# Resolving Assumptions in Art-Technology Collaboration as a Means of Extending Shared Understanding

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**Abstract.** This paper extends the knowledge and understanding of art-technology collaboration. It reports upon a close empirical study of how computer programmers interacted with a digital artist to develop a computer-based interactive artwork. Analysis of the data collected showed that the joint uncovering and resolving of assumptions made by each party led to increased shared understanding. The contribution of this paper is to provide a better understanding of creative collaboration, particularly focusing on how developing the artefact increased the understanding between the artist and technologists.

**Keywords:** Art-technology collaboration, computer-based interactive artwork, case study.

## 1 Introduction

In art-technology collaboration, as in other multidisciplinary projects, it can be very hard to develop shared understanding (Candy & Edmonds 2002) (Zhang & Candy 2006a) (Zhang & Candy 2006b). In such projects, the two parties typically have only limited experience of one another's domain. In addition, the artist typically starts the project with an ill-defined vision of what they would like to create. The translation of this vision into programmatic code by the technologists is a very important activity. Problems may arise because it may be very difficult for the programmer to grasp or relate to the artist's vision. Similarly, the artist typically does not understand the intricacies of the code involved.

Shared understanding comes about where two people's spheres of experience overlap to some degree. In terms of the nature of the shared understanding, there is a very important concept; the 'boundary object' (Star 1989). Boundary objects are defined as concepts or ideas that exist in this shared space and which have the same meaning to each party (Wenger 1998). Fischer et al (2005) pointed out that boundary objects allow different knowledge systems to interact by providing a shared reference

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that is meaningful within both systems and they serve to communicate and coordinate the perspectives of various constituencies communicate.

Following Fischer, this research aims to examine the process where the shared understanding between artists and technologists accumulates during the collaboration and also understand further how boundary objects shared between artists and technologists affect the shared understanding in between. In order to achieve this, we conducted an in-depth case study of an art-technology project named the GEO narrative landscapes project.

In the next section, a brief background of the GEO project and how the study was carried out are provided.

## 2 Study Contexts

### 2.1 Background of the GEO Project

The GEO narrative landscapes project is the result of an art-technology collaboration led by the artist Chris Bowman. Phase one of the project was carried out from June to December in 2006 within a multi-disciplinary research team comprising an artist, two technologists, one graphic designer and one observer. All participants were co-located in the same city. The artist was the designer of the digital artefact and also the leader of the team. The designer mainly worked on the video sequences. The two technologists were in charge of different parts of the technical functions of the project: one was mainly working with the software application MAX/MSP (Cycling74 2001), the other was mainly working with the programming language Java (Java). The observer, who is also the first author of the paper, remained on site for five months observation. During the five months observation period, there were eighteen group meetings that were observed. The artist, the technologists and the observer attended 95% of the meetings and the designer attended 35% of the meetings.

The basic collaboration mode for this project was via group meetings. The duration of the group meetings was between thirty minutes and one hour based on on-site-demand and the frequency of the meetings was once a week. In addition to the weekly meeting, the remaining time was spent working individually or in person to person communication by email or telephone. The meeting location was in the Creativity and Cognition Studio (CCS) at the University of Technology, Sydney where a power Macintosh G5, a projector, and interactive floor pads were installed (see Fig. 1).

In this paper, we will give an overview of the system in practical terms, without going too deeply into its artistic aims. The system is an immersive environment where the user can explore a remote location seen through the eyes of other people. It is designed for installation in a museum location. The user interacts with the system by moving around in front of a wall-sized rear projection screen. Beneath the carpet, a six-by-six grid of pressure sensors detects where the users are standing. Displayed on the screen is video and text material relating to the remote location. Initially the user is presented with a 360 degree panorama of the site. As they move around the space, the panorama rotates and tilts up and down. As the interaction continues, the system enters another, deeper, mode of interaction where the user can choose from a number of locations around the panorama by stopping its rotation at the appropriate point. When a location is selected, the display transports to that location, where the user is presented with material specific to a particular person's experience of that location. This material is again video, text and sound.

