in this area of the gallery. The fact that visitors spend time watching the film without necessarily examining the object itself may not be important, but it once again points to the rather fragile relationship between interactives and the objects whose interpretation and exploration they are designed to enhance. It also stands in contrast to the ways in which people use conventional labels and gallery cards as resources when looking at an exhibit (cf. Callanan, Jipson and Stampf Soennichsen, 2002; McManus, 1989).

The interactive display, the video, also serves to encourage particular forms of participation – forms that do not necessarily facilitate interaction and discussion. It is not unusual for visitors, when watching the film together, to fall silent, to become an audience, for the duration of the short program. Occasionally they will say something, perhaps look up, or even point to a feature of the washstand, but social interaction is largely limited to watching the program with someone else. Of course, in some cases the program serves to encourage discussion afterwards, but this depends upon how people have approached the exhibit, its accessibility and their willingness to discuss it further. Visitors make brief comments and occasionally glance at the exhibit itself, but to a great extent their co-participation is limited to a mutual alignment towards the film.

This may not be surprising. The narrative structure of the film and its uninterrupted flow limit the opportunities for visitors to simultaneously look at the object and converse. If visitors do look up and examine the piece for more than a second or so, then they may well miss the next part of the film, which demonstrates or illustrates some aspect of the exhibit. Similarly, if visitors exchange more than a brief comment, then their talk soon becomes unrelated to the material they are viewing on screen. Moreover, any comments that are made encourage the co-participant to turn and look at some feature of the exhibit itself; yet if they respond appropriately they are likely to miss the next part of the film.

Visitors go to some lengths in attempting to co-participate in simultaneously watching the video and looking at the exhibit. Once again, we find examples of a division of labour emerging, where one visitor will watch the video and read out the subtitles as they appear, while his or her partner inspects the actual piece. Rather sadly, however, these forms of collaboration often lead to difficulties, since the visitor viewing the piece will demand his partner's attention in examining some feature of the washstand, while she attempts to continue to watch the film. Unfortunately perhaps, the structure and pace of the film provide little opportunity for simultaneous participation in examining the exhibit, watching the video and discussing the exhibit. When visitors do attempt to use the film to create a more collaborative examination of the exhibit – for example, by selectively reading the subtitles to a partner – tensions arise between the interaction of the visitors and the structure and demands of the film. There is a delicate process of negotiation by which the visitors attempt to establish and maintain a common focus of

FIGURE 2 TWO VISITORS AT THE WILLIAM BURGESS WASHSTAND



involvement that interweaves the film with the exhibit, but within moments a fragmentation generally arises or the second person simply joins his or her partner in watching the video.

None of this is to suggest that the accompanying films are not interesting and informative. In the case of the Burges exhibit, the film dramatically illustrates aesthetic and functional aspects of the washstand that would be difficult if not impossible to describe in a label or even in accompanying pictures. However, the location, length, and structure of the film have a significant impact on the ways in which visitors inspect and experience the original washstand and, more broadly, the ecology of participation and interaction that arises within the area of the exhibit itself. The film engenders particular forms of participation and can temporarily transform visitors into an audience, undermining their ability to explore and discuss the piece collaboratively. The relationship between viewing the film and inspecting the object is highly dependent on the presence and actions of others within the same space, and even on the direction from which the visitor approaches this particular area of the gallery. However, unlike a conventional label, which provides resources for comment and discussion and the collaborative inspection of the exhibit, the film does not necessarily remain subservient to the object it is illustrating; rather than engendering discussion, it can transform the visitor into a passive participant while removing the need to examine the object.

Discussion

This discussion of visitors' use of PDAs and information kiosks shows that new technology can provide individuals with interesting and valuable information on the arts and the decorative arts. Both cases discussed above concern cutting-edge technologies as they are currently being deployed in art museums. These technologies are very well designed and present relatively few technical problems. Moreover, visitors use and seem to appreciate these novel interpretation devices. Yet some scepticism towards the increasing enthusiasm

for this kind of computer-based interpretation device in museums is warranted.

