King's Research Portal

DOI:

[10.1080/09647775.2015.1117237](https://doi.org/10.1080/09647775.2015.1117237)

Document Version

Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

SKydsgaard, M., Moeller Andersen, H., & King, H. (2016). Designing museum exhibits that facilitate visitor reflection and discussion. *Museum Management and Curatorship*, 31(1), 48-68.

<https://doi.org/10.1080/09647775.2015.1117237>

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Designing Museum Exhibits that Facilitate Visitor Reflection and Discussion

[8389 words]

Abstract

This paper explores how four design principles (*curiosity, challenge, narratives and participation*) facilitate reflection and discussion among young visitors in the issues-based exhibition *Dear, Difficult Body*. The investigation is based on a mixed-method approach combining questionnaire and interview data. The implementation of design principles resulted in a variety of exhibits which variously prompted reflection and discussion on the part of visitors. Exhibits with *narratives*, for example, here defined as both *personal* and *expert narratives*, were found to be effective in facilitating personal reflection but also prompted discussion. *Participation*, defined as including both *physical interaction* with exhibits, and *dialogic interaction* between visitors, facilitated the sharing of ideas and feelings between visitors. Exhibits with elements of *curiosity* and *challenge* were found to attract pupils' attention but also worked well with other design principles to engage the pupils in sustained reflection and discussion. While other contextual factors remain significant in determining visitor responses, this paper argues that the use of design principles can help create visitor experiences that correspond to exhibition aims.

Keywords: exhibit design; design principles; narratives; participation; curiosity; issues-based exhibitions

Introduction

It has been argued that many museums treat their audiences as 'passive consumers' and not as 'cultural participants'. Instead, it is proposed that museums should be transformed into more participatory places, where visitors create ideas, express their views and share knowledge with other visitors (Simon 2010). Museums should see themselves as a forum for debate, engaging in controversial or taboo subjects, which Cameron (2010) calls 'hot topics'.

The Steno Museum in Aarhus, Denmark, is committed to providing the young people of Denmark with opportunities to engage in both personal reflection and joint discussion about contemporary issues. Reflection is the act of thinking about, correcting, and internally reviewing new information (Duschl, Schweingruber and Shouse 2007). In reflecting, individuals are evaluating their thinking and becoming conscious of what interests them, and what is motivating them to engage further. Sociologists have long argued that knowledge is inherently social and distributed among many (Vygotsky 1978). By discussing one's ideas with others, individuals are able to rehearse their thinking, to practice and elaborate lines of argument, and to organise their thoughts within extant mental models. With regards to museums, it has been argued that support for visitor reflection and discussion is key to all efforts aimed at supporting engagement (King and Tran 2016). More generally, and across all learning settings, reflection and discussion provide the foundation for what Sawyer (2014) has termed deep conceptual learning.

In 2005 the Steno Museum developed the idea of an 'Inspiratorium' – a museum where science is incorporated into a broader cultural history in issues-based exhibitions that are specifically made more appealing to young people through the use of interactive exhibits (Nielsen 2006). The plans for a new museum were unfortunately halted due to a lack of financing, but the development work regarding exhibit framing and tone for the projected Inspiratorium remained central in the subsequent exhibitions. In 2007, Steno opened *Egg – Having Babies with Technology*, an exhibition about advances in medicine and technology and their influence

on sex, family life and our perception of children in the twentieth century (Meyer 2008). Steno's next exhibition, *The Incomplete Child* (2008), told the story of physical deformities and prenatal diagnostics. The exhibit developers acknowledged the difficulty of this content matter and decided that one way to explore this sensitive topic would be to present visitors with ethical dilemmas and challenge them to reflect on their beliefs and perceptions. Thus, visitors were confronted with, for example, authentic preserved fetuses, and shown films about the lives of disabled people. By eliciting strong reactions from visitors in this way, *The Incomplete Child* was found to foster visitor engagement and reflection (Skydsgaard 2010).

The experiences of these two exhibitions informed the development of the permanent exhibition *Dear, Difficult Body* (2011), the context of this paper.¹ In this exhibition young people are invited to explore their views on body ideals, nakedness and their acceptance of their own and other people's bodies. The body is a hot topic for many young people as a youth's notions of identity and self-perception are closely related to ideas about his or her physical appearance. Moving from childhood to adulthood is an emotionally testing process, because the body changes so radically. The teenage years have always been challenging, but the situation is arguably exacerbated by omnipresent images of 'perfect' bodies in the public space, with the ideal body being unrealistic and unattainable for most people (Orbach 2009). One recent Danish investigation has documented that an increasing number of young people are struggling with eating disorders, and more than 10% of Danish adolescents are 'dissatisfied' with their body (Waaddegaard 2010). In addition, researchers have found that teenagers who are unhappy with their bodies experience lower self-esteem and a reduced quality of life (Sørensen et al. 2011).

The design of *Dear, Difficult Body* was guided by four design principles: *curiosity, challenge, narratives and participation* (Steno Museum 2008). The identification of these principles built on prior experience with earlier exhibitions and design practice documented in the literature. In this paper we discuss the implementation of these design principles in the development of the exhibition, and report our findings on how they worked in practice. Our aim was to examine what effect, if any, Steno's design decisions had on young visitors. In particular, we sought to gain a deeper understanding of the strengths and weaknesses associated with each of the four principles, and their capacity to stimulate reflection and discussion among visitors.

In analysing the effects of the four principles in this way, our account contributes to ongoing conversations in the wider field pertaining to the effective design of exhibits that prompt visitor participation, with socio-scientific issues (Pedretti, 2004) and facilitate visitor engagement leading to deep conceptual learning.

Use of design principles in exhibit development

Arnold (2006) has described how different kinds of displaying techniques emerged with the development of the early English collections in the seventeenth century. These precursors of modern museums comprised objects from nature, antiquity and the art world. The objects were arranged according to functionality (use of objects) and classification (ordering the world), but were also displayed for their ability to arouse curiosity and to represent an appealing story or narrative. These modes of thinking about objects and their ability to evoke responses remain current in the present day.

