

# Affective presence in museums: ambient systems for creative expression

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## Abstract

The space of technology design is being shaped by a drive for creating more authentic, rich experiences, taking into account the complex meaning-making activities we engage in every day. One approach toward enhancing technology design for experience is to identify aspects missing from existing computer models, such as emotion, creativity, spirituality, and add these missing components to the equation. Another approach attempts not to fit complex experiences into computer models but looks at alternate uses of technology for drawing attention to the complexity of meaning-making experiences. This second approach is introduced through the work of the *Affective Presence* consortium and advances the idea of design as a process of co-construction between users, systems, and designers. One project from the consortium is examined in detail: affective presence displays in museums for creative expression. We present results from initial prototype testing and findings for advancing the design and evaluation of affective presence displays.

Keywords: affective presence, creative expression, museums, presence, social awareness

## 1 Introduction

During the rise of mainstream personal computing, a movement away from simple usability design toward designing for ‘experience’ began to take form (Kapor 1991, Winograd and Flores 1986). HCI researchers and designers at this time applied lessons from art and architecture in the hopes of shaping systems more attuned to context and sensitive to human activities (Schön 1990, Laurel 1993, Crampton-Smith and Tabor 1996). Over ten years later, the move toward ‘experience’ design is still a work in progress.

Today, we have more evidence of richer, expanded conceptions of computing design and applications (Dourish 2001). Tangible computing, for example, incorporates whole senses in the interface. Ubiquitous computing moves computational power from the desktop into the environment. Context-aware computing emphasises the situatedness of actions. Creative computing and ludic computing argue for pushing technology beyond task-based or utility-based applications. Social computing enlarges the scope of who is involved in interactions with and through technology. Affective computing challenges the dominant Cartesian, reason-focused, approach to computer design. All of these developments have worked to address the anaemic model of a single generic user at the workplace desk completing a well-defined task.

Although the examples above share a focus on experience, the approaches and results toward experience design remain varied. Arguably, the most common approach

toward experience design follows what we will call the ‘codification of experience’ model. In this approach, aspects of experience missing from computing—such as emotion, context, senses, etc.—are added to the equation through a process of abstraction.

Formalising aspects of human experience for computation can be traced through the history of computing as continual efforts are made to define what computers cannot do (Dreyfus 1979), or more specifically what separates humans from computers, and then testing these limits. Boden (2003), as a recent example, sets out to examine whether or not computers could be considered creative, a capacity generally held sacred to human beings. Likewise, Picard (1997) popularised the idea that computers could display, recognise and possibly even have emotions, again another defining characteristic of humanity. In both of these examples, creativity and affect are broken down into abstractions and codified for computation.

The codification approach requires discrete inputs and outputs and formalisable representations of the world, such as exemplified by the Shannon and Weaver (1963) mathematical theory of communication. Picard draws on Shannon and Weaver in her discussion of affective computing suggesting emotions are bits to transfer between sender (whether a computer or a person) and receiver (again, whether a computer or a person). The abstraction and computation of meaning—in other words, what a particular emotion is and what it means—occurs inside the black box of the system.

Another characteristic of the codification model is its continued focus on utility despite an emphasis on experience. Metrics for success revolve around producing greater numbers of results, more efficient results, or greater access and involvement from a wider population (e.g. “you too can paint a masterpiece with the simple click

of a button!” Or, “if your computer senses frustration, it can calm you down to help you work better!”).

Critics of the codification approach to experience posit that experience cannot be poured into or distributed to passive recipients any more than experience can be poured into discrete generic models. McCarthy and Wright (2004) draw on pragmatist philosophers John Dewey and Mikhael Bakhtin to argue against abstract models that ultimately lose the rich, relevant, and personally meaningful details of authentic lived experiences.

In this same vein, we also draw from critics of the Shannon and Weaver input-output communication models, such as social constructionist theories (Berger and Luckman 1967) or theories of language in use (Clark 1996). These constructionist approaches posit that knowledge and meaning are created through action and interaction in our social world. Affective computing informed by a social constructivist point of view would approach emotions not as some ‘thing’ to be transferred and decoded but as an activity of jointly constructed meaning-making.

