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Configuring 'Interactivity': Enhancing Engagement in Science Centres and Museums

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ABSTRACT There is a growing commitment within science centres and museums to develop exhibitions that engender new forms of participation that contribute to the public's understanding of science. Information and communication systems play an important role in this regard, enabling new forms of 'interaction' with and around exhibits. In this paper we consider how visitors respond to these exhibits and explore the forms of interaction that arise within these new exhibition areas. The analysis addresses the ways in which these so-called 'interactives' create highly constrained sequences of action that prioritize the individual user while undermining the opportunities for co-participation and collaboration. It examines the ecologies of participation that arise with, around and within different types of exhibit and exhibition. The paper suggests that many 'interactive' exhibits rely upon a model of 'interaction' and the 'user' that pervades computer-based systems, a model that has been subject to sustained criticism over some years. In other words, the paper points to the ways in which 'interactivity' is conflated with social interaction and how the seemingly innovative and entertaining exhibits may fail to engender the co-participation and collaboration that is seen as critical to learning and engagement.

Keywords 'interactivity', museums, science centres, social interaction, technology

Configuring 'Interactivity':

Enhancing Engagement in Science Centres and Museums

Christian Heath & Dirk vom Lehn

In recent years substantial funding from both the public and private sectors has been invested in science centres and museums in order to enhance the public's engagement in science. These initiatives have emerged, in part, from a concern within government and education with the growing disaffection, even distrust, among members of the general public with recent scientific developments and their disengagement from contemporary debates concerning such matters as genetic engineering or nuclear physics (Department for Education and Employment, 1997; Sainsbury, 2002). They also have been driven by the growing commitment to enhance the educational role of museums and galleries, and the recognition that 'informal learning' can make an important contribution to awareness and understanding not only among children but also adults (Durant, 1992; Farmelo & Carding, 1997; Hein, 2000).

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These commitments are not necessarily new: they echo debates and developments of the mid-19th century that led to the emergence of a range of museums and exhibitions, both in the UK and abroad, concerned with craft, design, manufacture and science (Hudson, 1975; Hooper-Greenhill, 1991; Bennett, 1995). However, the contemporary approach to enhancing engagement with science is not primarily concerned with assembling and exhibiting new collections, but increasingly with developing exhibits (and exhibitions) that create new forms of engagement with science and enhance the communication of technical and specialized knowledge (Beetlestone et al., 1998; Caulton, 1998; Bradburne, 2000).

Alongside the long-standing commitment of many science museums and even science centres to displaying authentic objects, we have witnessed a growing interest in exploring the ways in which new technologies can communicate science and enhance learning and engagement (Bradburne, 2000; Exploratorium, 2001). For example, new technologies such as personal digital assistants (PDAs), digital information kiosks and 'interactive centres' are used to provide visitors with information concerning collections. However, to a large extent, especially in science museums and science centres, new technologies have been used to create new forms of exhibit and exhibition. A key element of these developments is the growing commitment to 'interactivity' and the idea that 'interactivity' and the informal, interpersonal communication it involves is critical to engagement and learning (Caulton, 1998; Scott, 2004). In this regard, new technologies are used to design exhibits that enable visitors to 'interact' and thereby become more engrossed in, and engaged with, matters of scientific interest. The 'interactive' installations that increasingly pervade science centres and museums range from simple, personal computer-based exhibits that for example test an individual's understanding of a particular phenomenon, through to highly sophisticated, multi-party installations that enable groups of individuals to discuss matters of contemporary scientific debate and interest. It is assumed that by creating these new forms of 'interactivity' the exhibits and the technologies on which they rely enhance engagement through (social) interaction and thereby provide the resources through which people communicate, and come to understand, science (Bradburne, 2000).

Despite the substantial investment in 'interactive' exhibits within science centres and museums and a belief in the educational contribution of these new exhibition areas, there is surprisingly little research that examines how people use and respond to these installations. Many of the museums and science centres commission in-house evaluations and assessments, but in many cases these are based on focus groups and questionnaires and provide little insight to what actually happens at the exhibit-face. Even more wide-ranging comparative research, for example undertaken within the applied field of visitor studies, rarely addresses how people, both alone and with others, act and interact with and around these new forms of exhibit. Such research also rarely examines the kinds of activity or interaction that arise when people confront these installations (Screven, 1986; Serrell & Raphling, 1992; Falk & Dierking, 2000; Scott, 2004). In one sense this may

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not be surprising, given the methodological commitments that are found within museum and visitor studies. However, with the commitment to enhancing 'interactivity' and engagement and its potential educational value, one might imagine that the action that arises at the exhibit-face might become a central empirical and analytic issue. Unfortunately this is not the case, and we still know little as to the forms of action, interaction and 'interactivity' that is occasioned by computer-based, interactive exhibits, still less whether they successfully communicate and engage people in science.

In this paper, we wish to begin to address one or two of these issues, and in particular briefly examine the forms of engagement and participation that arise within and around a small number of interactive exhibits. The paper uses video-based field studies undertaken within a number of science centres and museums in the UK and focuses on the ways in which people use and interact with particular exhibits. In addressing 'interaction' with and around the exhibit, we consider how these 'interactive' installations delineate and constrain the engagement of visitors in ways that do not necessarily facilitate co-participation and collaboration. In this way, we suggest that the design and deployment of many computer-based exhibits in science museums and centres conflates 'interactivity' with social interaction and thereby undermines the informal educational contribution that such exhibits are thought to achieve.

There is a long-standing interest in sociology in the dissemination of scientific knowledge and the ability of various organizational arrangements and events to communicate seemingly complex ideas to the general public (Yearley, 2004). Perhaps the most significant of this research examines how the broadcast media influence the scientific agenda for the general public, and in turn how programme content and production arise in light of a range of highly contingent, and in some cases inexperienced, contributions by programme-makers and their consultants. As Silverstone (1985) demonstrates in his well-known study of the BBC *Horizon* programme, studies of production of scientific programmes are not sufficient to understand the communication of science. Silverstone powerfully argues that audiences and reception should be placed at the forefront of the analytic agenda. In this regard, and notwithstanding the 'reception' turn in literacy and cultural studies, it is surprising that so little attention has been paid to how 'audiences' respond to exhibits and exhibitions in museums and galleries, and how their response arises in and through highly contingent forms of interaction and participation. In part therefore we hope this paper will make a small contribution to a sociological programme of work that is directed towards taking 'response' seriously and in particular addressing how exhibits in science centres, museums and galleries are encountered in concert and collaboration with others (Heath & vom Lehn, 2004).