Since the 1980s, science museums have engaged more systematically in exploring ways to structure content, and prompt visitor engagement. Alt and Shaw (1984) investigated how exhibits attract visitors' attention and support their engagement. From their analysis of 2000 visitors' responses to 45 exhibits at The Natural History Museum in London, they found that the 'ideal exhibit' was eye-catching, dramatic and with a

¹ *Dear, Difficult Body* [Danish title: *Kære krop, svære krop*] at The Steno Museum, Science Museerne, in Aarhus, Denmark, opened in 2011 and is due to close in 2018.

short, clear message, and that in some (but not all) cases, enabled participation. The identification of these characteristics can be seen as an early attempt to formulate principles for exhibit design that accommodate visitors' needs. Nearly, ten years later, Perry (1992) developed a model for 'designing exhibits that motivate', which included six design principles: curiosity, confidence, challenge, control, play and communication. The original model has subsequently been developed during years of experimentation with interactive science exhibitions in different museums (Perry 2013). Perry has found that these principles are relevant for visitors' engagement with exhibits, and also increase the duration of visits and visitors' understanding of science.

Families are a key target group for many science centres. To identify the particular needs of this group, Borun and Dritsas (1997) studied the learning that takes place in families visiting informal science institutions. They identified seven design principles to promote family learning: the ideal exhibit must be multi-sided (families can cluster around the exhibit); multi-user (several hands or bodies can interact); and multi-outcome (results can vary, which may, in turn, foster discussion). The exhibits must also be accessible, relevant and target different learning styles, and the texts should be readable (Borun and Dritsas, 1997). The last four principles are relevant for supporting learning in all visitors, while the first three are more applicable to families and other visitors arriving in groups.

In 2004, Pedretti argued that science museums must do more than 'teach' traditional scientific concepts and knowledge; they should also engage visitors with contemporary and controversial issues. To attain this goal, Pedretti argued in favour of 'critical' exhibits that personalize subject matter, evoke emotion, stimulate dialogue and debate and promote reflection. These four principles, determined post hoc by analysing two exhibitions about hot topics, challenged visitors intellectually and emotionally, and created powerful learning experiences. In *The Participatory Museum*, Simon (2010) argued for extending 'traditional' design strategies into participatory designs, defined as exhibits that help visitors create, share and connect with each other around content. Simon referred to participatory design experiments in art, science and cultural museums.

Four design principles

Building on prior experience and on the works of Perry, Pedretti and Simon, the Steno Museum identified four design principles to inform exhibit developments: *curiosity*, *challenge*, *narratives* and *participation*. The design of *Dear, Difficult Body* and subsequent visitor studies represent an attempt to document the efficacy of these principles and their ability to stimulate reflection and debate. In the following, we outline each of the four principles and its theoretical background.

Curiosity

Upon entering a museum, visitors are often bombarded with stimuli and information. Their choices about which exhibit to see first, and where to engage, are in part determined by their *curiosity*. Curiosity can be aroused by objects never seen before, new information relating to existing knowledge, and fascinating pictures or surprising effects. The first museum collections were described as 'cabinets of curiosities' for their ability to arouse curiosity and wonder (Arnold 2006). Catching attention and arousing curiosity is still crucial for visitor engagement with exhibits (Csikszentmihalyi and Hermanson 1995). Lindauer (2005a) similarly notes the importance of curiosity in the creation of an informal learning environment which can be described as a 'salad bar' – a place where visitors can pick and choose as they feel inclined.

Challenge

The notion of *challenge*, or the prompting of strong reactions, is one of the design principles identified by Perry (1992). The significance of this concept for engaging learners has also been described by Csikszentmihalyi and

Hermanson (1995). These scholars originally pointed to the motivational effect of an exhibit that challenged visitors to struggle, either physically or intellectually. But a challenge can also come from exhibits that evoke emotions, confront visitors with dilemmas or address prejudices and taboos. For example, the Canadian exhibition *A Question of Truth* (1996) at Ontario Science Centre investigated how cultural and political conditions influenced the racial prejudices of individual scientists and of society. The exhibition was found to evoke very strong emotions (Pedretti 2004). Kelly (2010) and Pedretti have both argued that because the public considers museums to be safe and trusted places, museums are potentially the ideal environment to present challenges in the forms of taboos and contested issues.

Narratives

Arnold (2006) has identified a ‘narrative tradition’ that goes back to the early English museums, where collected stories about the objects were considered just as important as the objects themselves. Perry did not include *narratives* in her list of principles, but she mentions ‘narrative creation’ as an important type of learning embedded in her concept of ‘communication’ (2013:15). In their arguments for challenging exhibits, Kelly (2010) and Pedretti (2004) both noted that the narrative device is useful for stimulating reflection and debate about difficult and contentious topics. Analysing the value of narrative in science education, Avraamidou and Osborne (2009) suggest that one of its effects is due to its familiarity. Scientific language can be off-putting, whilst the use of narratives can serve to ground scientific concepts and the scientist’s vision of the material world in ways that make it memorable and indeed more inclusive to those who would otherwise find science inaccessible. This argument is supported by findings from a subsequent museum study (Murmah and Avraamidou 2014) that examined the inclusion of a story to support young children’s engagement with exhibit content in science education. In sum, as Bedford (2001: 33) has argued, ‘Stories are the most fundamental way we learn... They teach without preaching, encouraging both personal reflection and public discussion.’

Narratives can be both personal and expert. *Personal narratives* are those that reflect other people’s ideas and experiences, thus acting as an important source of inspiration and information. Narratives from members of the same target group as the audience help to increase the personal relevance of the exhibition, whereas narratives from other groups or generations can serve as documentation of cultural differences and changes over time. *Expert narratives* – views presented by experts – offer visitors insight into research and scientific discoveries that can humanize science and make it accessible to non-scientists, through their potential to link the exhibition to real life (Martin and Toon 2005).