We therefore propose an additional perspective on experience design with a fundamentally different approach to the codification model. In an augmentation approach to experience, we use technology systems for reflecting, enhancing, and/or evoking non-formalisable aspects of experience, what we call affective presence.

## 2 Affective presence

The affective presence agenda differs from traditional affective computing in two important aspects. First, we draw attention away from the computing device and subsequent emphasis on the system’s intelligent view of the world. Instead, we focus on presence as an indicator or trace of existing and potential human meaning-making activities. We also differ in our use

of the word 'affect'. Picard (1997) uses 'affect' primarily to indicate emotion and mood, but we use the term more broadly. Affective presence incorporates the ineffable but inescapable qualities of lived experience including emotions, spirituality, social communion, and creative inspiration.

The authors of this paper are part of an international consortium to develop theories, strategies, and methods for affective presence, including Bill Gaver from the Royal College of Art, London; Kristina Höök from Stockholm University, KTH; and Michael Mateas from the Georgia Institute of Technology. We are designers, computer scientists, artists and social scientists all with a common interest in the role of active interpretation in experience. Our emphasis on interpretation for experience has led to design strategies influenced by literary tropes that encourage reflection and meaning-making.

Some of these design strategies include ambiguity, exaggeration and defamiliarisation. Gaver, Beaver, and Benford (2003) demonstrate how ambiguity in systems can draw users in, allowing them to project their own meanings. Exaggeration in designs can raise issues around variable constructions and uses of technology. Djajadiningrat, Gaver, and Frens (2000), for example, design PDAs (Personal Digital Assistants) for 'extreme characters' such as a drug dealer or the pope to open up the design space beyond the stereotypical corporate world. Defamiliarisation, or taking objects out of context, is another useful literary strategy for opening up the design space (Dunne 1999). At the CHI 2003 Workshop on Designing Culturally Situated Technologies for the Home, several participants used defamiliarisation to make 'strange' the seemingly familiar landscape of the home and technology for the home.

Supporting and expressing affective presence does not fit with a codification model of computing. Rather, we seek to design

systems open to interpretation by varying where the control of interpretation lies. In any technology system, there are three parties to the interpretation: the users, the system, and the system designers. We see all parties as engaged in a process of co-construction or co-interpretation (Gaver, Beaver and Benford 2003, Fagerberg, Ståhl and Höök 2004). Participation may not always be equal but awareness of all three levels participating is imperative. Some of our designed systems for example operate without a representation or generative model in the system. In an office installation for expressing mood, the system itself has no internal 'emotional model' but people who use the system map their own sensory inputs to output displays and create their own inferences (Sengers et al. 2004). In other installations, exhibiting what Michael Mateas (2001) calls the 'alien presence' of artificial intelligence, the system plays a more active role and interpretation must be negotiated between parties.

A final distinction between our approach and that of the codification model of experience is in metrics that push beyond utility and efficiency measures. Successful systems are not determined by whether or not a user 'got it right' or if the user performed more efficiently. Instead we look toward metrics such as levels of engagement, enjoyment of use, integration with everyday experiences, and the variability of use or capacity for re-appropriation.

### 3 Affective presence in museums

A more detailed example of one of the projects in the *Affective Presence* consortium will help illuminate the ideas and methods driving our approach. Two of the authors have been examining the uses and effects of new technology in museums for a number of years. Most recently we participated as evaluators on the *CIMI Handshape* initiative<sup>1</sup>, researching the use of handheld guides in museums

and historical sites. The use of technology in general, including handheld guides, for museums tends to follow the codification approach to computing designed for one-way transfer of information. Furthermore, these applications tend to prioritise individual interaction with the technology as opposed to interaction through or around technology (Heath and von Lehn 2003).

However, museums serve not only as a place for information gathering but they also serve social and liminal or spiritual needs as well (Bell 2002, Halkia 2003, Woodruff et al. 2001, Brown et al. 2003). At any given time, a museum houses not only objects but a collection of people and the unique dynamic presence of people's activity in a museum space dramatically influences the overall experience. Therefore as we design and evaluate portable guides to support information transfer, we also develop technology to augment social and liminal aspects of the museum experience.

