

# Understanding the Experience of Interactive Art: Iamascope in Beta\_space

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## ABSTRACT

This paper describes a study into the situated experience of interactive art. The study was conducted with audiences of the artwork Iamascope and is framed by the four categories of embodied experience that have been proposed by its artist Sidney Fels. The video-cued recall method we employed was shown to reveal rich detail about situated interactive art experience. The results provide a detailed account of how the categories of embodiment manifest themselves in audience experience and lead to the proposal of a blueprint for the trajectory of interaction produced by Iamascope which may be generalisable to other interactive artworks.

## Categories and Subject Descriptors

H5.2 [Information Interfaces and Presentation]: User Interfaces – Evaluation/Methodology.

## General Terms

Design, Human Factors, Measurement.

## Keywords

Interactive Art, User Experience, Interaction, Methodology, Retrospective Reporting, Video-cued Recall, Iamascope, Sidney Fels, Beta\_space.

## 1. INTRODUCTION

### 1.1 Studies of Interactive Art Experiences

In computer-based interactive art the artwork comes into being through a process of exchange or dialogue between an active audience and a dynamic art-system [6]. However, despite the fact that interactive art is a form that privileges experience over static objects, there is very little empirical research on the audience experience of this art form.

Some of the most significant work in this area has come from research projects where the fields of interactive art and Human Computer Interaction intersect. Hook et al [10] for example has used the co-discovery method as a means to gain verbal data describing the audience experience by recording conversations between research participants in laboratory situations.

In contrast research by vom Lehn et al [18] uses an ethnomethodological approach to understanding how audiences

encounter interactive exhibits in real-world settings. Through video based observations of visitors to galleries and museums, vom Lehn et al show how the audience experience of interactive artwork is socially determined. From a Human-centred design approach Robertson et al [15] have used extensive field observations of audience behaviour in museums and galleries to develop design tools to be used in the creation of interactive exhibits. These two projects illustrate an approach to understanding the experience of interactive systems that acknowledges the importance of situated action [16].

There is a lack of research that bridges the gap between such observational research in real world settings and more in-depth verbal data-gathering in laboratory conditions exemplified by Hook et al. The objective of this study is to obtain a detailed insight into the situated experience of interactive art through gathering and analyzing rich verbal data from real-world audience encounters.

### 1.2 Beta\_space

Beta\_space is an initiative to provide a public context in which to conduct situated research with interactive art. It is a collaboration between two Sydney institutions; the Powerhouse Museum, one of the largest museums in Australia which focuses on science, design and history, and the Creativity and Cognition Studios (CCS), a multi-disciplinary practice-led research group in digital media and the arts.

Situated in “Cyberworlds”, the Powerhouse’s permanent exhibition on the history and future of computing technology, Beta\_space is an experimental exhibition area that extends the interactive-art research studios of CCS into the public context. It shows interactive artworks at different stages, from early prototype to end product.

Beta\_space is a practical solution to two areas of need: the needs of practice-based researchers in interactive art to engage audiences, in real-world settings in their research, and the needs of the museum to provide current and dynamic content to their audience in the rapidly changing field of information technology

Beta\_space opened in November 2004 with an exhibition of Iamascope, an artwork by Canadian artist Sidney Fels. This paper reports the results of the first research project to emerge from the Beta\_space initiative.

### 1.3 Research aims

The primary aim of this research was to find a useful methodology for recording and analyzing the situated experience of interactive art in Beta\_space. We based the research on the case study of the artwork Iamascope and took as a starting point the artist's own observation that the audience experience of Iamascope can be accounted for using a continuum of 4 categories of embodied relationship between the audience and the art-system; response, control, contemplation and belonging. We aimed to find out whether our methods would gather data that could enrich these observations by showing how such categories are produced and operate in audience experience.

## 2. IAMASCOPE AT BETA\_SPACE

Iamascope is an interactive kaleidoscope that creates images triggered by participant's movements in front of a video camera. The kaleidoscopic image reflects back an abstracted portrait of the participant. The speed and frequency of the participant's movement also produces musical notes, creating a sonic accompaniment to the flow of images.