Participation

The principle of *participation* comprises both physical and dialogic interactivity. Alt and Shaw (1984) emphasized physical interactivity in their notion of participation, whereas Simon (2010) noted the importance of dialogic interactivity in her analysis of features that engender engagement among visitors.

Physical interactivity

Science centre designers have long believed that physical interaction is important in fostering mental engagement (Allen 2004). The theoretical basis for this belief, however, was largely non-existent. Recently, findings spanning the fields of human perception, cognition and physiology have led researchers to propose a new conception of learning with physical or bodily interaction at its core. The concept of embodied intelligence (Lucas and Claxton 2010) regards the physical processes of movement and gesture as forms of knowing which are just as valid as, for example, writing or explaining. The resolving of questions or problems that occur in life cannot only be attributed to processes occurring in the brain. Rather, we also use our senses, our physical experiences, and bodily somatic processes of which we are hardly aware in order to inform our understanding (Claxton 2015).

Dialogic interactivity

Dialogue plays an important role in the process of sharing and constructing new knowledge (Falk and Dierking 2000; Vygotsky 1978). In the classical museum, communication is mainly uni-directional with only one voice being heard, namely the authoritative voice of the museum. More recently, however, exhibit designers have sought to include elements of interactivity, as in the exhibition *On the Road* (2007) held in Lowell, Massachusetts, about the beat poet Jack Kerouac. Here, visitors wrote more than 10,000 messages at an exhibit that consisted of an old typewriter, a chair and a famous quote from Kerouac: ‘Never say a commonplace thing.’ In Worcester, UK, visitors voted for their favourite painting with paper ballots in the exhibition *Top 40. Countdown of Worcester’s Favourite Pictures* (2009) and subsequently began to follow the rankings of the pictures week by week (Simon 2010). Such elements of dialogic interaction have been found to engage young visitors and facilitate meaning-making and sharing of ideas (Dysthe 2012).

Implementation of design principles in *Dear, Difficult Body*

The exhibition *Dear, Difficult Body* consists of six sections, each addressing a separate thematic content area. Table 1 gives an overview of the different sections, indicating how the curators implemented the design principles in each section.

[Insert Table 1 somewhere here]

Curiosity is applied in all sections but particularly in object-rich sections like ‘Body Ideals and Rituals’, ‘The Body Eating’ and ‘The Body in Action’. *Challenge* is primarily applied in ‘The Locker Room’, where six full-scale pictures show naked people (three generations of men and women) each taking a shower in a communal changing room, see Figures 1 and 2.

[Insert Figure 1 somewhere here]

Pupils looking at sculptures of women from different historical epochs in ‘Body Ideals and Rituals’, including a figure of a human-sized Venus of Willendorf and a Barbie.

[Insert Figure 2 somewhere here]

‘The Locker Room’ with photos of naked people, and ‘explore boxes’ in the foreground.

The *narrative* aspect is included in most of the sections and comprises *personal narratives* from ‘ordinary’ people talking about their experiences with, for example, eating disorders, sport and nudity. In the section ‘Prejudices about Obesity’ four researchers (an epidemiologist, two physicians and an anthropologist) present new knowledge on obesity and refute myths displayed as exhibit headings, e.g. ‘Fat people love food and are lazy’, or ‘Being thin is always healthy’. These *expert narratives* also include a personal dimension and end with personal advice from the researcher, e.g. ‘I would put it this way: It’s better to be fat and fit than slim and lazy’, see Figure 3.

[Insert Figure 3 somewhere here]

In ‘Prejudices about Obesity’ pupils can choose a myth by pressing a black buzz-button placed to the left of the pupils.

The design principle *participation* is embodied in exhibits that include elements of *physical* and *dialogic interactivity*. For example, the participatory ‘Your-Choice Films’ begin with a 60-second film that presents a given issue and afterwards asks visitors for their opinion. ‘Nudity’, for instance, begins with a film of three young teenagers undressing to take a communal shower, but one of them feels uncomfortable with the situation. Afterwards, visitor can select their own gender and age by choosing one of four icons and answer the questions: ‘How do you feel about using the communal shower after sport?’ Possible answers are: ‘It’s okay’, ‘It’s not okay’, or ‘I don’t know’. At the end of session, the visitor’s answer is compared to answers from former visitors via computer-generated graphics, divided by gender and age (see Figure 4).

[Insert Figure 4 somewhere here]

Your-Choice Film about ‘Nudity’ and communal showering showing the answers from former visitors divided by gender and age.

The element of *dialogic interactivity* is also applied in the section ‘Straight from the Heart’, where visitors are encouraged to post sticky notes with thoughts, feelings and worries about their body – thereby communicating with visitors past, present and future (see Figure 5).

[Insert Figure 5 somewhere here]

The dialogic interactivity ‘Straight from the Heart’. In a small room at left (the ‘Heart Chamber’) visitors can write red notes about parts or aspects of their body that they find endearing, and grey notes about things they dislike.

Investigation and method

The aim of the study was to investigate how lower-secondary school pupils experience the exhibition *Dear, Difficult Body*. The pupils explored the exhibition in their own way, mainly in friendship groups of two or three pupils. There was no specific assignment and no restrictions on topic, space, object, time, interaction or order; they were free to choose what they wanted to dwell on. Hence, different pupils experienced different parts of the exhibition, depending on what caught their and their friends’ attention and held their interest. In particular, the study focussed on the nature of personal reflection and pupil-pupil discussion as initiated by the exhibition, and on the ways such actions were prompted by the four design principles inherent in the exhibition’s design. The investigation is based on a mixed-method approach, where quantitative and qualitative data – questionnaire data and interviews – are used in tandem (Creswell 2009). An interpretative approach was used in our analyses of the collected data (Lindauer 2005b) and the authors abided by ethical guidelines practised by the Danish educational research community.