Taking action at the exhibit-face seriously places certain methodological constraints on research. For example, it is not at all clear that focus groups and post hoc questionnaires, the favoured techniques of museum studies can provide insight into what people say and do when encountering exhibits. Indeed, it has been argued that there is little correspondence between people's

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post hoc characterizations of their museum experience and the activities in which they engage when visiting exhibitions (Gilbert & Priest, 1997). More importantly perhaps, as Garfinkel (1967), Sacks (1992) and in a very different way Goffman (1963, 1971) powerfully articulated some years ago, the mundane or commonsense standpoint necessarily glosses the details in and through which activities are accomplished in concert with others. In this regard, it is increasingly recognized that recording media, augmented by fieldwork, provide unprecedented access to the details of social action and interaction. Coupled with appropriate methodological resources, they enable analytic attention to be directed towards the situated character of practical action. In science museums and science centres, where so much of what we do is accomplished through visual and tactile engagement with objects as well as talk, then video, or rather audio-visual recordings would seem to have practical advantages. Our own project has involved a substantial body of audio-visual recordings in museums and galleries in the UK. These recordings have been augmented by field studies and interviews with visitors and museum managers, curators, designers and exhibition organizers. We have also undertaken studies of the development of new exhibitions. Among other things, these studies enabled us to explore the models of the visitor and visitor conduct that inform the design of particular exhibits and installations.

Prescribing 'Interaction'

Many of the interactive exhibits that have been deployed within science centres and museums rely upon relatively basic computing technologies, not unlike those found within conventional domestic or workplace environments. The interface can be slightly more sophisticated, relying for example on touch-screen or finger pads rather than keyboards, but to a significant extent the models of interaction and forms of hardware that underpin conventional computing technology pervade science centres and museums. Consider for example a well-established exhibit at Explore-at-Bristol, a relatively new science centre that focuses on the human body and

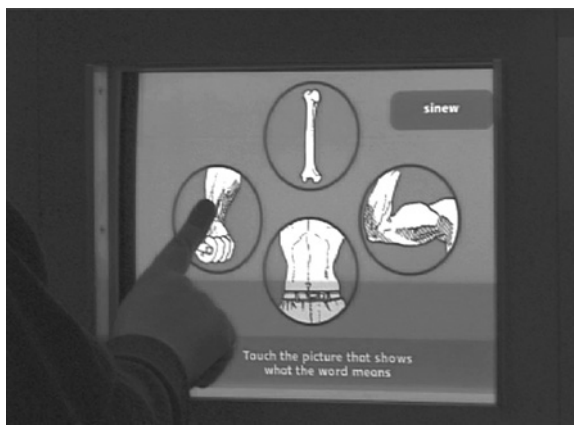

Image 1.1

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mind. The exhibit is designed to reveal people's linguistic or word skills. It consists of a conventional 17-inch monitor and a touch-screen interface. The exhibit poses a series of tests for visitors to take, and then provides a rating score for their linguistic abilities.

We join the action as a young woman arrives at the computer exhibit. She sits on the stool and selects one of the tests provided by the system. The first question appears on the screen. She reads the question and makes her selection from a range of options by touching the relevant field on the screen (Image 1.1). The display turns blank for about 2 seconds before posing the next question (Image 1.2). The woman once again selects one of the various options and the screen turns momentarily blank again.

While she waits for the next question to be displayed, she looks at the screen (Image 1.3). After 3 or 4 seconds the next puzzle is posed together with multiple-choice answers. She makes her selection, touching the screen

Image 1.2

Image 1.3

Image 1.4

and waits for the next question to appear (Image 1.4). She continues to select answers in response to questions posed by the exhibit until the test is complete and the score is provided.

We can see that the exhibit prescribes a simple, yet highly structured pattern of action by the visitor. The pattern of action consists of selecting one of a number of potential answers to successive questions posed by the system. The 'interaction' consists of a series of questions posed by the computer and responses selected by the visitor, with each response providing the system with the possibility of posing the next question. The 'interaction' is directed towards the achievement of a particular goal – a cumulative evaluation or assessment of the linguistic skills of the visitor – and the goal prospectively and retrospectively provides for the intelligibility of the activity. The interaction with the system consists of a series of two-part sequences that builds into a cumulative trajectory of action that enables a final, personal assessment of the individual's performance. The character of the 'interaction' prescribed and structured by the exhibit prioritizes the 'use' by individuals over collaborative forms of engagement. It constrains each subsequent opportunity for action by offering a small set of choices and finally assesses the user's abilities.

Despite some variation between different institutions, it is estimated that approximately 75% of people who visit science centres and museums do so with others – friends, family, in school groups, and the like (Butler & Sussman, 1989; MORI, 2001). Even when alone, it is likely that others will be in the

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Image 2.1

same physical area, and, as we have suggested elsewhere, the actions of others, both those they are with and those who just happen to be in the same space, have an important impact on people's discovery and experience of exhibits and exhibitions (Vom Lehn et al., 2001). When approaching an 'interactive' exhibit, people therefore are often accompanied by companions. For example, consider a fragment in which two visitors arrive at an exhibit. It is drawn from 'Jumping Numbers' at Green's Mill Science Centre in Nottingham, an exhibit that confronts visitors with a mathematical puzzle that is solved by repeatedly stepping on two alternative footpads that add or subtract numbers (Image 2.1).

As Bob and Peter arrive at the exhibit, a question appears on the screen 'How many steps does it take you?' Peter steps onto the footpad and the screen changes but then steps off to examine the screen. Bob moves forward and repeatedly steps onto the '+' pad. The display rapidly changes; '3', '6', '9'.

Bob steps 12 times onto the '+' section of the panel and then once onto the '–' section. Each step onto the panel is followed by a change in the display, showing a new number to add to or subtract. He finally achieves the figure of 31. Once again, it is the cumulative actions of the visitor that enables him to complete the task. In this instance, once Bob has secured access to the exhibit, the activity prioritizes a series of his consecutive actions. He becomes the principal user of the installation and Peter is relegated to being an onlooker until they exchange positions (Images 2.2, 2.3 and 2.4).

Image 2.2

Image 2.3

Image 2.4

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Consider a further fragment. It is drawn from a very different interactive exhibit, 'Energy Minister', a computer-based installation in the new exhibition on energy at the Science Museum in London. The exhibit is a touch-screen computer game where the user plays the part of Energy Minister of an imaginary country called Lectraland. The task is to provide energy for the country by making decisions about sources (wind, water, nuclear, and so on) and locations of power plants. Each step in the game requires the user to select an energy source from the panel on the left of a screen and deploy it by touching a location on the map. Fred is using the systems with his friend Tom standing to his left. At one point Fred laughs aloud, points at the screen and then turns his head slightly to the left, until his friend attends to his 'outloud' (Goffman, 1981b).

Transcript 1
F: hehehehehe
T: what was that?
F: Protestors
T: ah
(3.9)
F: don't know why that should upset people

Despite standing alongside Fred at the exhibit, Tom's response to the laughter displays his disassociation from the game and from the successive moves that his friend has made. Fred's response – the single word 'Protestors' – enables Tom to find for himself, retrospectively, the object of the laughter – the exhibition displays a news item announcing that there are protests in the streets of Lectraland against the Minister for his failure to provide appropriate levels of energy. Tom glances at the screen and provides a minimal acknowledgement token 'ah'. He then turns away, and Fred resumes the game — touching the screen — and deploying another power station (Images 3.1, 3.2).