The case studies point to the inadequacy of conventional methods and techniques to account for digital interpretation devices in museums. Such methods may be able to demonstrate a rise in visitor numbers to an exhibition after the deployment of new technology or an increase in the amount of time visitors spend with exhibits, but they do not assess the quality of visitors' experience of exhibits. Visitor research has begun to address this gap but remains primarily concerned with individual visitors and their behaviour. Only recently have social aspects of the museum visit begun to be taken seriously – surprisingly, however, without consideration for social scientific theories and concepts of social action and interaction.

Ethnographic and video-based research, coupled with existing accounting methods, may enhance the effectiveness of museum accounting. Financial accounting and behavioural studies of the museum experience provide important findings concerning the success and effectiveness of museums. However, they ignore the museum's mission and agenda and are inadequate to reveal the quality of visitors' experience of exhibits. Ethnographic and video-based methods may provide an opportunity to address this shortcoming of conventional accounting techniques and visitor studies. They can reveal the ways in which visitors organize action and interaction at exhibits, by virtue of which they experience and make sense of exhibits.

The two case studies discussed above reveal that visitors who use PDAs and information kiosks spend a relatively large amount of time at exhibits but are primarily oriented to the device rather than to the art work itself. The PDA displaces the art object. It also hinders social interaction amongst visitors, because the hardware and content are designed and structured for retrieval by one person rather than by two or more.

Interactive information devices are designed to facilitate particular forms of conduct and experience and rely on visitors using the exhibit or artifact in particular ways. They may even necessitate the visitor interrelating objects and making connections between exhibits that are not necessarily located together. Unfortunately, however, visitors do not necessarily respond

in the ways we imagine or hope, and circumstances may arise that make it difficult if not impossible for them to engage in the pattern of action required by the interactive. Even if we reflect on one of the more seemingly straightforward assumptions underlying many interactives and exhibitions – that visitors will follow particular navigation paths and thereby engage in the relevant actions in the appropriate sequence – we can see how easily such an assumption may be undermined by virtue of the number of visitors or the different paces at which or directions in which they pass through the galleries. Such considerations are important in exhibition design and need to be placed high on the agenda when interactives are being developed (Heath, vom Lehn and Osborne, in press).

Our research has led us not to abandon the idea of developing and deploying novel interpretation technologies in art museums but, rather, to the idea of developing a number of *design sensitivities* concerning interface technology and content of novel interpretation devices, such as:

- portable technology that is not tied to an individual user but is designed to facilitate sharing among multiple visitors
- display technology that allows for multi-party participation and facilitates overhearing and co-participation
- screens that can be viewed or read by multiple visitors at once, from various angles
- content that is structured such that it encourages visitors to view the exhibit at certain points and facilitates the interweaving of information delivered by the device and that inherent in the exhibit itself
- content that is designed to stimulate comment and discussion about the exhibit.

In some exhibitions, large, tangible, portable interpretation devices are relatively successful in informing visitors about exhibits and encouraging interaction. For example, many conventional art exhibitions, including the Raphael cartoons at the Victoria and Albert Museum and galleries of the Louvre in Paris and the Musée de Rouen, provide visitors with large cards. These interpretation devices are mobile and non-interactive. They contain text and images concerned with the exhibits in a given gallery. They are designed to be shared and used collaboratively by companions.

Observations in the Musée de Rouen have shown that visitors use these cards to comment on and discuss exhibit features whilst examining the artifact itself (Heath and vom Lehn, in press). These tangible devices provide visitors with the opportunity to interweave textual and visual information with aspects of the exhibit. There may be some benefit in using such low-tech interpretation devices that have proved relatively effective and augmenting them with computer technology. Recent developments in technology design may provide us with the tools and technologies to augment paper and other kinds of familiar, tangible artifacts in order to support social interaction and discussion at the exhibit face.