The investigation was conducted by the two first authors, who coded and analysed the data separately and then compared data analysis and resolved discrepancies through discussion. Skydsgaard is the senior curator at the Steno Museum and has a detailed knowledge of the exhibition development process. Møller Andersen is an external researcher in science education and was involved in the development of the Inspiratorium project.

Data collection and analysis

The questionnaires were answered by 98 pupils from five classes in four schools. The schools are located in the same city as the museum, but situated in different urban areas. We chose to focus on lower-secondary pupils (aged 13–15 years) because they represent the exhibition’s main target group. The first class (18 pupils)

answered a short questionnaire with three open-ended questions, where each pupil was asked to write what they liked and/or disliked about the exhibition. Based on their answers we developed a revised version of the questionnaire, which was subsequently given to the remaining pupils. This questionnaire contained ten open-ended questions, and the pupils were explicitly asked to give reasons for their answers, with wordings such as: ‘Which section of the exhibition did you find most absorbing and engaging? What was it, in particular, that attracted your attention?’ Other questions addressed the effect of the exhibition and how it had prompted pupils’ reflections in relation to their own and other people’s bodies, e.g. ‘Did the exhibition make you think about how you feel about your own body? Please state the reason for your answer’ and ‘Did the exhibition make you think about how you look at other people’s bodies? Please state the reasons for your answer’. Five of the ten questions targeted the pupils’ experience and reflections concerning one specific part of the exhibition: ‘The Locker Room’ or ‘Body Ideals and Rituals’ or ‘Straight from the Heart’.²

The questionnaire data provided some general points about pupils’ views on the exhibition. To gain a more profound understanding of the exhibition’s effect on young people’s reflections and discussions we conducted follow-up interviews with eleven pupils (6 girls and 5 boys). These pupils came from a comprehensive school situated in a mixed area (private houses and rented flats) and had a heterogeneous background (ethnically and socioeconomically). The pupils were selected based on their responses with the aim of capturing the broadest range of responses in the interviews. The selected pupils had expressed varying degrees of reflection and enthusiasm in their questionnaire responses.

Table 2. Details of informants and data-collection methods.

Participant type	N	Age	♂/♀	Data-collection methods
Pilot class	18	14–15 years	9/9	Short questionnaire with open-ended questions
Four classes	79	13–16 years	38/41	Revised questionnaire
Selected pupils	11	13–15 years	5/ 6	In-depth interview

The semi-qualitative interviews were carried out one week after the pupils had visited the exhibition. The interviews were based on an interview guide and photos from the exhibition supporting pupils’ memories about the exhibition. The interviews were structured around the different exhibition sections, addressing individual reflections and actions initiated by different exhibits and by the exhibition as a whole. The interviews were recorded and transcribed verbatim.

The interview transcripts and questionnaire responses were subsequently analyzed and coded in ATLAS.ti 6. The final coding schema comprised the following:

1. Personal reflections and feelings prompted by exhibition (including views of own and other peoples’ bodies)
 - a. Prompted by curiosity element
 - b. Prompted by challenge element
 - c. Prompted by narrative element
 - d. Prompted by participation element
 - e. Prompted by other element or the exhibition as a whole

² Sections on body health (‘The Body Eating’ and ‘The Body in Action’) have not been investigated in depth. To obtain the full questionnaire material, please contact the first author.

2. Discussions and other communication prompted by exhibition
 - i During visit with other visitors present
 - ii During visit with past and future visitors
 - iii With friends and family after the visit
 - a. Prompted by curiosity element
 - b. Prompted by challenge element
 - c. Prompted by narrative element
 - d. Prompted by participation element
 - e. Prompted by other element or the exhibition as a whole

In analysing our data, our first step was to look for instances of reflection and feelings, and discussion and communication that the students reported to have been prompted by certain exhibits. We next examined which exhibit element, and embodiment of a design principle, initiated the reaction. On many occasions, we agreed that pupil responses could be tagged with multiple codes. Our aim here was not to discern the relative efficacy of each principle, but moreover to identify in what ways the exhibits were successful in achieving the aim of facilitating reflection and discussion. More specifically, we were able to determine which design principles afforded which behaviour, and whether such effects were due to the design principles acting individually or in concert. In the findings below we present example questionnaire comments and interview transcripts to illustrate our coding process. All names are pseudonyms.

Findings

Pupil responses to *Dear, Difficult Body*

In the questionnaire survey, 63 pupils from the four classes (80% of 79 pupils) indicated that the exhibition had given rise to new ideas about their own or other people's bodies.

'It [the exhibition] has probably **made me think** more about my own body, but it has **also made me think** more about other people's bodies, too, because it includes a lot of opinions and attitudes.' (Female, survey, June 2012)

10 % of pupils indicated that they found the exhibits surprising, interesting and challenging (e.g. the full-size naked photos) and fun (e.g. 'Straight from the Heart'), but noted that the exhibition had not prompted new thoughts about the body. Finally, 10 % of pupils said that the exhibition had not prompted any new idea or notions either because they already knew about most of the things or they did not find the topic interesting.

Impact of design principles

Arousing curiosity

Curiosity can be awakened by intriguing images, words, artefacts and displays. In identifying instances of curiosity we noted pupils' use of words like 'surprise', and personal reflections of wonderment or shock. 87 % of students' comments across both the interview and questionnaire included references to curiosity. The pictures included in the slide show, illustrating the changing body ideal over a period of 100 years, appeared to be particularly effective in evoking curiosity and prompting reflection.