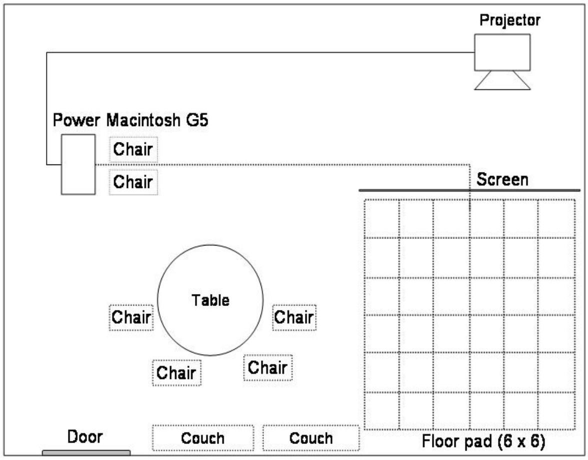


**Fig. 1.** Equipment layout of the Creativity and Cognition Studio

Within the GEO system, the user can explore the remote space, at several levels of interaction, and explore different people's views of particular aspects of the site. Three views of the GEO interface in a test laboratory are shown in Fig. 2. The final outcome of this work will be exhibited in April 2007 at Beta-space in the Sydney Powerhouse Museum. Beta-space is an exhibition space where the general public can engage with art outcomes of leading research in art and technology (Costello et al. 2005).

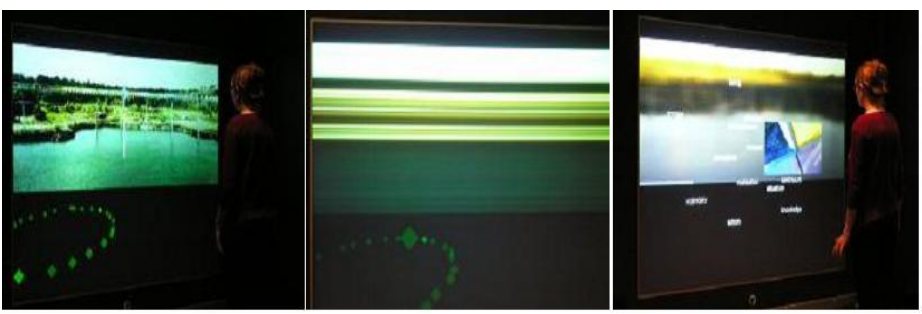

**Fig. 2.** Three views of the GEO artwork

During the project, team meetings were video-recorded and field notes were taken by the observer over a period of five-month collaboration. More detail about the data collection methods in this study could be found in the following section.

### 2.2 Study Approaches

The main data collection approach adopted in this research is a combination of non-participant observation and semi-structured interviews (Yin 2002) (Valerie 1998) (Denzin & Lincoln 1998). Non- participant observation is a method where researchers ‘stand to one side’ and view the experience or the environment (Slack & Rowley 2001). During the observation of this project, the observer used video facilities to record the meetings between participants over the five-month period from July 2006 to December 2006. In addition, field notes were taken for each meeting by the observer. As non-participant observation cannot provide cognitive information, such as attitudes, beliefs, motivation or perceptions (Slack & Rowley 2001), we overcame this by having the observer ask questions and conducting informal conversations with participants subsequent to the video observation. At the end of the five-month observation, a semi-structured interview was also conducted with each participant. In addition, emails between participants relating to the project were also included as part of the data collected in order to arrive at as detailed a picture of the collaboration as possible.

Within these collected data, we analyzed the video data of these observed meetings with the assistance of the analysis software application INTERACT (Mangold 2005). From the data, we have found that the protagonists clarified and improved understanding between one another using verbal communications, gestures and sketches drawn on paper or the whiteboard. In this paper, we specifically concentrate on how they used prototypes of the system under development to build up shared understanding between each other. In the next section, the detailed findings with specific examples extracted from the data are provided.

## 3 Findings

From the analysis of the empirical data within the GEO project, we found that the understanding between the artist and technologists improved when the technologists showed a working prototype to the artist and occasionally, these prototypes enlightened the artist's creative ideas. Furthermore, we also found that the technologists, both deliberately and non-deliberately, made assumptions about what the artist required. Acting on these assumptions, they produced prototype systems which they then demonstrated to the artist. The prototype systems did not always exactly embody what the artist had in mind. It was often in uncovering shortcomings in the prototypes that new understandings arose. At such times, assumptions made by the technologists were revealed. Similarly, the artist's assumptions about what could be achieved programmatically were exposed on review of the prototypes developed. In order to illustrate this process more closely, the following are some examples extracted from the data project where technologists built prototype systems based on the assumptions of the artist’ requirement.