These observations and findings derive from our ethnographic and video-based studies of visitors examining and making sense of exhibitions. They point to the inadequacy of conventional methods and techniques for assessing the visitor's museum experience and accounting for investments in novel interpretation devices for exhibitions. They suggest the need for methods and techniques that will enhance our understanding of the exhibit experience as it emerges at the exhibit face. Current accounting practice in museums tends to focus on individual visitors and their behavioural response to exhibits, thereby ignoring the processes of action and interaction through which visitors experience and make sense of art works.

Ethnography and video-based field studies, coupled with a relevant methodological framework, provide an opportunity to address and unpack the conduct and interaction by virtue of which visitors examine and experience exhibits. Coupled with more conventional methods for measuring accountability of museums, such as those used in visitor studies, ethnography and video-based field studies will contribute not only to our understanding of the museum experience, but also to the development, evaluation, and deployment of exhibits and novel interpretation devices, especially those designed to create new forms of co-participation and interaction. The museum environment has been transformed by technology. It is becoming increasingly important for us to understand whether this development will enhance or impoverish interaction in the visitor's experience of museums.

References

- Aoki, P.M., R.E. Grinter, A. Hurst, M.H. Szymanski, J.D. Thornton and A. Woodruff. 2002. *Sotto Voce: Exploring the Interplay of Conversation and Mobile Audio Spaces*. Chi 2002. Minneapolis: ACM Press.
- Callanan, M.A., J.L. Jipson and M. Stampf Soenichsen. 2002. "Maps, Globes, and Videos: Parent-Child Conversations About Representational Objects." In *Perspectives on Object-Centered Learning in Museums*, S. Paris, ed. Mahwah, NJ: Lawrence Erlbaum, p. 261–283.
- Carnegie, G.D., and B.P. West. 2003. "How Well Does Accrual Accounting Fit the Public Sector?" *Australian Journal of Public Administration*, Vol. 62, n° 2, p. 83–86.
- Carnegie, G.D., and P.W. Wolnizer. 1996. "Enabling Accountability in Museums." *Accounting Auditing and Accountability Journal*, Vol. 9, n° 5, p. 84–99.
- Debenedetti, S. 2003. "Investigating the Role of Companions in the Art Museum Experience." *International Journal of Arts Management*, Vol. 5, n° 3, p. 52–63.
- Exploratorium. 2001. *Electronic Guidebook Forum*. San Francisco: Author.
- Falk, J., and L. Dierking. 2000. *Learning from Museums: Visitor Experiences and the Making of Meaning*. Walnut Creek, CA, Lanham, MD, New York and Oxford: Alta Mira Press.
- Fleck, M., M. Frid, T. Kindberg, E. O'Brian-Strain, R. Rajani and M. Spasojevic. 2002. *From Informing to Remembering: Deploying a Ubiquitous System in an Interactive Science Museum*. Palo Alto, CA: Hewlett-Packard.
- Goulding, C. 2000. "The Museum Environment and the Visitor Experience." *European Journal of Marketing*, Vol. 34, n° 3/4, p. 261–278.
- Heath, C., and D. vom Lehn (in press). "Configuring Reception: Looking at Exhibits in Museums and Galleries." *Theory, Culture and Society*.
- Heath, C., D. vom Lehn and J. Osborne (in press). "Interaction and Interactives." *Public Understanding of Science*.
- Hein, G. 1998. *Learning in the Museum*. London: Routledge.