Our previous attempts at supporting social aspects of the museum experience focused on providing visitors with a channel for explicitly commenting on their reactions to objects (Gay, Boehner and Panella 1997)<sup>2</sup>. Visitors could use a handheld guide to leave a comment for curators or other visitors. The uptake of this functionality was well below our expectations. By way of explanation, visitors indicated they did not use the comment feature because they didn't know what to say. Simply having a channel for participation was not enough for establishing a license to participate. We felt this underscored the predominant design and expectations not only for technology behaviour in museums but also for visitor behaviour. Visitors are there to learn or to be entertained but not necessarily to create and contribute.

Yet, visitors are already implicitly commenting on the museum experience by virtue of what they choose to look at, how long they spend with certain objects, how they

react to these objects, and in what activities they engage. Therefore, we began to create a kind of scaffolding for a new museum experience. By collecting dynamic measures of existing visitor behaviours, their patterns and preferences of movement and information access, we would reframe this participation through an ambient display of affective presence.

#### 4 Ambient displays of affective presence

Ambient displays offer an interesting device for incorporating the three design strategies of ambiguity, defamiliarisation, and exaggeration. 'Ambient' suggests something peripheral but the term 'display' suggests broadcasting or bringing something to the foreground<sup>3</sup>. This juxtaposition can stimulate awareness of and reflection on information that tends to fade into the background.

There is a growing body of research in ambient displays (Ishii et al. 1998, Pederson and Sokoler 1997, Mankoff et al. 2003) for digitally augmenting physical environments, yet developments in this area are also broadly influenced by the codification model of computing. Many ambient display installations map concrete granular information to an alternate display format, for example the weather forecast indicated by the number of seagulls on a digital display or stock market performance indicated by a glowing orb. The task of the user is to use these displays as a new type of symbolic language—for example, "the colour red in this display means call my broker".

Furthermore, ambient displays tend to work with information that is peripheral in the sense that it is separate from other main activities. Checking the weather, for example, is a different or separate task than drafting a research paper. A researcher may switch focus from their foreground activity of writing

a paper to a separate activity of checking the weather by glancing at the ambient display. At that moment, checking the weather moves, ideally in a seamless and immediately communicative way, into the foreground.

We are interested in more complex ambient information, such as emotions, information that exists in the ‘periphery’ but is intimately connected to nearly every foreground activity. In an office environment, for example, one engages in various work activities that are subtly influenced by ambient information about the office environment, such as the level of activity in the office, or the collective mood of the office. This information is not about moving between separate tasks—such as moving from writing a paper to checking the weather. Rather, this information about peripheral social cues provides a necessary relief for the foreground of everyday interactions.

Ambient displays, therefore, offer an interesting device for drawing attention and perhaps influencing existing patterns in physical spaces. In the museum space, people attend to the presence of others without any formal training or direction (Galani and Chalmers 2004). They seamlessly navigate around each other, catch phrases of each other’s conversations, purposefully choose to view or not to view an object because of the crowd size around it.

Although people have an implicit sense of presence, we use ambient displays to draw explicit attention to this awareness. By doing so, we aim to cause critical reflection on the role of visitors in the museum experience and the visitors’ ability to impact the space of the museum. For example, by creating a visual display that builds up patterns of traffic over time, visitors can reflect on their navigation through the museum compared to the paths of others. They might wonder why one area of the museum remains undiscovered and set off to explore, or they may try to trace the same path of an anonymous stranger and wonder

what connections he or she made between various objects.

By projecting onto a large screen or by creating an auditory display of affective presence, we employ defamiliarisation and exaggeration. To make the familiar strange, we take implicit information and present it in a new form, asking visitors to see their role as a creator of ‘art’, as the displays will be presented in the form of an installation. In terms of exaggeration, we take information that generally fades into the background and instead amplify it. The content of the displays will also use the strategy of ambiguity. Rather than intuitive bar charts (e.g. “50 people looked at this object”), affective presence displays offer multiple levels of interpretation and evoke an impression rather than an accurate measure of presence and preference.

#### 4.1 Design study

Through our involvement with the *CIMI* consortium, we have shared the idea of displaying presence with several museums including the Smithsonian American Art Museum, the Smithsonian Native American Museum, the Portland Art Museum, and the Cornell Johnson Museum of Art. Most of the efforts have been on adding displays of presence on top traditional gallery guides.