*Example 1*
The GEO system is controlled by a person standing on the pressure pads in front of the screen. During the development of the project, one of the technologists raised the issue of how the system should behave if there were two people present in the room.

In a number of discussions, he suggested a range of alternative strategies to the artist. These were that the system should find some average position between the two (or more) people, and use that as the position of an imaginary person in the room, alternatively it was suggested that just the person nearest to some point in the room should control the system - other inputs would be ignored. The technologist suggested that, given the time limits imposed on the project, it would be too difficult to track a single user's interaction (or that of many users) with the system as other people came into or left the room.

The artist was reluctant to commit himself to either course without further investigation or thought and for this reason the technologist decided that the person nearest the entrance to the room should control the piece. In the museum setting where the piece was to be shown, this would be the person furthest from the screen and to the right. The rationale for this, on the part of the technologist, was that this would mean that the system would start to respond to a person as soon as they walked into the room, hopefully encouraging them to come in further.

However, in an evaluation carried out in the test laboratory, this choice of corner proved less than ideal. Some audience members were sitting at the back of the room and their feet activated floor pads there, preventing the person actually interacting with the system from being able to control it properly. From a technical point of view, then, a number of assumptions had been made in arriving at the architecture of the system under development. At this point in the project, a number of the decisions taken had to be reversed and the system architecture was redeveloped. Therefore, the assumptions made by the technologists and embedded in the prototypes systems did not achieve the way the artist requires and the development had to be redone.

*Example 2*

The GEO system presents to the user data (video, text and so on) which is location-specific. At the same time that the video was captured, a GPS track log was recorded about the spatial position of the camera person. The intention was that a visualisation of the track in space would be presented to the user at the same time as the video material to help them orientate themselves within the virtual space. In the storyboards, which are proposals the artist made specifically for how the system should behave in response to specific actions, the visualisation of the GPS data was designed to be achieved in three steps: reading the co-ordinates from the GPS data, scaling them appropriately and then drawing a line in a 3D space from each co-ordinate to the next.

As an experiment, and unprompted by the artist, one of the technologists rewrote the visualisation module so that it displayed points on the track as spheres in a three dimensional space. As the user's location in the virtual space passed over an individual sphere, its diameter was increased. The technologist here was assuming that, because this added additional functionality to the system, the artist would be pleased with this new representation. It would, of course, have been difficult to give an indication of the current location using just a single line representation.

At the next project meeting, the artist was shown the new representation at a relatively early stage of development: there were a few problems with the implementation still to be solved. The artist asked for a new representation, which was a development of the spheres display and not a return to the single line. This is an example of the technologist's assumption being accepted into the artist's view of the system and then developed further by him.

*Example 3*
In the early stages of the GEO project, the system was envisaged by the technologists as one that reacted to user input. The approach taken to the design was an attempt to create a system that exhibited certain behaviours. The aim was to develop a general system in which data about any site could be displayed, and that this display would be controlled by the behaviours built in to the system. The artist wanted a high degree of control over what material would be displayed by the system as well as over how this would be shown. It was at this point that it became clear that there had been an assumption made on the technological side that had influenced the work to date. One of the technologists described it as the artist wanting to be much more like a movie director than he had previously imagined. That is, the artist wanted to be in much closer control of the moment-by-moment audience experience.