The work was first developed in 1997 for Siggraph and has since been shown at Ars Electronica (1999) and in the Millennium Dome, London (2000). It was a useful starting point for testing our methodology as it is a stable and well-developed artwork that tends to produce a positive reaction from diverse audiences.

Fels has produced several versions of Iamascope each with different visual, audio or interactive components. The version that was exhibited at Beta\_space had a circular kaleidoscopic image (see Figure 1) and used piano-based musical notes. The work was displayed within a four-walled space with a large rear projection screen contained within one of the walls. A small hidden camera positioned centrally below the bottom edge of the screen captured the participant's movements.

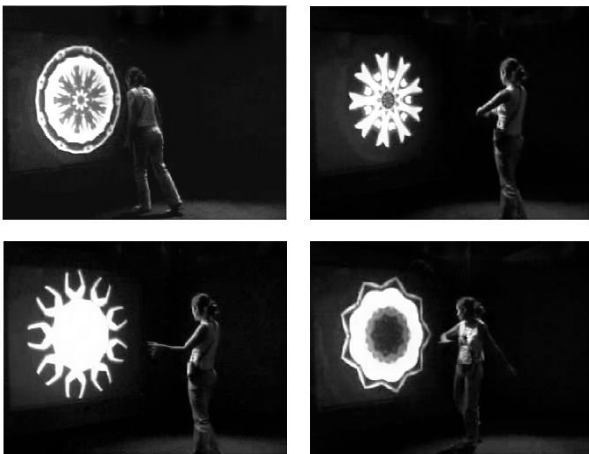


Figure 1. Person interacting with Iamascope.

### 2.1 Categories of Embodiment in Iamascope

Fels has published several articles about Iamascope and the categories of embodied object relations that he considers are at work within it [8-10]. He has developed these relations into a framework that he describes as being essential for ensuring

successful human computer interaction [8]. Fels' framework is divided into four types of relationships between an object and a person. He regards these relationships as overlapping categories that may occur simultaneously during an interactive experience. Fels is primarily concerned with the development of intimacy between a person and an interactive system and he links the intensity of this intimacy to the different types of pleasures that these object relations can stimulate.

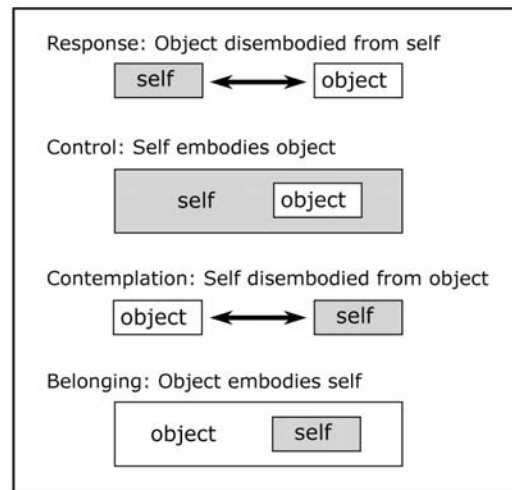


Figure 2. Fel's categories of embodiment.

In his first relationship, which he calls *response*, Fels describes a case where the person perceives the object to be separate from their own self. The object relations here are seen to be similar to those in a conversation. The person interacts with the object and waits for a response before deciding how to interact further. Fels sees the pleasure the person gains from this relation as depending upon their expectations being satisfied by the object's response to their interaction.

The second relationship is called *control* and Fels likens this to the skilled playing of a musical instrument. Here the person feels like the object is an extension of their self. They feel in control of the object and able to play with it. Fels describes this intimate relation as occurring quite quickly within Iamascope due to the system's prompt visual feedback [8]. The pleasures the person gains from this relation are those of control and mastery.

Fels' third relationship is not an interactive one. In this relationship the person sees their self as separate from the object. Fels sees this relation as similar to that between a painting and its viewer. The person is stimulated by the object to contemplate what it is that the object is communicating. Fels describes the possible pleasure this relation evokes as being dependent upon each person's prior personal experience and belief system. He uses both reflection and contemplation to denote this category. For consistency we will use the word *contemplation* in later references to Fels' third relation, which also avoids confusion with the physical video mediated reflection that occurs within the artwork itself.