The overt laughter presupposes the presence of Tom while recognizing that he may not have noticed the object of laughter. It serves to draw him, momentarily, to the game, but fails to secure his engagement. Fred's return to the game that is already in progress, a game consisting of a series of contingent moves that will provide some form of his assessment of his moves as Energy Minister, provides little opportunity for Tom to intervene, take interest, or even observe. Tom is at best a bystander; co-present but only

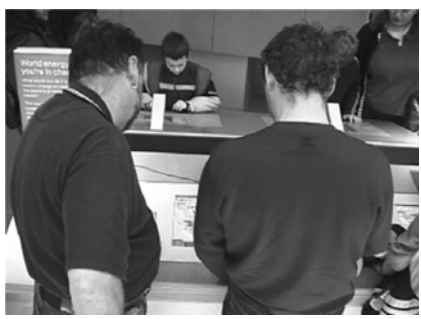

Image 3.1

Image 3.2

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momentarily engaged in Fred's use of the exhibit. He waits his turn but there is little to do in the meantime except watch the activities of the other. The exhibit does little to encourage co-participation or interaction between people while one is 'interacting' with the system.

Word Skills, Jumping Numbers and Energy Minister are three of a range of similar exhibits deployed in science centres and museums. For example, at Explore and the Science Museum London there are a range of computer-based exhibits that provide visitors with a particular challenge and pose a succession of problems and questions that enable visitors to assess their ability at undertaking a particular task and, more generally, their reasoning and knowledge concerning a particular domain or skill. At museums such as Explore in Bristol or Green's Mill in Nottingham we find exhibits that test the language and mathematical skills of visitors. At Think Tank in Birmingham, people are invited to protect a human body from infection or to assess whether they are talking to a machine or human being; and in Glasgow, visitors are provided with an opportunity to progressively restructure and transform their own image. Despite differences in subject matter and the problems posed by the exhibits, the 'interaction' they prescribe and the forms of participation they afford embody particular characteristics that severely restrict the forms of co-participation and collaboration in which visitors are able to engage.

In each case the exhibit presents the visitor with an overall problem and a goal. The problem is addressed by responding to a series of questions or prompts issued by the system. In most cases, these questions or prompts provide the visitor with one of a number of potential responses – a multiple choice. The selection of a response provides the basis for the next question or prompt. The visitor's response to each of the questions or queries then forms the basis to the overall outcome, not infrequently a score or assessment of the person's ability to undertake a particular task. The 'interaction' consists of series of two-part sequences, consisting of query and response, where the response passes the floor with dispatch to the system to issue the next query, and so on. The 'interaction' is analogous to the 'chaining rule' (Sacks, 1992: 230) of question–answer sequences found in conversational interaction; the person posing a question has 'a reserved right to talk again' (ibid.). In the case at hand, the system asks a question that the 'user' answers by touching the screen which allows the system, and the system only, to pose the next question, and so forth. The bias towards a particular respondent, namely the user of the system, is strengthened by virtue of the final assessment or evaluation; in most cases it is the individual's ability to undertake a particular task that forms the basis for the score and its potential comparison to others. The 'interaction' not only prioritizes the single individual, but an individual whose principal contribution is to respond to questions and prompts of the system in order to achieve a particular goal.

The activity prescribed by these exhibits is not unlike the model of 'interaction' that is said to pervade human–computer interaction (HCI) and artificial intelligence and has been subject to sustained criticism over the past couple of decades. It is assumed that action is plan-based and goal-oriented

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and structured with regard to pre-specified rules and scripts that enable users to achieve the goals in question. More complex tasks are broken down into sub-goals that in turn have associated rules or plans that enable the systematic accomplishment of particular actions and activities. This model of interaction is perhaps best exemplified in the Card et al. (1980, 1983) influential study of HCI where they develop GOMS, a model that exposes several layers of goals, operators, layers and rules that enable the cumulative and hierarchical accomplishment of higher-level goals. Despite the intuitive appeal of this model of 'interaction' as Suchman (1987) and others powerfully demonstrate, it diminishes the significance of the immediate context of action and in particular the ways in which plans, rules and scripts have to be applied and suspended with regard to the circumstances that emerge during the execution of practical action. It disregards the flexible and the contingent ways in which the application of rules and scripts relies on common-sense knowledge and practical reasoning. Most fundamental, perhaps, for present purposes, is that the model prioritizes the single user and disregards the socially organized interaction that underpins the use of technologies and that provides many of the contingencies that individuals have to manage when using a particular system. In the case at hand, it is as if the design of exhibits presupposes a neutral domain that consists of series of isolated individuals and individual actions, who at best are prepared to wait their turn and if necessary become a passive audience.

Ecologies of Participation

In developing computer-based 'interactive' exhibits, museum managers and design teams recognize that people may well be with others when visiting the museum, and they are concerned with enabling some form of collaborative engagement with or around particular exhibits. Perhaps the most pervasive form of collaborative engagement facilitated by computer-based 'interactive' exhibits is 'my turn-your turn' where, following their own turns, users contrast and compare results. If we take Word Skills, for example, we sometimes find members of the same family taking turns to use the exhibit, though it is rare for people to remain to watch the next person take a turn. A queue forms, a queue that often includes both companions and strangers. Depending upon their position in the queue and within the layout of the exhibit, visitors may have the opportunity to engage in the activity in various ways. In the case of strangers, a queue is formed but participation in the exhibit is largely limited to simply watching what is happening until they have the opportunity to use the exhibit (Images 4.1, 4.2 and 4.3 [overleaf]).

Depending upon their location within the immediate environment, they may have limited access both to the questions that arise on the screen and the responses of the current user. All the same, while waiting their turn, a user becomes a partial, even reluctant, member of an audience, and often becomes familiar with the test or task.

The 'interactivity' facilitated by computer-based exhibits therefore does not only underpin the form of engagement that the user adopts when 'inter-

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Image 4.1

Image 4.2

Image 4.3

acting' with the installation, but also serves to delimit the forms of participation for others around the exhibit. For example, each person in the queue does not have equivalent access to the exhibit and its use, nor necessarily the same interest or commitment to a particular visitor's use of the installation. So for example, standing back and letting a friend or partner go first, knowing that when your turn comes you might compare and contrast results, creates a very different form of participation than waiting for a stranger to complete their turn. Different positions within the queue afford different access, not only to what appears on the screen, but also to the 'user's' actions: their reading of the materials on the display, such as the questions and selection of particular answers. Moreover, even the point at which you arrive in the queue can be relevant to the type of information you gain about the exhibit and its 'interactivity' before taking your turn. In other words, the ecology of participation that arises with and around the exhibit not only serves to create a more or less engaged 'audience' to a visitor's interaction with the

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Image 5.1
Moira: what do you do (.) here?

Image 5.2
Moira: stop that

system, but also renders each turn at the exhibit non-equivalent – since anyone who has queued, despite the scale of the screen and text, is likely to have witnessed some aspects of the 'interaction' with the exhibit. Those who are with others while awaiting their turn do not have an equivalent experience of the exhibit, since the next turn is undertaken in the light of what has been gleaned from the previous turn(s). Even the user is not insensitive to the queue and it is not unusual for an increasingly restless audience to bring an individual's use of the installation to a premature end.