The presence displays proposed for these museums would serve as a tool both for curators to refine exhibits based on popularity and traffic flows and as a navigation tool for visitors. To this end, some of the displays take on more of an information visualisation approach with typical views showing visitor’s paths superimposed on a floor plan (see Figure 1). We see these more literal displays as a necessary step for moving from a predominant use of technology to serve information toward a use of technology for new forms of expression.

However, our collaborators are also beginning to explore how else this information could be expressed and to what effects.

At the Cornell Johnson Museum, we are experimenting with ambient displays to vary the type and form of information offered to visitors.

We have two main sources of data driving these displays: usage patterns and physical location paths collected through use of the wireless guides, and activity measures through a combination of motion and sound sensors. From this data, we can infer the following indices: density of visitor traffic, pace or tempo of physical activity and amount of information activity (such as accessing information).

Prior to implementing the full installation in context, we conducted a quick prototype test of possible display options. We will present the results of this test before detailing our refined method for moving the displays into the museum.

#### 4.2 Prototype testing method

We convened two separate focus groups for the installations at the Cornell Johnson art museum in addition to less formal discussions with visitors and museum staff. The purpose of the focus group was to collect initial feedback on issues such as what information about presence is most interesting or valuable and how should this information be displayed.

One focus group consisted of six museum representatives (curator, educational directors, and special project coordinators; ages ranging from 23–60 years old) and the other group consisted of eleven museum visitors (ages ranging from 18–30 years old). For each focus group, we presented a range of displays, fourteen displays total, depicting different aspects of visitor behaviour, such as common paths on a museum floor plan. Only two displays qualified as affective presence displays and we will limit our discussion in this paper to these displays.

One display took the form of an ‘emotional climate map’ (see Figure 2) colour coding or shading areas of the museum floor

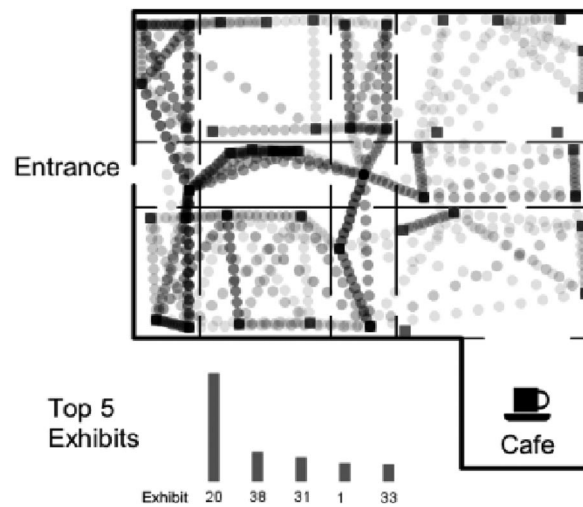


Figure 1. Animated display of visitor traffic over time.

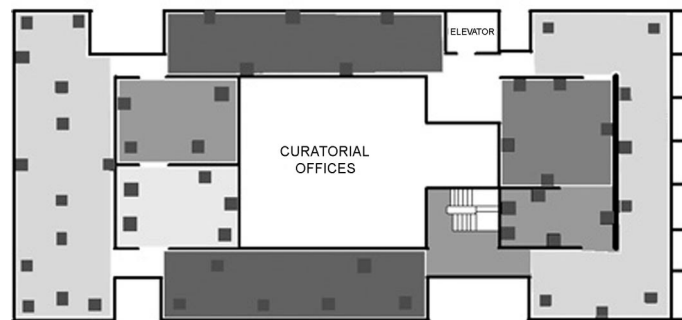


Figure 2. Emotional climate map of affective presence.

plan to suggest different ‘atmospheres’ in various regions of the gallery. The other display took the form of what we call ‘emergent art’, as it mimicked an abstract painting with circles of different colours appearing somewhat randomly on a black background (see Figure 3).