The fourth relationship Fels regards as being both the most difficult to achieve and the most interesting. This relation involves the person allowing themselves to become embodied within the object. Here the person feels like the object is controlling them

and they get pleasure from being thus controlled. Fels calls this pleasure *belonging*.

Fels argues that the shape and composition of the kaleidoscopic image in Iamascope permits the relation of belonging to occur. Fels experimented with several different levels of abstraction within the image and with several different overall shapes. The circular kaleidoscope with its pie slice shaped reflecting image was judged to be the most effective for producing intimate experiences. Fels argues that this was because the image represented enough of the interactor to make them feel connected to the image while also being abstract enough for the interactor to feel like the system was in control of them [8].

### 3. STUDY METHODOLOGY

#### 3.1 The Video Cued-Recall Method

Video-cued recall or retrospective reporting is a method for collecting verbal data commonly used for investigating human cognitive processes. Because reports are made after the experience, this method is regarded as having less impact on cognitive processes than concurrent think-aloud methods [7]. Reporting retrospectively, however, presents the risk that the participant will forget details and that their recall will be interpretively filtered. The video cued-recall method helps to avoid these pitfalls by using video to help the participant recall the detail of their experience and avoid selective interpretation.

Suchman argues that verbal data obtained using video records can more accurately reflect lived experience than verbal data from interviews [17]. Her argument is backed up by results from recent studies using video cued-recall methods [1, 2, 5, 14, 18]. These studies reveal that not only does this method enable participants to recall more detail about their experience but also more importantly to recall pre-verbal perceptual, motivational and affective states that rarely emerge from interview data. Omodei et al also argue that the cued-recall experience is less threatening for participants than other verbal reporting methods which can make them feel self-conscious.

Our own preliminary tests comparing verbal data from think-aloud, cued-recall and interview methods supported these findings. Think-aloud reports in a public exhibition context caused participants to be extremely self-conscious about their performance and the quality of their comments. Post-experience interviews were able to elicit participant's interpretations of the artwork but did not reveal much about their actual lived experience. The video cued-recall method enabled participants to interact freely with the artwork and, because of its emphasis on non-interpretive reports, removed the fear that can arise out of being asked to evaluate an art experience [12]. Above all the video cued-recall method was the most effective of all the methodologies tested at revealing the kind of affective and motivational data that we were interested in.

We adapted the video cued recall method to suit the context we were working in. A common feature of the method is to mount the camera on the participant's body so that it captures their first-person point-of-view. However in our case participants are interacting with a system they have never encountered before that responds to full-body movement-based input. In order to enable the recall of this embodied experience we needed to capture both the movements the participants were making with their body and

what they were looking at on the screen. Thus in our method the camera was positioned so that it captured a third person perspective.

#### 3.2 Participants

This study involved three case studies of two females (24yr and 29yr) and one male (48yr). In recruiting the participants we focused on finding persons who were likely to visit the Powerhouse museum and who were also likely to visit an art gallery exhibiting interactive art. We specifically chose people who were not involved in the production, exhibition or analysis of interactive art. One participant was an english and history schoolteacher, one an actor and the other a part time student and parent/carer of a young child.

#### 3.3 Data Collection

The participants were first briefed about the general procedure of the study and asked to sign a consent form. They were told that the Beta\_space exhibit was the object of the study, but were allowed to approach it at their leisure looking at whichever other exhibits caught their attention; this was to situate the experience in a natural sequence. Once they entered Beta\_space their interactions were captured on video. For privacy reasons we did not allow the general public to enter while the camera was recording. This meant that, apart from the person operating the camera, participants were alone in the space while data was being collected. The camera was positioned so that it captured their full body, the screen and the two signs in the exhibit space. The participants each spent between 4-10 minutes interacting with the exhibit and left when they decided they had had enough.