We have relatively few examples of people who remain together while each takes a turn at a computer-based 'interactive' exhibit and then discusses their results. Having completed the task, people rarely wait at the exhibit while others complete the activity – which can take up to 10 minutes. Moreover, it can be argued that the non-equivalence of each turn, which arises by virtue of one or more parties partially witnessing a particular user's activity, undermines the comparability of the results. However, notwithstanding the form of 'interactivity' prescribed by many computer-based exhibits, it is not unusual to find companions attempting to contribute to, or intervene in, a user's activity. Consider the following fragment. Moira begins the test with her husband standing by her side. She touches the screen and one of the tests appears on the display; it prompts her to respond to the events by touching the screen. When she has difficulties in doing the test, she turns to Jim, who stands close by, and asks him, 'What do you do (.) here?' As she says 'here', she looks up towards Jim who glances at the screen (Image 5.1).

Jim does not verbally reply to the request for help, but immediately stretches towards the screen to select an answer (Image 5.2). Jim's touch at the screen triggers the next question to appear on the screen. This time, Jim does not wait for Moira to respond to the question but leans forward and selects an answer on the screen. Whereas in the first instance Moira had seen Jim's move as a response to her request, this time she considers the action as an intervention in her test. She asks him to 'stop that' (Image 5.3).

Although Moira had already objected to his actions on the screen, he once more reaches past her to answer the next question. She again objects,

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Image 5.3
Moira: he::y

Image 5.4
Moira: get off

and admonishes him not to meddle with her activity, by saying 'get off' and slapping his hand (Image 5.4).

We have collected a large number of such fragments in which people help a companion to use a computer exhibit. In some cases, the helping involves calling in answers to questions or next moves in puzzles and tests. In other cases, a form of practical assistance in manipulating an interface arises that helps the 'principal user' to work the system. It may be worthwhile to consider a fragment that sheds light on the possibilities and limitations of such forms of assistance at computer exhibits. The fragment was recorded at the Age-a-Tron, a computer-based system in 'Who am I?' in the Wellcome Wing at London's Science Museum.

The Age-a-Tron encourages an individual visitor to take a seat on a stool and operate the system to take a photograph of her/himself. Once the photograph has been saved on the system it can be manipulated by pressing buttons on the screen. A satisfactory photo ready to be manipulated requires the user to align her/his eyes and chin with 'guides' displayed on the screen (Image 6.0a–d).

The fragment begins when Jo and Siona, who have been at a similar exhibit before, begin to interact with the Age-a-Tron. Jo slides on the stool in front of the screen and Siona stands to the side where she can monitor both her friend's actions and the events on the screen (Image 6.1).

Image 6.0a

Image 6.0b

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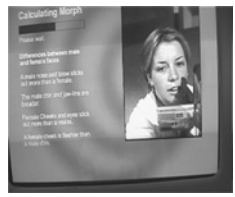

Image 6.0c

Image 6.0d

Transcript: Jo and Siona

J: Okay I push my head into it

S: u u up

J: This is better this one

S: u up a bit up a bit

J: (I don't) that way

S: No down there (1) that's better innt it

J: If you take the photo (2) That's better

S: Mhm

J: Are your eyes and chin within the guides? (.) yes

Oh god I don't want to see myself any older

Oh::

[

S: Oh go on go on( )

[

J: hehehehehe hang on wait a minute (I want to do my own thing here)

(2.3)

I want to see myself older

Jo begins the interaction with the system by touching the screen and saying, 'Okay I push my head into it'. Jo has difficulty lining up her face with the guides on the screen to take the photograph. When Siona notices her friend's troubles, she places her left hand on her companion's head and instructs her how to position her head with regard to the guides on the screen, 'u u up' and 'u up a bit up a bit' (Image 6.2). After a few moments, Siona suggests that now Jo's face may be in a good position to take the photograph, 'that's better innt it'. Jo agrees and asks her friend to 'take the photo'. Siona reaches past Jo and presses the button on the screen to save the photograph (Image 6.3). As the picture appears on the screen they both assess its quality and consider it suitable for manipulation. Jo presses the buttons on the screen a few times and decides to transform the photograph of herself into that of an older woman.

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Image 6.1
J: okay I push my head into it

Image 6.2
S: u u up

Yet, in apprehension of seeing a picture of herself as an older woman Jo retracts her pointing right hand and hesitates to press the button on the screen. Jo's dithering at the screen occasions Shauna to encourage her, 'Oh go on go on', and then to move forward to press the button on her behalf. Yet, Jo wants to determine when the transformed picture is produced, 'hehehehehe hang on wait a minute', and then briefly looks around to see who else is nearby (Image 6.3). A moment later, she turns to press the button and both of them wait for the image on the screen: Siona once again displays her unease while anticipating the picture that is about to appear on the screen (Image 6.4).

It is not therefore that friends, partners and associates are necessarily excluded from the activity in which the user is engaged, but rather that their participation is limited to supporting, appreciating or interfering with the actions of the other. Different stages of the activity enable, allow or require, different forms of participation from the other – forms of participation that can range from simply watching what the other is doing,

Image 6.3
J: oh god I don't want to see myself any older

Image 6.4

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through to helping them operate the system. When the user is able to undertake the activity, it is not unusual for the contributions of the other to be limited to remaining attentive or appreciating a particular action or response, but they are largely excluded from contributing to the accomplishment of the task, save to provide occasional assistance. This is hardly surprising. As we have suggested, the principal task is organized with regard to the achievement of a particular goal and serves as a measure of an individual's success and skill. The accomplishment of that goal is structured with regard to a series of questions and problems that emerge in response to the contributions of the individual user. Indeed, the contribution of others can serve to undermine the individual's achievement – or at least the ability to measure one's success and skills by virtue of the outcome. In one sense, therefore, we can see how the design of the system and the 'interaction' it affords serves to engender passivity among those who are present, but not the principal user, just as it encourages the user; to largely exclude the real-time contributions of others within the task's accomplishment.

Multi-user 'Interactives' and Interaction

There is a growing commitment among both museum managers and designers in developing 'interactive' exhibits that enable a number of visitors to simultaneously engage in a particular activity. It is recognized that installations that facilitate co-participation, where participants have equivalent access to the resources and to the task in question, may well make an important contribution to generating mutual engagement and in encouraging discussion and debate concerning issues of contemporary scientific relevance (Lemke, 1990; Sutton, 1995; Wellington & Osborne, 2001). Though comparatively rare, there are an increasing number to be found in science museums and science centres.

For example the Science Museum in London has recently installed a multi-user game called Energy Shutdown. The aim of this 'four-player game is to retain the most energy, with players battling to rescue the city engineer from a lift and working to keep hospital patients alive'.[1] It consists of four separate consoles built into a table accessible to individual players. Each console consists of a joystick, an accompanying button and a screen. The screen displays the puzzle – a city hit by major power failure – and the resources, for example engineers, which the players manipulate to deal with the catastrophe by using the joystick and button. Visitors approach and play the game. Many arrive separately so that the games begin at different times. When accompanied, companions may, if more than one console is available, begin the game simultaneously; if not, then it is not unusual for companions to stand behind the principal user, at least for a short time, and watch them playing the game. The interaction that arises between the different players, even when those players are visiting the museum together or arrive at the table at the same time, is relatively limited. They will occasionally call out, in particular at the start of the game and make one or two

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Image 7.1

remarks during its course, but to a large extent, orientation towards the other(s) is limited to an occasional glance. When all four systems at the table are occupied and other people arrive at the exhibit, companions or other visitors may stand behind one of the 'users' and even watch events unfold on the monitor (Image 7.1).