‘I was a bit **surprised** by the fashion in the 1970s, the stuff about body-building and going about topless.’ (Female, survey, June 2012)

Objects also stimulated pupil curiosity. Human-sized statues of Venus of Willendorf and Barbie proved especially effective at initiating personal reflection:

‘Really fun, especially the giant Barbie’s body, because suddenly **I could see how ugly it would look if I had the same body** [as her].’ (Female, survey, June 2012)

With respect to the exhibition’s aim of promoting discussions, the curiosity-evoking objects about body-ideals appeared to be particularly successful. In the interview, Therese referred to a discussion she had had with one of her female classmates about dolls as ‘role models’ after having seen the showcase of ‘Dolls and body ideals’ displaying Barbie and Action Man figures:

‘Barbie dolls, and Bratz dolls – **we discussed it**, like ... “hey, you know, they should have ... they ought to make fat Barbie and Bratz dolls,” because then maybe they [young girls] might have a bit more self-esteem when they get older, because then they will know how the world really works; that you aren’t as skinny as they are.’ (Therese, interview, October 2012)

An exhibit consisting of a corset and an old anatomical poster showing the deformation of a corseted woman’s internal organs also appeared to arouse pupils’ curiosity and prompt discussion. One boy described how this exhibit initiated a discussion with his friends about what some people do to their body:

‘**We also talked about** what corsets are. Those things, you know, with tight ... just how insane it was.’ (Benjamin, interview, October 2012)

Presenting challenge

In the survey, several pupils indicated that they had felt challenged by the exhibition, and especially by the full-scale pictures of naked people in ‘The Locker Room’. Half of the pupils (25/51) who answered specific questions about ‘The Locker Room’ indicated that the pictures were ‘repellent’, but some of them explained that their strong reaction was a result of ‘not being prepared’ for this visual representation of naked people. Questionnaire responses included the following:

‘**Frightening**. You’re **not used to** seeing a naked body.’ (Male, survey, March 2012)

‘**Fairly shocking**. Especially the boys. You’re used to seeing girls naked, either [after sports] at school or in the swimming pool [showers], but it’s not every day you see naked boys.’ (Female, survey, October 2012)

The use of narratives

53 % of students’ comments included references to narratives. Most of their comments related to the *personal narratives* about experiences in locker rooms or with anorexia. These personal narratives caused the following reactions:

‘The locker room, it caught my attention because **you heard other young people say** that you’re not the only one who’s in doubt as to whether you are OK the way you are.’ (Female, survey, June 2012)

‘Because you **heard the opinions of other young people**, so you could identify with them.’ (Male, survey, June 2012)

Another exhibit featuring a *personal narrative* consists of a self-portrait by an anorexic girl together with a letter describing her eating habits. This exhibit prompted instances of personal reflection, and discussion

between pupils:

‘It just makes no sense to me, right? It’s just, you know ... eating, it’s like the most normal thing you can do, to me, and so it’s just ... “I don’t want to eat, because I want to be skinny” ...’ (Benjamin, interview, October 2012)

‘I talked with Freja [...] and we talked about that anorexia part [of the exhibition], and about, you know, “No way are we ever getting into that”. And we just thought it was so horrible that she ate washing-up liquid.’ (Therese, interview, October 2012)

The *expert narratives* about being overweight also caught the attention of many pupils:

‘I think that the part with the [scientist’s] explanation and the video, that’s probably **the part I got the most out of** [...] I watched them all.’ (Oscar, interview, October 2012)

Enabling participation

65 % of the pupils’ responses, across both the questionnaire and the interviews, reflected the design principle of participation.

Physical interactivity

The opportunities for physical interaction – from the use of a touch screen to the manipulation of exhibits – clearly facilitated pupil engagement with the exhibition’s content. Indeed, even the simple act of pressing a button was perceived by students to be engaging:

‘I like the little films, and it made it more exciting that you could click on the touch screen ... **instead of not being allowed to touch anything at all.**’ (Male, survey, October 2011)

Another physical interactivity, a water pump designed as a fitness machine, facilitated reflections among some boys:

‘It shows really well how life was really tough for people back then. Today we can just open the tap, and water comes out.’ (Male, survey, June 2012)

Dialogic interactivity

Many visitors expressed their opinion through the ‘Your-Choice Films’, e.g. on the issue of communal bathing. During the first year of the exhibition, approximately 25% of all visitors responded to at least one of the ‘Your-Choice Films’. Indeed, the pupils in our study appeared to find these films quite appealing, and the statistics made them reflect on other peoples’ views:

‘... it was, you know, exciting to see **what other people thought of it.** Those films ... where you had to press what your own opinion was, and then you could see what others thought.’ (Marie, interview, October 2012)

The invitation to write notes in ‘Straight from the Heart’ was also found to be successful in both prompting reflection, and enabling discussion with visitors past and future. It was also evident that girls enjoyed this activity more than boys. While we were unable to capture how many girls versus boys wrote notes in our sample, the general data from the exhibition show that girls wrote 81 % of 1700 notes posted during the first year, and female visitors wrote longer notes than male visitors. The gender difference was most pronounced when the notes concerned visitors’ negative feelings in relation to their own body: Here, the notes from

women/girls were in average 12.0 words long, while male notes were in average 4.6 words long. The notes on positive own-body feelings were more equal in length: Here, women/girls used 8.8 words while men/boys used 6.4 words. The notes often include personal reflections about one's body:

'Like most girls, it's my tummy and my breasts, of course. – Is my tummy flat enough? – Are my breasts big enough?' (Female, 14 years, note)

'**I find the most difficult** thing to be spots, pimples on my face. Besides that, I often measure my muscles up against everybody else.' (Male, 15 years, note)

Half of the pupils who answered specific questions about 'Straight from the Heart' indicated that the exhibit and the notes had prompted new ways of thinking:

'Yes, it's strange to **hear other people's attitudes** towards themselves, since that's not something you would normally talk with others about.' (Male, survey, March 2012)

'I was both **surprised and yet also expected to see** that the woman's figure has more notes than the man. It makes me sad and angry that women have to think more about their appearance than men.' (Female, survey, June 2012)

Our data clearly indicate that young people appreciate the contributions from former visitors, and while anonymity remains important, some of them are quite thrilled at the possibility of sharing their ideas and feelings with others.