For the next stage of data collection participants were taken into a private room nearby. The video footage of their interaction was replayed to them on a computer screen and they were asked to report retrospectively on what they had been thinking whilst they were interacting. A video camera recorded both the image as it played on the computer and their verbal report enabling us to accurately match their comments with their interactions. Participants were shown how to control the playback of their interaction video and some paused playback when they had a lot to report. Participants were asked to try to recall only what they were thinking at the time and to refrain from making evaluations. Although there was a researcher present in the room they sat out of sight of the participant during the reporting phase. This meant that the participants directed their attention during their reports at the computer screen and spoke to the screen not to the researcher. There was approximately an 8-12 minute gap between the participants experiencing the exhibit and then giving their verbal reports.

After each participant had completed his or her retrospective report we conducted a brief informal interview. Participants were asked if they had any opinions they wished to express about the exhibit and, depending on their answers, some further questions were asked. Finally, participants were asked if they had any comments about the retrospective reporting method. The whole data collection process took around 45 minutes per participant.

#### 3.4 Data Analysis

Analysis began with the transcription of verbal data and the creation of movement charts for each interaction video. We then

began the process of analysis by categorizing or coding the events within the video and verbal data using the qualitative analysis software HyperResearch. This software allowed us to code with the original video and audio as well the verbal transcripts thus maintaining the full expressiveness of the data (Figure 3).

In areas where a significant amount of prior research has been done researchers will often begin analysis by applying already developed coding schemas [3, 4]. However, there were no well-developed coding schemas available for the analysis of interactive art experience or analogous situations. We decided not to begin our coding at the macro level of Fels' four embodiment categories out of a concern that this would blind us to the intricacies within each experience.



**Figure 3. Data analysis in HyperResearch software**

The first coding session, therefore, involved the whole research team viewing one of the retrospective reports and together developing a suite of codes. In keeping with Suchman's approach to coding, wherever possible, we used the actual terminology of the participants when naming codes [17]. Team members were then each assigned one of the other two reports and coded these individually using the codes we had developed and developing new codes if the situation arose.

A second team meeting discussed the coding of all three reports and revised the coding system. We then mapped the 27 codes looking for relationships, patterns and the order in which particular codes occurred in each experience. This resulted in the division of the codes into two groupings, Movements and Cognitive States. The Cognitive States group was then further divided into four master codes (Figure 4).

Master Codes	Sub-codes
<b>Assessing System</b>	Reading text Working out how to work it Realisation Identify limitation Completed interactive possibilities
<b>Refer to Self</b>	Identity reference Comments re seeing self

<b>Response</b>	Positive response Negative response
<b>Described Behaviour</b>	Play Goal or aim Feel in control Decide to leave Wondering or questioning Mesmerised

**Figure 4. The Cognitive States coding group**

The final stage of analysis involved grouping the coded data based on Fels' four categories of embodiment. We looked for ways in which our coded data either confirmed or contradicted Fels' categories, and the ways in which our findings from the second stage of analysis could elucidate the categories and their relationship to the experience of the participants.

### 3.5 Reliability of Method

In order to test the reliability of our method we began our study by conducting observations of the general public within Beta\_space. Compared to our general observations of people interacting with Iamascope we did identify some changes in participants' behaviour that were attributable to them being under study. The participants stayed longer, did more and were more careful that they had activated all the aspects of the artwork, that they hadn't "missed" anything. In some ways you could see these experiences as "ideal", with a level of focus that artists hope all visitors will bring to their work. While some participants did feel that the presence of the video camera possibly influenced their behaviour, "I tried not to let it inhibit me, but I'm sure it probably did to some extent"; others indicated that they became so immersed in the work that they forgot the camera was there, "it would come in and out of my consciousness, but it didn't really worry me". There were some behavioural changes that also resulted from our decision to test participants alone. This was in spite of our observation that many visitors experience the artwork with others. While this decision allowed us to concentrate on the exchange between artwork and participant, it did mean that participants were unable to learn through observation of others. Most other aspects of participant's behaviour, however, did match our general observations so these changes were not seen as overly influencing the results.