Companions tend to stand close by the user, occasionally commenting or giving instructions, while other visitors will simply monitor the actions from the corners of the table (Image 7.2). As each individual game takes several minutes, huddles form around the systems comprised of companions standing close by the user and other visitors standing at some distance, where they can still glean the events at the exhibit (Image 7.3).

While designing the installation to enable simultaneous participation in parallel games, Energy Shutdown resembles more conventional 'interactive' exhibits. The games are played independently and entail a progressive sequence of moves that generate distinct activities that neither demand nor enable the contribution of other players. The emerging sequence of moves and opportunities for action in the games are more flexible, more contingent, than many of the exhibits discussed earlier, but in turn this leads to a

Image 7.2

Image 7.3

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more particularized activity that does not necessarily encourage or enable explicit comparisons with the performance of others. Moreover, while not encouraging collaboration or competition among players, the exhibit does not facilitate the co-participation of companions and bystanders. The size of the screen and its horizontal position lying flat in the table undermines the ability of others to see what is happening on the monitor; the users' moves become unintelligible. Other visitors are almost completely excluded from participating in the game. They may glance at events on the table, but the flat position of the screen does not allow them to see what the players are doing; they swiftly move on to other parts of the gallery.

Energy Shutdown is designed as a four-player game. The number of computer systems embedded within and the layout of the table gives the impression that the exhibit has been developed to encourage social interaction among those gathering around the table. Yet, the content and structure of the game, as well as the form of the engagement it engenders, enables four people to play the game simultaneously but independently. The exhibit separates the players' fields of action; it neither requires, nor facilitates, cooperation or even competition.

There are, however, a number of 'interactive' exhibits that have been more explicitly developed to encourage discussion and debate. For example, In Future, an exhibition in the Science Museum, London, includes three interactive, circular tables that have been designed to stimulate discussion and debate, and to engage visitors in the scientific issues that they are likely to face in the future.[2]

The games on each table are played from seven positions where small round, turn-able plates and an illuminated button are embedded in the surface. Visitors play the games by revolving the plates and pressing the buttons. The games address controversial topics such as chip-implants in children, male fertility, intelligent cars and holidays in outer space. To encourage discussion and debate, at the end of each game a question is projected onto the table; visitors are then asked to vote on the issue by

Image 8.1

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Image 8.2

selecting, 'yes' or 'no'. The exhibit has been greeted with some commendation and has proved popular, especially with children and teenagers.

The following fragment begins as three people arrive at one of the tables. They stand facing each other where each can operate a separate interface. The display on the table requests the selection of a new game by pressing the button that lights up at the players' positions. In the case at hand, the buttons that light up are at positions other than those of the three players. The players stand at their interface, turn the plate and occasionally look around while waiting for an event (Image 8.1).

After a minute or so, other visitors arrive at the table and stand at the remaining interfaces. One of the buttons flashes, and the girl standing at the relevant interface presses the button and starts the game concerned with chip implants for children (Image 8.2).

By using the turn-able plate, the participants can navigate an avatar from the home-position around the table. A satellite beam operated by the computer system follows the avatars. When the satellite catches an avatar, it is returned to the starting point by the participants' interface. The

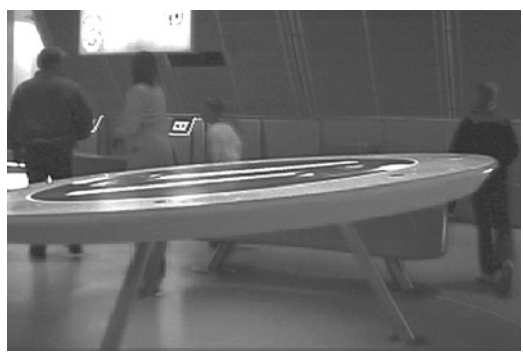

Image 8.3

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participants turn their plates back and forth trying to escape the satellite. After approximately 3 minutes the game comes to an end. The participants remain for a few moments, glancing at the table, before they turn and leave, failing to notice the question projected on the table (Image 8.3).

We can begin to see therefore that despite being provided a common activity and field of action, players do not necessarily play the game together or even orient to the play of others. Players have visual access to each other's actions inasmuch as their play is conducted in a mutually visible space, but the visibility of the actions of others and their engagement in the 'same' activity does not necessarily encourage co-participation and collaboration. This is not to suggest that players remain insensitive to actions of others, at least during certain moments of the game, for example as they arrive towards its completion (and their potential exit from the tables), but rather that the game itself and the ecology of the scene does little to facilitate or engender social interaction among players. Moreover, we have little evidence to suggest that, on the completion of the game, players, either those who are together or simply happen to be in the same space, discuss the game and its scientific and social implications.

Image 9.1

Not infrequently, visitors arrive at the tables when a game is in progress; they stop by the edge of the table and watch the action for some time. If an interface is available, they may move in and begin to use the system, and on occasions try to join the game in progress. Consider the following fragment. We join the action when Peter sits on the bench by one of the tables. When his father arrives at the table, he invites him to 'take a seat'. The projection shows the question associated with the game concerned with male fertility. Peter turns the plate and selects 'yes'. He then turns to his father and explains how to select an answer by pointing to the button (Image 9.1).

A few moments later, Peter selects the next game, 'Holidays in outer space'. When the first images are projected on the table, he voices his excitement, 'Yeah yeah', and repeatedly presses the button. Both participants begin to play the same game (Image 9.2). However, they do not play the game together. Rather they play the game independently. At moments

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Image 9.2

Image 9.3

during the course of the game, each appears to be sensitive to the actions of the other or renders visible certain elements of his own moves; for example, they point at and identify objects appearing on the table and their role in the game (Image 9.3). In other words, the game is played simultaneously, but not collaboratively; its production is accomplished individually with little cooperation or co-participation between the players themselves. Indeed, aside from enabling people to vote on a common matter, the installation does little to encourage the collaborative production of the activity or engender debate or discussion following the game's completion.

It is interesting to note that the designers of multi-user interactive installations in museums and galleries, and perhaps those that build similar systems for other domains, largely appear to transpose models of the user and 'interactivity' for personal computing to complex exhibits that are believed to encourage co-participation and collaboration. In many cases, neither the interface nor the hardware appear to be designed to facilitate the ability of more than one person to simultaneously use, or even watch the use of, the system. More importantly perhaps, the ways in which the 'interaction' is structured prioritizes successive single contributions from particular individuals, even if those individuals have the opportunity to engage in games alongside each other. The technology and the 'interaction' it facilitates creates independent rather than inter-dependent activities, even though those activities may be similar or provide comparative outcomes. Social interaction between co-participants primarily serves to voice or animate aspects of an individual's engagement with their particular activity or game; or, in some cases, to provide others with the resources for using the system. The instances we have collected rarely involved mutual collaborative engagement in the game itself, or discussion concerning the scientific or technological matters addressed by the exhibit, either before or following the event.