Design principles at work

Our findings indicate that the use of design principles can help to structure exhibit development and facilitate engagement. But what is the effect of such principles in combination? And how well do they relate to visitor's particular needs and expectations.

Working in concert

While we have described each design principle individually, they often work in concert, exerting a joint impact on the way visitors experience an exhibit. The significance, or otherwise, of principles working in concert has been variously described by researchers. Alt and Shaw (1984) referred to a hierarchy of their principles. In contrast, Perry (2012) noted that principles ought to be combined specifically from exhibit to exhibit, while Pedretti's (2004) principles were explicitly described as complementary aspects of critical exhibits. The Exploratorium in San Francisco has investigated joint impact and found that *physical interactivity* could successfully be combined with a *multi-user* strategy and exhibit labels that posed *challenges* (Allen 2004).

The section 'Prejudices about Obesity' communicates the latest research on obesity. The design principle most prevalent in this section is the *narrative* aspect, but the exhibit also draws on the design principles of *curiosity* and *active participation* (pressing a big buzz-button). To arouse curiosity, the designers chose to name the exhibit 'Prejudices about Obesity' (and not the more neutral 'Information about Obesity'), followed by a purposively controversial and thus compelling subtitle, e.g. 'Fat people love food and are lazy'. 'The Locker Room', meanwhile was perceived to be a very *challenging* exhibit and all the young visitors remembered the pictures of naked people showering. However, they also welcomed the *personal narratives*, and indeed, the combination of the *challenging* content and *narrative* format appear to have been particularly effective in encouraging the majority to think more deeply about what they were seeing.

In some cases, however, the combination of elements did not work. In the section 'Body Ideals and Rituals', a doping exhibit included a normal heart and an enlarged heart displayed alongside confiscated packets of anabolic steroids in a glass showcase. The exhibition developers expected the enlarged heart to be

one of the exhibition's 'centrepieces', believing the diseased heart would arouse *curiosity* and *challenge* some visitors. On the contrary, the heart attracted little pupil attention and did not lead to discussions about the physical consequences of using anabolic steroids. Thus, it would appear that certain exhibits, even when designed according to acknowledged principles, do not foster engagement. Interestingly, however, when a museum guide led a tour of the exhibition and introduced these objects, they were found to prompt plenty of questions (indicative of personal reflection) and group discussion: 'They get extremely interested when I tell them how large a normal heart is. Then they understand what an enlarged heart is. Then they can see that it's wrong' (science educator Kamma Lauridsen, personal communication, January 2015). Further research exploring the role of a museum guide highlighting exhibits and building on their underlying design principles is clearly necessary.

Alignment with visitors' needs

Our investigation demonstrates that the pupils' experiences of the various exhibit elements and design principles are affected by their existing knowledge and interests, and also their gender. Some pupils stated that the exhibition did not make them reflect because they already knew a lot about the topic. For some exhibits, responses could be delineated along gender lines. The human-sized Barbie and the dolls triggered *curiosity* and discussions about body ideas among female pupils, but not among the males. A written *narrative* from a girl with anorexia and a bottle of washing-up liquid similarly had a strong effect on the interviewed girls – one of whom personally knew girls suffering from the disorder. According to the general data, girls also participated much more in the *dialogic interactivity* 'Straight from the Heart'. In contrast, the exhibition developers had thought the exhibits on doping and physical activity aimed at arousing *curiosity* and generating *participation* would address boys' interests more, but only one exhibit – a water pump converted into a fitness machine – appeared to be favoured by the boys. In other exhibits however, both genders expressed the same level of interest regarding the *challenge* from pictures of nudes or the *narratives* on communal showering or obesity.

Clearly, personal and physical factors influence the extent to which the potential of the various design principles can be realized, and more research is needed to understand the interplay at work here.

Implications and discussion

In the past, museum exhibitions have been built on more or less explicit understandings of how exhibits affect visitor behaviour and indeed what sorts of behaviour are deemed desirable. The findings from our study suggests that the judicious application of design principles could ensure a more rigorous and robust design process and one that more effectively supports efforts to engage visitors in issues-based exhibitions about contemporary topics. This conclusion echoes the observations of the exhibition architect:

While working to develop this exhibition, our discussions made us aware that the goal of the exhibition could be achieved by consciously working with the design ideas we had previously tried out [...] Not all principles were equally influential on the design process. Some operated at a more general level (*curiosity* and *challenge*), whereas others (*personal narratives* and *participation*) more explicitly gave us a picture of the actual design

(Architect Susanne Kirkfeldt, pers comm, October 2015).

The design principles helped to provide a common framework for the exhibition which ensured a richer display, but also served to ensure that the exhibition aims were understood by all staff. Moreover, the resulting exhibition was clearly effective in serving its audience:

First of all, this [the four design principles] gives a direction that everyone can work towards, and secondly I think it makes for greater variety in the exhibition, which brings the different learning styles of our visitors more into play.

(Head of School Services, Line Stald, pers comm, October 2015).

Seeking environmental novelty in order to stimulate one's *curiosity* is an innate human characteristic (Falk and Dierking 2000). Thus, the principle of arousing curiosity should always form a prominent part of the curating process: from the overall design of the exhibition, to the choice of objects, photos, films and audiovisual elements, to the way information is presented in text.

Telling *narratives* represents another innate human characteristic and is, according to Arnold (2006), axiomatic to museums. Narratives provide richness to all kinds of exhibitions, as exhibitions are inherently related to human activity in one way or another (Avraamidou & Osborne, 2009). In Denmark, for example, Esbjerg Art Museum has experimented with different interpretations of an artwork and found that visitors preferred children's spontaneous interpretations to those of an art historian. The museum has subsequently implemented children's personal narratives in their exhibitions (Esbjerg Kunstmuseum 2008). *Expert narratives* about science, art or the humanities can also provide richness and cutting-edge knowledge to most exhibitions. Several exhibitions with this approach have emerged in recent years, e.g. in the Cocoon at the Natural History Museum, London, in which the lives and narratives of four researchers of natural history follow the visitor through the galleries.