All participants agreed that the video record helped them to recall their experience with one participant saying that it "plugs you straight back in". None expressed any discomfort at talking about their experiences; in fact all said that it was easy for them. It appears that, as anticipated, watching videos of their actions prompts participants to remember their experience in great detail and leads them to be accountable to their actual lived experience, particularly in terms of the sequence of thoughts and feelings, and their duration. Rather than guessing what certain movements may imply the subject is doing, thinking or feeling, we have the dual source of their own account of the aim, or meaning of those movements. One of the strengths of the method is that it gives researchers these two sources of evidence to work from. It should be noted, however, that the subject's account, though based on a degree of personal insight beyond that of the investigator, is still

an interpretation, as the account and the movements do not take place simultaneously.

## 4. RESULTS

The video-cued recall and code based analysis techniques allowed us to unpack the detail of Fel's categories of embodiment and to more clearly understand the ways in which they operate. We identified a number of different classes of movement, vocabulary and behaviour which could be associated with each stage, such as exploratory movement as opposed to fine and detailed movement, or "wondering" vocabulary as opposed to goal oriented vocabulary. We noted particularly significant moments that marked the transition from one stage to another, such as seeing one's face, and identified the kind of pattern of engagement that might lead to the most elusive stage of embodiment: belonging.

The results outlined below are divided into four sections, one for each of Fels' categories of embodiment; response, control, contemplation and belonging.

### 4.1 Response

For Fels the pleasure of the interactor experiencing this stage is based on their expectations being met by the response of the system. In interaction design terms this could be described as feedback. How does the subject know that what they are doing is the "right" thing, how can they tell what the system understands?

For all three participants this process began with reading text. While few of the participants had clear memories of the text, they all indicated that they were reading it to try to understand what the artwork was about. After reading the text, all of the participants approached the artwork with three key expectations: that what they do will affect it, that it is a kind of kaleidoscope and that there is a camera somewhere.

#### 4.1.1 How to work it

As they approach the work, having read the text, all know in theory how the system works – but none know "How to work it". All three go through a series of very similar activities that exemplify a phase of testing the broad parameters of the system.

This phase is characterised by two classes of movement: walking forwards and backwards until the screen goes black large movements of legs and arms often from side to side. Both these movements are primarily about participants trying to discover the limits of the field of action.

In this testing phase causing the screen to go black provided clear feedback about the limits of the camera's range of view and typically participants paused once this happened before changing the direction of their movement.

This phase is also characterised by a frequency of question words such as "how" and "wonder" and by indications that the participants are testing the system's responses.

*"[I'm] thinking...how's my body position changing what I'm looking at? So I'm walking right up to the screen thinking; I wonder how this changes it?" (subject B)*

*"[I'm] just trying to gauge what space or the parameters of it were, how my movements would affect the picture" (subject A)*

#### 4.1.2 Seeing your face / Realisation

A key transitional moment in this initial testing phase was marked in all cases by the participant seeing their face:

*"And then I see my face actually merge on the screen and I think; oh yeah okay now I can see how changing my body position and doing things with my body might actually influence the way the kaleidoscope works" (subject B)*

*"I couldn't quite work out where the camera was - where I was in relation to the camera, and then I couldn't see my face or anything recognisable at first, until I started to step back and then I saw my face and I realised that it was above me." (subject C)*

The participant's recognition of their face elicits a realisation of the perceived relationship between the self and the system. A connection is established in which the potential of the system is understood in an embodied way.

Seeing the face rather than any other part of the body may be significant because the face within the kaleidoscope is recognisable in a way that other body parts are not. While other parts of the body may be recognised by colour of clothing, the nature of the image makes it very unclear what the body's orientation is and what the difference is between legs and arms, or between right and left limbs. For all the participants seeing their face marked the moment that dis-ambiguated the relationship of the body to the image in terms of orientation. As Gibson points out [11], visual perception is manifestly tied to the physical body; seeing the face and the eyes, therefore, situates the rest of the mobile body and connects what we can see with how we see it.

Interestingly, in the case of subject C the realisation of the nature of the connection between self and work is actually incorrect; the camera is not above her. However she continues on to the next stage of exploration in much the same way as the other subjects and her ongoing experience of the work is not limited by her misinterpretation. This suggests that it is not actually correctly understanding how the system works that is key for the experience of this stage, but how it is perceived to work. Although subject C did not understand *how it worked*, she understood *how to work it*.