During the focus group, a researcher projected each display on a large screen and gave a brief description while participants individually rated the picture on a seven point scale for three different dimensions: attention, information and behaviour change. In addition

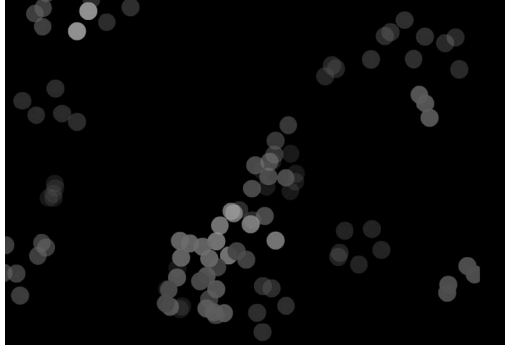


Figure 3. Emergent art display of affective presence.

to filling out the surveys, participants were encouraged to discuss the displays with each other.

We asked each population (visitors and museum staff) to rate the displays from their own perspective and from what they imagined the perspective of the alternate population to be. By drawing out what curators felt was important for themselves and for visitors and what visitors felt was important for themselves and for curators, we could gain insights into their perceptions of what the museum experience was about and what their respective roles were.

#### 4.3 Prototype testing results

Our results led to insights both on the shape of the displays as well as our method for evaluating them. In terms of evaluation, scales are a common measure in survey research for the use of statistical analysis. Yet, rating displays on the seven point scales posed a challenge to our participants for two main reasons. First, the designs were presented out of their intended context of the museum, therefore requiring people to imagine how they might use this information. Second, it was ‘new’ information that they had no prior experience to using in the museum.

Our small sample size and low variance in results (67% of all scores fell between 4 and 6 on the 7 point scale) suggest our results were

primarily useful as a general popularity gauge. For example, visitors rated the emotional climate map highest in terms of information and behaviour influence and second highest across all the displays in terms of attention grabbing potential. However, the scale scores did nothing to tell us why one design might be better than another or how one design might be appropriated in context.

More interesting than the actual scores for each display was the discrepancy between visitor’s perceptions of what curators would find useful and vice versa. Across all of the displays (including affective presence ones), museum staff rated all but one of the views (a personal path model against an aggregate path) higher for their own use than for museum visitors. Staff had difficulty envisioning how visitors would benefit from access to visitor preference information. Visitors agreed that the displays would be more informative and lead to more potential behaviour change (e.g. changing exhibits around based on traffic) for museum staff. Yet, visitors rated the displays higher for themselves in terms of attention. In other words, visitors felt displays of presence would be more useful for museum staff but perhaps more interesting for museum visitors.

More helpful for our design process than the tabulation of scale scores were the conversations generated around the displays. We encouraged people to express their views and offer interpretations about what the display meant and how they might use this information. Both the emotional climate map and the emergent art display generated enthusiastic comments such as: “Beautiful! Patrons creating art!” and “This is really interesting to watch” or “We could project this on the side of the building” and “I’d like to be able to find myself in this”.

#### 4.4 Iterative design and evaluation

The lessons from our first prototype are influencing the development of new displays for installation in the museum. These lessons

apply to both the designs themselves and to our evaluation methods. We will discuss both briefly here.

### Proposed design

We tested only two displays of affective presence in our prototype, but were encouraged by the levels of attention people claimed the displays would generate, even if they weren't sure how they would respond to the information. Although we did not take quantitative measures of these conversations, the use of ambiguity in the designs appeared to correspond with more interest and engagement in trying to figure out what the display meant.

We only exploited one dimension of ambiguity in our designs, namely ambiguity of content in terms of the literal or abstract level of the information form. Once we implement the designs in the museum, we intend to vary other dimensions of ambiguity, such as whether or not we frame the experience for visitors ("this display is about...") or how easy or hard it is to identify an individual's contribution to the display. The ability to find oneself in the collective display was iterated multiple times during the discussions. For the installations in the museum, we plan to vary systematically dimensions of ambiguity to move toward a greater understanding of how this strategy affects the types and levels of interpretation.

The last critical lesson of importance for our displays is the role of context. In the laboratory setting, we used relatively generic displays that could be applied across any museum. We believe that part of the difficulty in the leap of imagination required during our prototype testing was the disconnectedness between the displays and the surrounding space. For our next iteration, we have developed displays specifically attuned to the Johnson Gallery's Asia Gallery where we will locate our installation.