Neither the interface, nor the structure of the content, support or require collaborative playing. The design of the games prefigures people's interaction with the system but is not able to accommodate the contingency of social

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action and interaction arising around the exhibit. Social interaction between players is largely limited to an exchange of glances or to assistance in playing the game. This kind of table-top exhibit facilitates forms of participation that are similar to those observed at touch-screen computer systems. The players stand next to one another, facing and acting in their use space. They may help each other with using the systems or briefly comment on events at the table, but they interact relatively little with each other. People who do not play the game form huddles around the players and monitor the events on and around the table: companions close by the players, others standing further back and on the sides. Where they stand, only few opportunities arise to engage with the game other than by observing, commenting or instructing the action. Visitors stand by and operate the interface while looking at the display. Their interaction with the system is an accountable event, visible and intelligible to other players who stand at the table as well as other visitors observing the events. Interactions with each other, such as talk and discussion stimulated by the system, arise, if at all, only after the games. While talk and interaction are accountable phenomena, their relationship to the interaction with the systems swiftly fades when visitors move on to other parts of the museum.

Instantiating Interaction

Computer-based, 'interactive' exhibits are frequently the products of teams that involve museum managers, curators, designers, system developers and educationalists. The educational agenda is of increasing importance, and a principal motivation informing the development of computer-based exhibits is the widespread commitment to enhancing engagement and learning through interactivity. This motivation is to be applauded, and yet the turn towards computer-based interactives is one in a series of developments through which museums have attempted to facilitate learning. So, for example, two decades or so ago we witnessed the widespread deployment of hands-on exhibits, a development that in part was driven by Piagetian constructivism and the belief that learning arises through physical activity (Caulton, 1998; Hein, 2000). These developments were subject to sustained criticism (Gregory, 1989) and increasingly it was argued that computer-based interactive exhibits provided the resources with which to enhance interpersonal communication, collaboration and learning. Underlying these various initiatives therefore is a model of conduct that is thought to resonate with learning, or a particular conception of learning, and in various ways design teams attempt to develop exhibits that engender particular modes of action and cognition.

Alongside our video-based analysis of conduct and collaboration in science museums and centres, we have undertaken field studies of the design and development of exhibits and exhibitions for museums and galleries including science centres and museums. One or two of these studies have been longitudinal, following the course of projects; others have involved discussions and interviews with the personnel involved in the creation of new

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exhibits and exhibitions, including for example one or two major initiatives by the Wellcome Trust. These studies point to the highly contingent character of exhibit development and the ways in which the design of exhibitions is systematically transformed as emerging influences, interests and financial constraints bear upon the career of their production. They also point to the almost idiosyncratic feature of exhibit design, and the seeming absence of an accepted corpus of knowledge and practice concerning the development of 'interactive' installations and the ways in which their design can enable people of different ages, backgrounds, and experience to readily and unproblematically engage with them. Indeed, the studies reveal how designers and members of design teams have little access or opportunity to learn from their successes and mistakes, since evaluation is severely limited and there is little opportunity to share or accumulate knowledge. Moreover, the temporary life of project teams, and the increasing use of outside consultants, means that the museums themselves do not necessarily have the opportunity to build a body of cumulative, institutional experience and practice.

Perhaps the most interesting issues in this regard are the assumptions, presuppositions and 'models' of visitor behaviour that inform and underpin the design and development of 'interactive' exhibits and exhibitions more generally. Members of the design teams place a high premium on communication and participation and are committed to the idea that sociality is an important feature of learning and, more generally, of people's enjoyment of exhibitions. They also recognize the importance of 'interactivity' and the opportunities it provides to engage the visitor and to create new and distinctive forms of participation in museums and galleries. However, while it is recognized that many people visit museums and galleries with others (friends, family and the like) and that even when visitors are alone it is likely that others will be in the same space, the model that pervades the conception of the visitor is of an individual, perhaps accompanied by others. In the first place, therefore, it is necessary to prioritize the participation of the individual and provide resources that enable people, when alone, to enjoy and experience the exhibit in question. The forms of 'interactivity' that these designers largely develop maximize the ability of individuals to engage with exhibits, a principle that similarly informs the design of information resources that accompany exhibits in more traditional museums and galleries, whether labels, gallery cards or, more recently, Interactive Kiosks and PDAs. In this regard, we can also see why museum managers, designers and curators prioritize the 'my turn–your turn' models that underpin, and are presupposed in, many types of interactive exhibit. It is interesting to note therefore that there is a convergence between the conception of the visitor and visitor behaviour that pervades museums, galleries and science centres, and the model of the user that underpins much computer-based technology and the structure of 'interaction' that is entailed within the interface and many software programs. Unfortunately, however, instantiating these models of conduct within exhibits neglects the interests of the companions and inadvertently undermines mutual, simultaneous, collaborative engagement with the installation.

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The criteria and techniques that are commonly used to assess exhibits, for example in their prototype stage prior to deployment in a museum, do not necessarily reveal forms of social interaction that arise or fail to arise at exhibits. Individuals are asked to conduct trials of exhibits away from the museum floor, and of course users are interviewed and observed. However, it is difficult to draw conclusions about the merits of an exhibit, to know of its consequences, or to assess the quality of the engagement that it engenders without taking account of the contingencies that emerge in actual museum spaces. It also is necessary to know how the conduct and contributions of other visitors feature in a user's access to and interaction with exhibits, and why dwell times are short or long, or what others who accompany particular visitors are doing at other exhibits while a member of their party is occupied with a particular installation. In other words, the institutional environment in which 'interactive' exhibits and exhibitions are produced, the presuppositions that inform their design, the fragmentation of knowledge and experience they engender, the methods and criteria that inform their assessment, and, most profoundly, the difficulties their design engenders for co-participation in public domains, undermine the ability to predict and produce exhibits that support interaction and collaboration.

Discussion

Science centres and museums are under increasing pressure from government and other public institutions to broaden access and facilitate the public understanding of science and technology. Substantial public and private sector funding has been invested in creating new exhibitions and exhibits that are designed not only to significantly increase the numbers of visitors drawn from various backgrounds, but to create opportunities for engagement, participation and learning. In this regard, developments in information and communication technology are seen as providing unprecedented resources to create new forms of interaction, and to secure and sustain interest and commitment among visitors.

The commitment to create new forms of engagement and participation in science museums and science centres reflects the growing recognition that 'informal learning' can play a significant role in education and enable the general public of all ages to participate in, and come to understand, important contemporary debates about science and technology. Collaboration and communication are critical in this regard, since it is argued that informal learning arises in and through social interaction, interaction that enables people to mutually engage in cooperation and co-participation and to become familiar with and understand seemingly technical and complex issues and problems (Dierking & Falk, 1994; Gee, 1996; Rennie et al., 2003). Computer-based exhibits with their emphasis on 'interactivity' appear to resonate with these arguments and provide a vehicle through which people can become interested in, aware of, even knowledgeable about, matters of contemporary scientific interest and debate. Indeed, underlying the design and deployment of many computer-based exhibits is the idea that in developing new forms of 'interactivity' the

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installations facilitate social interaction and co-participation. Unfortunately, however, while creating innovative, and in some cases engaging, activities with a particular system, it is not clear that 'interactive' exhibits facilitate or even encourage social interaction; that is, interaction between people. It has even been argued that the 'interactivity' provided by these systems creates an 'illusion of choice' by prefiguring a set of possible actions for the user (Strathern, 1992; Barry, 1998). More importantly perhaps, it would seem that the very idea of 'interactivity' – a term that has primarily emerged with computer-based technologies – is conflated with social interaction, as if they are equivalent or the one naturally gives rise to the other.