### 4.2 Control

Once the connection between self and work is established by the moment of facial recognition all subjects moved on from the earlier exploratory state to a new state of more confident and "expert" exploration. We identified this state as falling within Fels' relation of control. In this relation, control of the device itself, rather than its response provides a positive emotional experience. This state is characterised by two particular kinds of movement – one was coded as "purposeful movement" and one as "fine and detailed movement".

#### 4.2.1 Purposeful movement

Purposeful movements have a different quality to them than the exploratory large limb movements of the earlier stage. Whereas the exploratory movements are guarded and experimental, the purposeful movements have a degree of commitment and confidence to them, indicating that the subject has expectations about the response these movements will produce.

*"I felt quite free to just zoom around it. I am trying to see how I can...how speed affected it I think there. Using my body in different ways too." (subject A)*

#### 4.2.2. Fine and detailed movement

Fine and detailed movements were also associated with increased confidence but were additionally associated with a satisfying level of creative control. All of the participants went through a phase where they intently played with the relationship between small movements of their body and limbs and the images created on the screen.

*"I was more focusing on the visual effects, how I think it was like a flower and just little subtle changes and subtle movements." (subject A)*

*"I liked the way it sort of exploded with images after going very small and almost disappearing and how [...] you could kind of sculpt it if you worked on it... the more you interacted with it and realised how it responded, the more you could actually consciously influence the design that you were making." (subject B)*

*"I was just playing around with different shapes that I could make. I liked the [...] little details that I could add into the kaleidoscope" (subject C)*

It is clear from their comments that, as Fels suggests, the participants were deriving a lot of pleasure from the control they had over the image. Overall, the control state elicited far more positive responses than the response state.

#### 4.2.3 Goals and aims

What can also be identified here is the participants making numerous references to aims or goals, signaled by phrases like "I'm trying...", "I was focusing...", "I tested how...". These phrases are used in relation to trying to see the effect of aspects such as speed or subtle movement, trying to make different kinds of images and trying to get particular body parts to appear on the screen. The noticeable difference between these goals and aims and the expressed intentions we noted in the earlier state is that in the response state people's "wondering" is focused on the system's behaviour, e.g. what will it do, if I do this? In the control state participants have a hypothesis, or expectation and are very focused on their own behaviour and intentions.

### 4.3 Contemplation

Fels describes this state as encompassing the participant's reflection upon the meaning communicated by the artwork and as dependent upon their personal experience. The participant's reports included a quite a lot of contemplative thinking, manifested in fragmentary comments – like thoughts passing through one's head rather than considered opinions. These comments were often contemplations about the participants themselves that were born out of their encounter with the system.

*"[I'm thinking] about my son enjoying it...coming back later on and the different kinds of flowers I thought it was like ... and also my favourite colours are blue and green and that I happen to be wearing them...."(subject A)*

*"I was thinking oh this is quite cool and ... at this point I was thinking - because I do a lot of choreography and I was thinking oh this is a really interesting way to choreograph." (subject C)*

Being able to tie these contemplations to specific moments of the participant's interactive experience was also very revealing. Such comments seemed to occur during sections where participants were highly engaged and having strong positive responses to the work. This suggests that high engagement encourages contemplation and also suggests that an interaction becomes meaningful through participants reflecting about aspects of their life experience.

### 4.4 Belonging

The belonging state, where the participant feels as though the work is controlling them, was one that we did not expect to uncover. Fels felt that it was the most difficult state to achieve. It was also a state that was, unlike response or control, not possible to deduce from observation. One participant, however, explicitly described an experience that ties in with this stage:

*"I noticed a few times how mesmerizing [it is], you get lost a bit in there so you are not as conscious of what you are physically doing. Taking the lead I guess a bit from the screen" (subject A)*

This participant may have been the only to reach the stage of belonging because she spent by far the longest time with the work, which suggests a high level of engagement, interest and pleasure. Secondly, she also spent less time in the response state and more in the control state.

Other differences between subject A and subject's C's experiences support Fels' opinion that the abstract nature of the images encourages belonging. Subject C, who did not experience this state, avoided abstract images and focused on reflecting recognizable aspects of herself.