Challenging the visitor emotionally with hot topics is not about mimicking the tabloids' sensationalist strategy. It is about placing exhibitions in the rich social and cultural context of the real world. Museums should not only be oriented towards 'facts learned', but also engage themselves in issues that *challenge* an individual's or a group's values or beliefs (Cameron 2010) and thereby, in the case of *Dear, Difficult Body*, 'equip young people to manoeuvre amongst the media's innumerable voices on bodies and health' (Skydsgaard and Stald 2009: 2). From a normative point of view, one could argue that challenging visitors is what museums ought to do as a public institution engaged in society. For example, instead of a more conventional exhibition about dinosaurs, the Natural History Museum in London produced 'Extinction' (2013), an exhibition which confronted guests with the possibility of the sixth mass extinction on Earth, caused by greenhouse-gas emissions and the excessive felling of rain forests. By contrast, the majority of Botanical Gardens around the world simply exhibit plants as aesthetic phenomena in sterilized greenhouses, where there is no reflection about the accelerated extinction of flora and fauna, or about habitat destruction. Cameron (2010) argues that museums today are important gatekeepers for opening up and directing conversations on socio scientific topics significant to our society.

Participation is about transforming the visitor from a passive consumer to an active participant who can add content to the exhibition. Three months after the opening of *Dear, Difficult Body*, data from the 'Your-Choice Film' about young people's attitudes towards communal bathing were cited on the front page of a national Danish newspaper. This contributed to a radio, television and newspaper debate about the topic, as knowledge about young people and communal bathing was sorely lacking at that time.³ In addition, the data

³ *Jyllands-Posten*, 10 February 2012; according to www.infomedia.dk the data from 'The Locker Room' was cited 31 times over the following month.

obtained in ‘Straight from the Heart’ has generated interest from youth researchers, as the exhibit has produced substantial material on young people’s views about their bodies and thus adds to knowledge around how young Danes think and feel about body and gender issues. In other words, *participation* can generate a flow of information from visitors to other visitors and to the surrounding society, and make an exhibition grow post-launch. This new conceptualisation of the museum, defined as the ‘post-museum’ by Hooper-Greenhill (2000), thus acts as a platform connecting the life of the citizens with the knowledge of the experts. The objective for the museum is not only to disseminate authoritative knowledge, but also to facilitate personal meaning-making and, at its best, to help the materialization of a public discourse about a chosen topic (Watermeyer 2012).

The use of design principles in exhibition development has been critically discussed by Achiam (2012) (née Mortensen (2011)). Achiam finds it problematic that design principles are often articulated at a very general level, making them difficult to apply in practice. She also discusses the difficulties of evaluating the effectiveness of design principles, because in some cases the principles stimulate a given visitor behaviour without promoting the intended learning outcome. Whilst we agree with Achiam that there is no ‘one-size-fits-all’, and that the applicability of design principles depends on the exhibition’s content, aim, target group and prototype-testing, we maintain that design principles have a general value as a tool in the process of developing exhibits.

The aim of the exhibition *Dear, Difficult Body* was to facilitate reflection and discussion among young people about body ideals, nudity and their acceptance of their own and other people’s bodies. In order to reach this goal the exhibition developers systematically worked with selected design principles. Our analysis has demonstrated that the systematic use of design principles has largely enabled a clear match between the aim of the exhibition and visitor outcomes. The data from our study indicate that, for the majority of the pupils, the exhibition prompted personal reflections about their own and other people’s bodies, and also encouraged discussion between visitors past, present and future. These findings suggest that the use of design principles is effective in informing exhibition design. More specifically, we note that the use of the particular principles of *curiosity*, *challenge*, *narrative* and *participation* serve to help create exhibition experiences that provide visitors with the opportunity to reflect, to discuss, and thus to actively participate in contemporary hot topics.

Acknowledgements

.....

References

- Achiam, M.F. 2012. A Content-oriented Model for Science Exhibit Engineering. *International Journal of Science Education, Part B*. 3: 214–232.
- Allen, S. 2004. Designs for learning: Studying science museum exhibits that do more than entertain. *Science Education*. 88: S17–S33.
- Alt, M.B., and K.M. Shaw. 1984. Characteristics of ideal museum exhibits. *British Journal of Psychology* 75: 25–36.
- Arnold, K. 2006. *Cabinets for the curious. Looking Back at Early English Museums*. Aldershot: Ashgate.
- Avraamidou, L., & Osborne, J. 2009. The role of narrative in communicating science. *International Journal of Science Education*, 31(2): 1683–1707.
- Bamberger, Y., and T. Tal. 2007. Learning in a Personal Context: Levels of Choice in a Free Choice Learning Environment in Science and Natural History Museums. *Science Education* 91: 75–95.
- Bedford, L. 2001. Storytelling: The real Work of Museums. *Curator* 44: 27–34.
- Borun, M., and J. Dritsas. 1997. Developing Family-Friendly Exhibits. *Curator* 40 (3): 178–196.
- Borun, M., and J. Dritsas. 1997. Enhancing Family Learning Through Exhibits. *Curator* 40 (4): 279–295.
- Cameron, F. 2010. Introduction. In *Hot Topics, Public Culture, Museums*, eds F. Cameron and L. Kelly, 1–7. Newcastle upon Tyne: Cambridge Scholars Publishing.
- Claxton, G. 2015. *Intelligence in the Flesh. Why your Mind needs your Body much more than it thinks*. London and New Haven CT: Yale University Press.