Despite substantial investment in new science centres and exhibitions of science and technology, there are relatively few studies that examine the action and interaction that arises at the exhibit face. There are, of course, a growing number of studies using surveys, interviews, focus groups, and so on, to assess the effectiveness of exhibits. Indeed, 'dwell time' and 'holding power', are not infrequently used as measures of success (Serrell, 1998; Shettel, 2001), but, like other forms of variable analysis, they tell us little about the quality of action that arise at exhibits and the forms of participation that they engender, facilitate or occasion. When we do begin to address action at the exhibit face, it is not at all clear that the forms of participation that arise with and around many computer-based 'interactive' exhibits resonate with the broader institutional commitments to collaboration, communication and co-participation that underpin investment in, and the development of, these new exhibition areas. Many computer-based 'interactive' exhibits deployed within these new exhibition areas rely upon, or create, a model of the user and interaction, that, as we have suggested, prioritizes the individual's 'interactivity' with the system without regard to the real-time contributions on participation of others. The very hardware that is used for many of these exhibits – the scale of the monitor, the density of the image, the form of the interface and so on – fails to facilitate collaborative engagement and in many cases the specification and structure of the task presupposes the contribution and assessment of a single individual. This is hardly surprising, not simply because many of these exhibits rely upon conventional computing technology (used within the workplace or domestic environment), but more importantly because of a model of the visitor that pervades the design of many 'interactives' is of a single user accompanied by others. One might imagine, however, that the very public nature of museums and galleries, coupled with the wide-ranging commitment to enhancing collaboration and communication, might give rise to a rather distinctive approach to 'interactivity' and social interaction. A small number of exhibits that allow for multiparty participation and are somewhat flexible with regard to the modes of participation are part of, for example, Energy at the Science Museum in London and the recent Constable exhibition at the Tate Britain. These exhibits use sensor technologies to capture people's movements and convert them into images displayed on a large screen. Although not without problems, these exhibits are good examples for the innovative use of novel technology by museums.

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The materials discussed here are part of a programme of research that is concerned with the ways in which sense and significance of exhibits in museums and galleries is constituted in and through the situated conduct of visitors, and in particular their interaction with the people they are with as well as others who happen to be within 'perceptual range of the event' (Goffman, 1981a). Elsewhere we discuss the ways in which visitors attempt to engage others in their use of 'interactive' exhibits by, for example, animating particular actions or producing momentary theatrical performances to render aspects of their use of the system mutually available and even exciting (cf. Heath & vom Lehn, 2004; vom Lehn 2006; Meisner et al., 2007). In this regard, it is worth noting how visitors are able to create mutual engagement and co-participation when examining more conventional exhibits such as pictures, objets d'art or furniture. The mutual accessibility of the objects and their accompanying information, such as labels, provide important resources that enable visitors to orient each other to exhibits and generate observations, comments and discussion. In other words, the design of more traditional museum spaces and the conventional resources that accompany exhibits enable people to flexibly establish mutual engagement and co-participation when looking at and appreciating the objects on display. In contrast, many 'interactives' create curious interactional asymmetries that undermine co-participation and mutual engagement.

In social studies of science and technology there has been a growing interest in public understanding and engagement and with the development of new ways of communicating science and with the relationship between users and technology (cf. Collins, 1987; Kirby, 2003; Oudshoorn & Pinch, 2005; Yearley, 1994, 2004). These initiatives reflect, in part, the growing commitment within government, education and the cultural industries in encouraging museums, galleries and science centres to place learning and public participation at the heart of the agenda. These initiatives are to be welcomed. However, they need to be accompanied by a more thorough understanding of the ways in which people, both alone and with others, respond to and receive the exhibits and exhibitions. What happens at the 'exhibit face' is critical in this regard since it is in and through the actions and interaction of the participants that they come to encounter and engage exhibitions and various forms of information that are communicated. It also provides an opportunity to consider what people do and whether the conduct and interaction that arises at the exhibit face reflects the aims, intentions and purpose that underpinned the design and development of the exhibition. Thus, detailed studies of action and interaction at the exhibit face provide us with an opportunity to reconsider Woolgar's notion of 'configuring the user' (Woolgar, 1991) and explore how users themselves configure their participation with technologies in the situation in which they encounter and engage with exhibits (cf. Lindsay, 2005). Perhaps most importantly, however, by taking action at the exhibit face seriously, we can begin to consider whether the growing commitment to 'interactivity' is providing a vehicle to enable and encourage people to address and discuss in concert and collaboration with each other matters of science and scientific understanding.

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Our ethnographic and interview-based research into the work of exhibition designers complements observations and findings concerning people's conduct and interaction in museums. It provides insights into the origins of the concepts and ideas of interactivity that drive the development and deployment of many computer exhibits. It illuminates the specific understanding of 'interactivity' that pervades the design and development of many computer exhibits. It also shows that managers' and designers' concept of interactivity rests upon the idea of a 'principal user' and others who would form an audience around the task undertaken by the individual. In other words, it may be the case that the model of interaction that underpins the design and development of computer exhibits is not only constrained by the conventional structure of information technology but also by a particular conception of 'interactivity' that is ordinarily associated with HCI. By contrasting this technologically defined concept of 'interactivity' instantiated in the exhibits with visitors' interaction with and around those artefacts, this paper hopes to contribute to a richer understanding of the complex and contingent circumstances in which people encounter, examine and make sense of science in science centres and museums.

Notes

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1. Quoted in *Design Week* (1 July 2004).
2. More information about the exhibition can be found at <www.sciencemuseum.org.uk/wellcome-wing>.

References

Barry, Andrew (1998) 'On Interactivity: Consumers, Citizens and Culture', in S. Macdonald (ed.), *The Politics of Display: Museums, Science, Culture* (London, Routledge): 98–117.

Beetlestone, John G., Colin H. Johnson, Melanie Quin & Harry White (1998) 'The Science Center Movement: Contexts, Practice, Next Challenges', *Public Understanding of Science* 7: 5–26.

Bennett, Tony (1995) *The Birth of the Museum: History, Theory, Politics* (London, Routledge).

Bradburne, James M. (2000) *Interaction in Museums: Observing Supporting Learning* (Hamburg: Libri Books on Demand).

Butler, Barbara & Marvin Sussman (1989) *Museum Visits and Activities for Family Life Enrichment* (Binghamton, NY: The Hayworth Press).

Card, Stuart K., Thomas P. Moran & Allen Newell (1980) 'Computer Text-Editing: An Information-Processing Analysis of a Routine Cognitive Skill', *Cognitive Psychology* 12: 32–74.