*"when I could see my face, or my fingers or something that was recognisable as a part of my body I was most interested in it. When it was just kind of like bits of colour or shape, it could have been anything so I wasn't so intrigued. I think that's why I kept trying to get little recognisable parts of my body onto the screen."(subject C)*

Subject A, who did experience belonging, seemed less attached to seeing parts of herself on screen and more attached to making sense of the overall shape of the images. She describes the images as being like flowers and as reminding her of water droplets. When she does mention her reflection its disembodied nature seems to make her uncomfortable.

*"I thought that looked like my legs opening and closing but in fact it was yes my arms... it was a little bit obscene for a second."(subject A)*

As Fels suggests, it is perhaps this lack of connection to her reflection that allows her to feel controlled by the work.

## 5. THE TRAJECTORY OF INTERACTION

Although all three participants clearly had their own unique experience of the artwork our analysis showed that there were common elements, which could be seen to occur in a similar order in each individual encounter. These included significant moments of realization and transition which defined the unfolding shape of the experience.

This suggested to us that we could describe a blueprint of what we call "The Trajectory of Interaction" for the experience of

Iamascope. This is a basic pattern which recurs, with variation and embellishment, in each experience of the work, it reflects not only the 4 states of embodiment described by Fels, but also the interrelation between those states, the progression and regression from one to another and the key moments that mark transitions between states.

Each experience started with the response state, with participants focused on trying to work out how to 'work' the system. The key moment when all recognised their face marked an end to this initial exploration and a transition for all participants into the control state. This shift can be likened to what play theorists describe as a shift between investigative exploration (what can the object do?) and diverse exploration (what can I do with the object?) [13]. Indeed all seemed to play with the diverse possibilities of the system thereafter.

There was a continuing connection between the response and control states. When participants became bored with the current possibilities of the system as they understood it, they would return to the response state to discover new ones. The control state, then, is always generated from response, but participants may switch back and forth between the two throughout an interaction.

The state of control forms the major part of the experience that drives the most intense periods of the interaction. It is a pivotal state out of which emerges the further states of contemplation and, occasionally, belonging neither of which are directly linked to the response stage in any of the cases. In the one case where belonging occurred the participant's description of this state suggests that belonging is something one drifts in and out of and that it occurs simultaneously with control

An aspect of the embodiment continuum not described by Fels but noticeable to us was the stage we termed disengagement. This stage encompasses the patterns of behaviour that occur around the participant's decision to leave the exhibit. In all cases participants ended their interaction experience in the control state. While this decision seemed to happen quite quickly, with all dropping their arms by their sides and turning away almost simultaneously, a close analysis of their movements revealed that they all repeated a previous action sequence just before this occurred. The actions they repeated were ones they had performed during their most intense control state period. This seems consistent with their expressed feelings at this point that they had "*exhausted the possibilities*".

The identification of the trajectory operating in Iamascope raises the question of whether such a pattern could be identified in other interactive artworks and, if so, how similar are these patterns to one another?

## 6. CONCLUSION

Our analysis confirms many of artist Sidney Fels' observations about the experience of his interactive artwork Iamascope. The four states of response, control, contemplation and belonging were all seen to occur during participants' experience of the artwork. Our analysis was able to flesh out the operation of these states and to make some tentative suggestions about their interrelationships across the trajectory of user experience.

Our results also show that the video-cued recall method is very useful for understanding the situated experience of interactive art.

The method definitely helps people remember how they made sense of what they were doing, and therefore helps us understand how meaning is generated in situated experience.

Both of these findings suggest some exciting directions for future work. CCS researchers will continue to develop the video-cued recall method within the situated context of Beta\_space, testing the method on artworks that are not as developed as Iamascope and also testing whether the method is equally effective for interactions that are not movement based. Our future research will additionally be directed towards developing a more solid understanding of the trajectory of user experience. It will be interesting to see whether Fels' four states can be observed operating within other interactive art experiences and whether our observations about the trajectory of interaction are true for all artworks.