Within each of the three examples above, an assumption was made by the technologist about what the artist either required or would like. In example 1 the technologist's assumption was deliberate. He knew that a decision had to be made on a particular point and assumed that his choice would be acceptable. In testing it turned out that the choice of orientation was not ideal for the test laboratory, but at the same time it became clear to all how the system was behaving. In uncovering a shortcoming in the system, the technologist's assumption was exposed, understood and open for further discussion. In example 2, aspects of the modification to the system, which the technologist assumed the artist would approve of, were adopted for use in the rest of the project. Here the technologist assumed largely correctly that he understood the artist's aims for the system and acted upon these assumptions. It was immediately clear to the artist, on sight of the prototype, what had been done and how it needed to be adjusted to bring it into line with the artistic requirements. In the third example, the artist did not realise that his storyboards would necessitate a change in the implementation of the system. Both parties, here, had made assumptions about the other's domain. Looking together at the storyboards helped them to uncover the assumptions and gave them something to refer to in subsequent discussions.

We suggest that during art-technology collaboration, the external representation of the artefact serves as a very important mediating tool to bridge the understanding between artists and technologists. By this exposing and clarification of assumptions, the shared understanding between artists and technologists was increased. We suggest that uncovering the assumptions caused the boundary zone of shared understanding to grow. In the next section, a mode built based on this finding is presented.

## 4 Model

As described in the previous section, the examples suggest that joint study of an artefact, either a software prototype or in one case a set of storyboards, helped the collaborators to discover and clarify assumptions they had made about one another's domains. Furthermore, in this study, we found that the knowledge, ideas and understanding that went into the creation of the programmatic artefacts come from the boundary object between artists and technologists combined with the assumed objects and programming knowledge of the technologist. Therefore, a model was developed, where we defined a space "assumed space", which extend the existing model of a boundary space containing boundary objects (Arias & Fischer 2000; Fischer et al. 2005)(Fig.4).

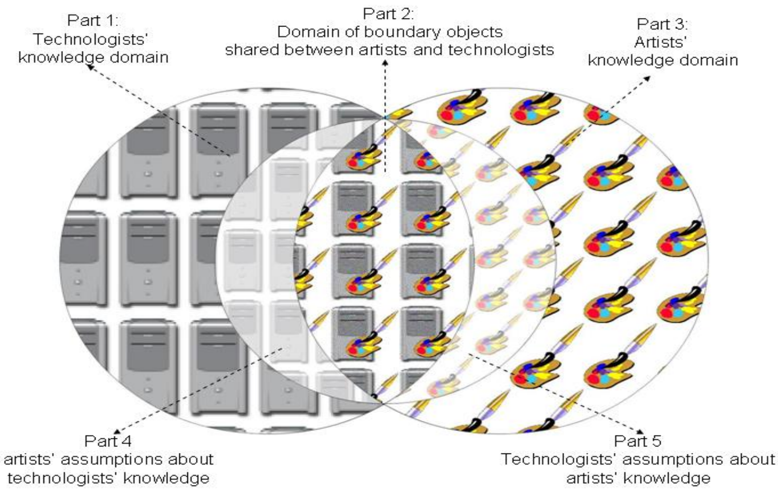


**Fig. 3.** Model of "assumed space" between artists and technologists

As we see from Fig. 3, boundary objects (part 2 in Fig 4.) allow both artists' and technologists' knowledge systems to interact with each other by providing a shared reference that is meaningful within both artists' and technologists' knowledge system. In contrast to the boundary objects, the assumed objects (part 4 and part 5 in Fig 4) are artist's and technologists' assumptions about one another's domains. They initially lie outside the boundary zone of shared understanding. In the GEO project the technologists occasionally built computer prototypes based on these assumed objects (Part 5 in Fig. 4). Similarly, artists occasionally expressed their artistic plans or requirement based on assumptions about the technical domain (Part 4 in Fig. 4)'.

When these assumptions were exposed both parties' understanding increased. Part of the assumed space therefore became included within the shared space. We suggest that this is one mechanism by which shared understanding can grow. Knowingly or unknowingly, one party makes an assumption about the other's domain. Some time later, perhaps when studying a prototype in which the assumption is embodied, the assumption and its shortcomings, if any, are revealed. Both parties then have a new, shared boundary object to which to refer in the future.

## 5 Conclusions and Future Work

In this paper, we presented a study based on an observation of a recent art-technology collaboration project. The outcome of this study is a model which extended the boundary object concept to cover part of the assumed space. The contribution of this study is that it has extended our knowledge of how shared understanding was developed during the art-technology collaboration. In the future, the model will be testified and validated further by applying more studies in the similar research contexts.

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