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Card, Stuart K., Thomas P. Moran & Allen Newell (1983) *The Psychology of Human–Computer Interaction* (Hillsdale, NJ, Lawrence Erlbaum Associates).
Caulton, Tim (1998) *Hands-on Exhibitions: Managing Interactive Museums and Science Centres* (London, Routledge).
Collins, H. M. (1987) 'Certainty and the Public Understanding of Science: Science on Television', *Social Studies of Science* 17(4): 689–713.
Department for Education and Employment (1997) *Connecting the Learning Society: National Grid for Learning* (London: The Government's Consultation Paper).
Dierking, Lynn D. & John H. Falk (1994) 'Family Behavior and Learning in Informal Science Settings: A Review of the Research', *Science Education* 78(1): 57–72.
Durant, John (ed.) (1992) *Museums and the Public Understanding of Science* (London: Science Museum).
Exploratorium (2001) 'Electronic Guidebook Forum', available at: <www.exploratorium.edu/guidebook/forum/>.
Falk, John H. & Lynn D. Dierking (2000) *Learning from Museums. Visitor Experiences and the Making of Meaning* (Walnut Creek, Lanham, New York & Oxford: Alta Mira Press).
Farmelo, Graham & Janet Carding (eds) (1997) *Here and Now. Contemporary Science and Technology in Museums and Science Centres* (London: The Science Museum).
Garfinkel, Harold (1967) *Studies in Ethnomethodology* (Englewood Cliffs, NJ: Prentice Hall).
Gee, James Paul (1996) *Social Linguistics and Literacies* (London: Taylor & Francis).
Gilbert, J. & M. Priest (1997) 'Models and Discourse: A Primary School Science Class Visit to a Museum', *Science Education* 81(6): 749–62.
Goffman, Erving (1963) *Behavior in Public Places: Notes on the Social Organization of Gatherings* (New York & London).
Goffman, Erving (1971) *Relations in Public: Microstudies of the Social Order* (New York: Basic Books).
Goffman, Erving (1981a) *Forms of Talk* (Philadelphia, PA: University of Pennsylvania Press).
Goffman, Erving (1981b) 'Response Cries', in E. Goffman, *Forms of Talk* (Philadelphia. PA: University of Philadelphia Press): 78–123.
Gregory, Richard (1989) 'Turning Minds on to Science by Hands-on Exploration: The Nature and Potential of the Hands-on Medium', in M. Quin (ed.), *Sharing Science: Issues in the Development of Interactive Science and Technology Centers* (London: Nuffield Foundation on Behalf of the Committee on the Public Understanding of Science): 1–9.
Heath, Christian and Dirk vom Lehn (2004) 'Configuring Reception: (Dis-)Regarding the "Spectator" in Museums and Galleries', *Theory, Culture & Society* 21(6): 43–65.
Hein, Hilde S. (2000) *The Museum in Transition: A Philosophical Perspective* (Washington, DC & London: Smithsonian Institution Press).
Hooper-Greenhill, Eileen (1994) *Museums and their Visitors* (London: Routledge).
Hudson, Kenneth (1975) *A Social History of Museums: What the Visitors Thought* (New Jersey: Humanities Press).
Kirby, David A. (2003) 'Science Consultants, Fictional Films, and Scientific Practice', *Social Studies of Science* 33(2): 231–68.
Lemke, Jay L. (1990) *Talking Science: Language, Learning, and Values* (Norwood, NJ: Ablex).
Lindsay, Christina (2005) 'From the Shadows: Users as Designers, Producers, Marketers, Distributors, and Technical Support', in N. Oudshoorn & T. Pinch (eds), *How Users Matter: The Co-construction of Users and Technology* (Cambridge, MA, & London: MIT Press): 29–50.
Meisner, Robin, Dirk vom Lehn, Heath, Christian, Burch, Alex, Gammon, Benjamin & Reisman, Molly (2007) 'Exhibiting Performance: Co-participation in Science Centres and Museums', *International Journal of Science Education* 29(12): 1531–55.
MORI (2001) *Visitors to Museums & Galleries in the UK* (London: Resource: The Council for Museum Archives and Library).
Oudshoorn, Nellie & Trevor J. Pinch (eds) (2005) *How Users Matter. The Co-construction of Users and Technology* (Cambridge, MA, & London: MIT Press).
Rennie, Leonie J., Elsa Feher, Lynn D. Dierking & John H. Falk (2003) 'Toward an Agenda for Advancing Research on Science Learning in Out-of-School Settings', *Journal of Research in Science Teaching* 40(2): 112–20.

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Sacks, Harvey (1992) *Lectures on Conversation*, two vols (Oxford: Blackwell).
Sacks, Harvey, Emanuel Schegloff & Gail Jefferson (1974) 'A Simplest Systematics for the Organization of Turn-taking for Conversation', *Language* 50: 696–735.
Sainsbury, D.L. (2002) *Science Centres & Museums: Engaging the Public with S & T* (London: ECSITE).
Scott, Carol (ed.) (2004) 'Interactivity', *Curator* (Special Issue) 47(2).
Screven, Chan G. (1986) 'Exhibitions and Information Centers: Some Principles and Approaches', *Curator* 29(2): 109–37.
Serrell, Beverly (1998) *Paying Attention: Visitors and Museum Exhibitions* (Washington D.C.: American Association of Museums).
Serrell, Beverly and Britt Raphling (1992) 'Computers on the Exhibit Floor', *Curator* 35(3): 181–89.
Shettel, Harris (2001) 'Do We Know How to Define Exhibit Effectiveness?', *Curator* 44(4): 327–34.
Silverstone, Roger (1985) *Framing Science: The Making of a BBC Documentary* (London: BFI).
Strathern, Marilyn (1992) *Reproducing the Future: Anthropology, Kinship and the New Reproductive Technologies* (Manchester: Manchester University Press).
Suchman, Lucy (1987) *Plans and Situated Actions. The Problem of Human–Machine Communication* (Cambridge: Cambridge University Press).
Sutton, Clive (1995) 'The Scientific Model as a Form of Speech', in G. Welford, J. Osborne & P. Scott (eds), *Research in Science Education in Europe* (London: Falmer Press): 143–52.
Vom Lehn, Dirk (2006). 'The Body as Interactive Display: Examining Bodies in a Public Exhibition', *Sociology of Health & Illness* 28(2): 223–51.
Vom Lehn, Dirk, Christian Heath & Jon Hindmarsh (2001) 'Exhibiting Interaction: Conduct and Collaboration in Museums and Galleries', *Symbolic Interaction* 24(2): 189–216.
Wellington, Jerry & Jonathan Osborne (2001) *Language and Literacy in Science Education* (Buckingham: Open University Press).
Woolgar, S. (1991). Configuring the User: The Case of Usability Trials', in J. Law (ed.), *A Sociology of Monsters: Essays on Power, Technology and Domination* (London & New York: Routledge).
Yearley, Steven (1994) 'Understanding Science from the Perspective of the Sociology of Knowledge: An Overview', *Public Understanding of Science* 3: 245–58.
Yearley, Steven (2004) *Making Sense of Science. Understanding the Social Study of Science* (London: Sage Publications).

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