- Hensel, K. 1987. *Families in a Museum: Interactions and Conversations at Displays*. New York: Teachers' College, Columbia University.
- Keene, S. 1998. *Digital Collections, Museums and the Information Age*. Oxford: Butterworth & Heinemann.
- Landry, C. 1994. "Measuring the Viability and Vitality of City Centres." In *Urban and Regional Quality of Life Indicators*, C. Mercer, ed. Brisbane: Institute of Cultural Policy Studies, Faculty of Humanities, Griffith University.
- Lave, J., and E. Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Leichter, H.J., K. Hensel and E. Larsen. 1989. "Families and Museums: Issues and Perspectives." *Marriage and Family Review*, Vol. 13, n° 4, p. 15–50.
- Leinhardt, G., K. Crowley and K. Knutson, eds. 2002. *Learning Conversations in Museums*. Mahway, NJ: Lawrence Erlbaum.
- Matarasso, F. 1997. *Use or Ornament? The Social Impact of Participation in the Arts*. Stroud, Gloucestershire, UK: Comedia.
- McManus, P. 1989. "Oh Yes, They Do: How Museum Visitors Read Labels and Interact with Exhibit Text." *Curator*, Vol. 32, n° 3, p. 174–180.
- McManus, P. 1994. "Families in Museums." In *Towards the Museum of the Future: New European Perspectives*, R. Miles and L. Zavala, eds. London: Routledge, p. 81–97.
- Rentschler, R. 1998. "Museum and Performing Arts Marketing: A Climate of Change." *Journal of Arts Management, Law and Society*, Vol. 28, n° 1, p. 83–96.
- Schulze, C. 2001. *Multimedia in Museen. Standpunkte und Aspekte interaktiver digitaler Systeme im Ausstellungsbereich*. Wiesbaden: Deutscher Universitäts-Verlag.
- Screven, C. 1991. "Computers in Exhibit Settings." In *Visitor Studies: Theory, Research, and Practice*, Vol. 3, S. Bitgood, A. Benefield and D. Patterson, eds. Washington: Center for Social Design.
- Serrell, B. 1998. *Paying Attention: Visitors and Museum Exhibitions*. Washington: American Association of Museums.
- Serrell, B., and B. Raphling. 1992. "Computers on the Exhibit Floor." *Curator*, Vol. 35, n° 3, p. 181–189.
- Shetrel, H. 2001. "Do We Know How to Define Exhibit Effectiveness?" *Curator*, Vol. 44, n° 4, p. 327–334.
- Spasojevic, M., and T. Kindberg. 2001. *A Study of an Augmented Museum Experience*. Palo Alto, CA: Hewlett-Packard.
- Thomas, S., and A. Mintz, eds. 1998. *The Virtual and the Real: Media in the Museum*. Washington: American Association of Museums.
- Thompson, G.D. 1999. "What's Wrong with New Zealand's Service Performance Reporting Model? The Case of Public Museums." *Public Management*, Vol. 1, n° 4, p. 511–529.
- Thompson, G.D. 2001. "The Impact of New Zealand's Public Sector Accounting Reforms on Performance Control in Museums." *Financial Accountability and Management*, Vol. 17, n° 1, p. 5–21.
- vom Lehn, D., C. Heath and J. Hindmarsh. 2001. "Exhibiting Interaction: Conduct and Collaboration in Museums and Galleries." *Symbolic Interaction*, Vol. 24, n° 2, p. 189–216.
- Walter, T. 1996. "From Museum to Morgue? Electronic Guides in Roman Bath." *Tourism Management*, Vol. 17, n° 4, p. 241–245.

- Wenger, E. 1999. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.
- Wertsch, J. 1991. *Voices of the Mind*. London: Harvester Wheatsheaf.
- Wohlfromm, A. 2002. *Museum als Medium. Neue Medien in Museen*. Cologne: Herbert von Halem Verlag.
- Woodruff, A., P.M. Aoki, A. Hurst and M.H. Szymanski. 2001, September. *Electronic Guidebooks and Visitor Attention*. Proceedings of 6th International Cultural Heritage Informatics Meeting, Milan, Italy.
- Wu, C.-T. 2003. *Privatising Culture: Corporate Art Intervention Since the 1980s*. London: Verso.