The Asia Gallery houses not only many pieces of art created to honour nature,

but the space itself is marked by wrap-around windows offering beautiful views across the hills of Ithaca and Cayuga lake. We felt our displays should resonate within this context.

Two of our recent designs ready for implementation include a visual display of presence and an auditory display of absence. For the visual display, we chose the metaphor of clouds as an amorphous form people have experience with reading both for information (e.g. the weather) and for expression (e.g. evocative of mood or finding playful images in cloud shapes). The generation of cloud sequences will be orchestrated from measures of density and movement levels. The cloudscape will be projected onto a screen cut into the shape of a Chinese scroll and placed in the gallery's scroll room.

The design for displaying absence or contemplation also draws its data from motion sensors around the gallery space. These sensors will turn on and off a tape loop of birds singing. The tape will play in areas where there has not been a set amount of activity for a given period of time. Therefore, visitors may be drawn to explore new areas of the museum, yet when they enter this area, the birds will metaphorically fly away.

Both of these designs will be tested separately in terms of how people interpret the displays and whether the displays influence the museum experience.

### Proposed evaluation

In terms of evaluation methods, we found the conversations about the displays more informative than the survey results. Therefore, we intend to conduct a more formal conversational analysis around the discussions generated by the new displays in the museum. We will look to metrics such as:

- \* how many interpretations are offered?
- \* what is the range of interpretations the designs generate?
- \* how much time is spent with each display?

- \* how do people not only interpret what the display means but what the display is for?
- \* how do people attend to and interact with the display?

Secondly, in terms of evaluation, in the first study, we asked people about perceived behaviour change. In the museum context, we will measure for actual behaviour change that may be attributed to the display. For a period of weeks prior to installing the design, we will collect data on movement and activity through sensors and observations. The general patterns collected during this time will be compared to patterns generated through the same protocol of sensors and observation data once the displays are installed.

Finally, when testing new displays in laboratory settings with the seven point scales, we will again employ the strategy of asking people to rate the displays from their own as well as another person's perspective. To advance this method, we will automate the scale collection and dynamically share the results with our subjects. The scales become a type of design artifact and display of preference, much like the displays they are rating. In this way, participants are co-interpreting the evaluation of the display as well as the design of the display. Of interest to us is not the score received but why differences in perspectives exist, and what interpretations visitors and staff themselves would have of these differences.

## 5 Conclusions

We are exploring how to design technology in general and ambient displays in particular to support new experiences in an art museum. We began with a desire to support subtle as opposed to explicit social experiences in the form of social awareness and creative expression. Ultimately through representing visitors in new ways, we hope to position visitors as more than recipients of information

or subjects to be studied but as integral participants and shapers of the museum experience. As much as we have emphasised the social space of museums, our user study reminds us how important it is for individuals to find themselves, their own unique print, within an impression left by others.

As we look toward implementing affective presence systems in actual environments, we continue to refine what a successful system would be. Perhaps most critically, people should feel empowered to use the system simply by virtue of being in the museum. Furthermore, it should cause reflection on non-discursive affective information, be enjoyable to engage with, and open to interpretation.

Finally, we introduced a new approach to experience design: one that focuses on systems not for codifying but for augmenting experiences of affective presence. Affective presence is an admittedly amorphous concept encompassing the rich, subjective experiences that make life authentic and irreproducible to generic abstractions. Yet, we are not arguing against all use of technology with regards to amorphous experiences.

Instead, we argue that computational devices can play a valuable role in drawing attention to and stimulating reflection on emotion, spirituality, communion, and creativity through a model of co-construction between designers, systems, and people. In this one specific context of the museum, ambient displays and sensor technology provide a stimulus for new meaning-making activities ultimately drawing visitors' implicit participation into an activity of explicit creative expression.

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## Notes

- <sup>1</sup> <http://www.cimi.org/whitesite/>  
<sup>2</sup> *The Muse Handheld Project*. <http://www.hci.cornell.edu/projects.php?id=3>  
<sup>3</sup> Personal conversation with Ken Anderson and Timothy Brooke at Intel's People and Practices Group, January 2004.

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