## 7. REFERENCES

- [1] Amitani, S. and Hori, K. Supporting Musical Composition by Externalizing the Composer's Mental Space. *Journal of Information Processing Society of Japan*, 42 (10). 2369-2378.
- [2] Bentley, T., Johnston, L. and von Baggo, K., Affect: Physiological Responses During Computer Use. in *OzCHI2003: New directions in interaction, information environments, media and technology*, (Brisbane, Australia, 2003), CHISIG, 174-182.
- [3] Britton, J.H., Candy, L. and Edmonds, E.A. (1998) Software Support for Usability Measurement: An Application to Systems Engineering Data Exchange Development. *Proceedings of HCI'98, People and Computers XIII*. H. Johnson, L. Nigay, C. Roast. (eds). Springer-Verlag Berlin, pp 37-52.
- [4] Candy, L., Bilda, Z., Maher, M.L. and Gero, J.S. (2004) Evaluating Software Support for Video Data Capture and Analysis in Collaborative Design Studies in *QualIT04 (Qualitative Research in IT and IT in Qualitative Research) Conference*, 24-26 November, Brisbane, Australia (CD Rom - no page numbers).
- [5] Christiansen, U. and Mark, G. Different Facets of Mobility in Collaboration: An Empirical Study of an Event Production Company, 2004.
- [6] Cornock, S. and Edmonds, E. The Creative Process where the Artist is Amplified or Superseded by the Computer. *Leonardo*, 6. 11-16.
- [7] Ericsson, A. and Simon, H. *Protocol Analysis: Verbal Reports as Data*. MIT Press, Cambridge, MA, 1993.
- [8] Fels, S., Intimacy and Embodiment: Implications for Art and Technology. in *ACM Multimedia Workshops*, (Los Angeles, CA, USA, 2000), ACM, 13-16.
- [9] Fels, S. and Mase, K. Iamascope: a graphical musical instrument. *Computers & Graphics*, 23 (2). 277-286.
- [10] Fels, S. and Mase, K., Intimacy as an Index for Understanding Human-Computer Interaction. in *Proceedings of the Workshop on Interactive System and Software*, (Kashikojima, Japan, 1997), 211.

- [11] Gibson, J.J. The ecological approach to visual perception. Houghton Mifflin, London, 1979.
- [12] Hook, K., Sengers, P. and Andersson, G., Sense and Sensibility: Evaluation and Interactive Art. in CHI: Conference on Human Factors in Computing Systems, (Ft. Lauderdale, Florida, USA, 2003), ACM, 241-248.
- [13] Hutt, C. Exploration and Play in Children. in Sutton Smith, B. and Herron, R.E. eds. Child's Play, Robert E. Krieger Pub Co, Florida, 1985, 231-250.
- [14] Omodei, M., Wearing, A.J. and McLennan, Head-Mounted Video and Cued Recall: A Minimally Reactive Methodology for Understanding, Detecting and Preventing Error in the Control of Complex Systems. in 21st European Annual Conference of Human Decision Making and Control, (Glasgow, 2002), Department of Computer Science, University of Glasgow, Scotland.
- [15] Robertson, T., Mansfield, T., Loke, L. (2005). "Tools to Think With" - Critical Engagements in the Design of an Immersive Environment for Public Use (Forthcoming).
- [16] Suchman, L.A. Plans and Situated Actions--The problem of human machine communication. Cambridge University Press, Cambridge, MA, 1987.
- [17] Suchman, L.A. and Trigg, R.H. Understanding Practice: Video as a Medium for Reflection and Design. in Greenbaum, J. and Kyng, M. eds. Design at Work: Cooperative Design of computer Systems, Lawrence Erlbaum Associates, Hillsdale, New Jersey, 1991, 65-89.
- [18] Suwa, M., Purcell, T. and Gero, J. Macroscopic analysis of design processes based on a scheme for coding designers' cognitive actions. Design Studies, 19 (4). 455-483.
- [19] vom Lehn, D., Heath, C., Hindmarsh, J. (2001). "Exhibiting Interaction: Conduct and Collaboration in Museums and Galleries." Symbolic Interaction 24(2): 189-216.