- Creswell, J.W. 2009. Mixed Methods Procedures. Chap. 10 in *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. 3rd ed. Los Angeles, CA: SAGE Publications.
- Csikszentmihalyi, M., and K. Hermanson. 1995. Intrinsic motivation in museums: Why does one want to learn? In *Public institutions for personal learning: Establishing a research agenda*, eds J.H. Falk and L.D. Dierking, 67–77. Washington, DC: American Association of Museums.
- Duschl, R.A., Schweingruber, H.A., and Shouse, A.W. 2007. Chap. 6. in *Taking science to school: Learning and teaching science in grades K-8*. Washington, D.C.: National Academies Press.
- Dysthe, O. 2012. Teoretiske perspektiver på dialog og dialogbaseret undervisning [Theoretical perspectives on dialogue and dialogue-based teaching]. In *Dialogbaseret undervisning. Kunstmuseet som læringsrum*, eds O. Dysthe, N. Bernhardt, and L. Esbjørn, 45–80. Copenhagen: Unge Pædagoger.
- Falk, J.H., and L.D. Dierking. 2000. *Learning from Museums. Visitor Experiences and the Making of Meaning*. Walnut Creek, CA: Alta Mira Press.
- Hooper-Greenhill, E. 1992. *Museums and the Shaping of Knowledge*. London and New York, NY: Routledge.
- Hooper-Greenhill, E. 2000. The rebirth of the museum. Chap. 7 in *Museums and the Interpretation of Visual Culture*. London and New York, NY: Routledge.
- Kelly, L. 2010. Engaging Museum Visitors in Difficult Topics through Socio-Cultural Learning and Narrative. Chap. 10 in *Hot Topics, Public Culture, Museums*, eds F. Cameron and L. Kelly. Newcastle upon Tyne: Cambridge Scholars Publishing.
- King, H., Tran, L. 2016. Facilitating Deep Conceptual Learning: The Role of Reflection and Learning Communities. I: Patrick P, red.: *Preparing Informal Science Educators*. New York: Springer.
- Lindauer, M. 2005a. From salad bars to vivid stories: four game plans for developing 'educationally successful' exhibitions. *Museum Management and Curatorship* 20: 41–55.
- Lindauer, M. 2005b. What to ask and how to answer: a comparative analysis of methodologies and philosophies of summative exhibit evaluation. *Museum and Society* 3: 137–152.
- Lucas, B., and Claxton, G. 2010. Chap. 3 in *New kinds of smart: How the science of learnable intelligence is changing education*. Maidenhead, GBR: Open University Press.
- Martin, L.M.W. and R. Toon. 2005. Narratives in a Science Center: Interpretation and Identity. *Curator* 48 (4): 407–425.
- Meyer, M.K.K. 2008. Reddet af Peter Pedal? Udfordringer til natur- og teknikvidenskabelige museer [Saved by Curious George. Challenges faced by museums of science and technology] *Nord Nytt* 105: 9–25.
- Melton, A.W. 1972. Visitor Behavior in Museums: Some Early Research in Environmental Design. *Human Factors* 14 (5): 393–403.
- Murmann, M. and Avraamidou, L. 2014. Animals, Emperors, Senses: Exploring a story-based learning design in a Museum setting. *International Journal of Science Education, Part B*, 4 (1): 66–91.
- Mortensen, M.F. 2011. Analysis of Educational Potential of a Science Museum Learning Environment: Visitors' experience with and understanding of an immersion exhibit. *International Journal of Science Education* 33: 517–545.
- Nielsen, K. 2006. Inspiratorium – Science in context. Paper presented at the annual Ecsite Conference, Mechelen, June 8–10.
- Orbach, S. 2009. Bodies real and not so real. In *Bodies*, 108–110. London: Profile Books.
- Pedretti, E.G. 2004. Perspectives on Learning Through Research on Critical Issues-Based Science Center Exhibitions. *Science Education* 88: S34–S47.
- Perry, D.L. 1992. Designing Exhibits that Motivate. *ASTC Newsletter* March/April: 9–11.
- Perry, D.L. 2013. *What Makes Learning Fun? Principles for the Design of Intrinsically Motivating Museum Exhibits*. Plymouth, MA: AltaMira Press.
- Esbjerg Kunstmuseum. 2008. Chap. 11 in *Reach out! Inspiration til brugerinddragelse og innovation i kulturens verden*. Copenhagen: Kulturministeriet (Ministry of Culture, Denmark).
- Sawyer, R. K. 2014. Introduction in *The Cambridge Handbook of the Learning Sciences*. 2nd ed. New York, NY: Cambridge University Press.
- Simon, N. 2010. *The participatory museum*. Santa Cruz, CA: Museum 2.0.
- Skydsgaard, M.A. 2010. The exhibition *The Incomplete Child*: Boundaries of the Body and the Guest. Extended abstract for the biannual conference of the European Association of Museum for the History of Medical Sciences, Copenhagen, September 16–18.
- Skydsgaard, M.A., and L. Stald. 2010. Kend din kropspolitik [Know your body-politics]. Unpublished leaflet for fundraising. 4 pages.
- Steno Museum. 2008. Retningslinjer for udstillinger på Steno Museet [Principles for exhibitions at the Steno Museum]. Unpublished.

- Sørensen, N.-U., J.C. Nielsen, and M.N. Osmec. 2011. Krop og Ydre. Chapt. 8 in *Når det er svært at være ung i Danmark*, eds J.C. Nielsen and N.-U. Sørensen. Copenhagen: Center for ungdomsforskning.
- Vygotsky, L.S. 1978. *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Waadegaard, M. 2010. Spiseforstyrrelsernes forekomst og udbredelse. In *Frås og faste – spiseforstyrrelser i klinisk og kulturel belysning*. S. Lunn, K. Rokkedal, and B. Rosenbaum, eds. Copenhagen: Dansk Psykologisk Forlag.
- Watermeyer R. 2012. A conceptualisation of the post-museum as pedagogical space. *Journal of Science Communication* 11 (1): 1–8.