A Study of Interdisciplinary Collaboration in Art and Technology

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This paper describes a method based on protocol analysis to study interdisciplinary collaborative activities between an artist and a technologist. The data was collected during an artist-in-residency project COSTART (COmputer SupporT for ARTists). The aim of the research is to understand how artists and technologists communicate with each other during a collaborative process. The paper describes how the research was carried out and, in particular, how the data analysis was conducted using coding schemes developed specifically for this context. At the end of the paper, preliminary findings are presented and future works are indicated.

1. Introduction

The paper describes a method based on protocol analysis to study interdisciplinary collaborative activities between an artist and a technologist. The protocol data sample comes from an artist-in-residency project named COSTART, where audio-recording of artists and technologists' conversation and activities was carried out. It goes on to describe the coding framework for analysing the data, how the analysis was undertaken and the initial results.

2. Background

In order to encourage the transfer of ideas between different disciplines, there are artists-in-residency programmes funded by governments, private foundations and companies, such as PAIR at XeroxPARC (Harris 1999), SCIART funded by Wellcome Trust (Wellcome 1997-) and SYNAPSE funded by Australian Research Council (Synapse 1999-). One of the common goals of these programmes is to have a strategy in place that encourages creativity across the whole spectrum of collaboration. As those residency projects continue to be an emerging area for research, it is important to have a close look at how artists pursue the creative process with the assistance of technologists. In a recent case study about the artist Olafur Eliasson, the artistic process is described as follows:

> "It is not a linear act of following a clearly stated and imagined path, but something quite different. It is a process that is aware of its path being constantly made and shaped during the journey in question." (Hannula, Suoranta & Vaden 2005, p. 130)

Furthermore, research has shown that one of the disadvantages of art science collaboration is that discussions of technical details need to remain at a superficial level and that additional interaction is required in order to further clarify expectations and requirements (Steinheider & Legrady 2004). As Mumford explains, an interdisciplinary team achieves a creative project in particular way:

> "In an effort to successfully realize a creative installation, all team members involved have to define problems, gather information and then progressively refine and extend initial ideas toward successful implementation." (Mumford et al. 2002)

Following Mumford, this research will aim to understand how artists' creative ideas are shaped, refined and implemented during the collaboration with technologists through communication interventions. In order to achieve this, we conducted a protocol analysis of a data sample selected from an artist-in-residency project. In the next section, we are going to give a brief description of what kind of data was used and how we have applied protocol analysis to the data.

3. Analysis framework

3.1 Case study data

As mentioned previously, the protocol data analysed in this paper comes from the COSTART project, (COmputer SySTems for Creative Work: An Investigation of ARt and Technology Collaboration) (COSTART 2002), which carried out research into creativity between artists and technologists, bringing experts together in Human Computer Interaction, Creative Media and Digital Art Practice. A full account of the COSTART project may be found in Candy and Edmonds (2002a) and Edmonds et al (2005). There were many types of data sources, which includes field notes, residency diaries, audio and video recordings of collaboration (Candy & Edmonds 2002b). The data sample analysed in this paper, which was selected from one of the cases of COSTART project, consists of two audiotape recordings (one is 18 minutes and the other is 21 minutes) taken by an observer involved in that case.

The case study is about an artist and a technologist who collaborated in the development of a 3D computer model based upon an existing physical model. During the residency, the artist' goal was to model a physical object by using a software- application called 3D Studio Max

(Autodesk). The artist A had a great deal of experience in the digital art but she was not familiar with the 3D Studio Max software. The technologist T had advanced expertise in the 3D Studio Max software but he had a limited knowledge of art practice. The observer O was himself an experienced digital artist who had worked in art-technology collaboration for years.

3.2 Coding schemes

As mentioned previously, the method applied in this research is protocol analysis based on empirical data. Protocol analysis is a rigorous methodology based on observation and analysis of professional work for eliciting verbal reports of thought sequences as a valid source of data on thinking (Ericsson & Crutcher 1991). Protocol analysis has been broadly applied in cognitive science research (Neill, Gero & Warren 1998) (Suwa, Purcell & Gero 1998) and collaboration research (Cross, Christiaans & Dorst 1996). For most projects, protocol analysis makes use of categories of fundamental knowledge such as concepts, attributes, values, tasks and relationships. A coding scheme is a group of these categories, which reflect researchers' interests focusing on particular aspects relevant by researchers' questions (Suwa, Purcell & Gero 1998).

There are two coding schemes involved in this research. The first coding scheme is focused on categorization of communication behaviours in the creative process (see table 1). These types of behaviours come from Olson's activity categories originally, where they were used to analyze the interactions of a group of experienced software designers during the design meeting (Olson et al. 1992) (Olson et al. 1996). These categories also have been broadly applied and refined by others in similar research contexts (Herbsleb et al. 1995) (Robillard et al. 1998). The list of communication behaviours in the coding scheme described in table 1 are found to be most relevant in the context of art-technology collaboration. The more detailed descriptions could be seen in Table 1.

Table 1: Communication behaviours code scheme

Code	Abrv	Definition
Request	REQ	Requiring a precise behaviour from another participant.
Evaluation	EVA	Judging the value of a subject. This evaluation can either be negative, positive or neutral.
Rejection	REJ	Discarding a subject as being invalid.
Acceptation	ACC	Considering a subject as being valid.
Justification	JUS	Arguing or explaining the rationale of a certain choice. It is often necessary to answer evaluations with a justification of the approach taken.
Clarification	CLAR	Questions or answers someone asked or seemed to misunderstand
Suggestion	SUG	Recommend a solution.

Hypothesis	HYP	Expressing a personal representation of a subject. such as "I believe that...", "I think..." or "...maybe...".

The second coding scheme is shown in table 2. In this coding scheme, according to the diversity of the discussions between artists and technologists, there are three categorizations: artistic parts of the project, technological part of the project and digressional part of the project. Similarly, according to the relationship between artists and technologists, there are three categorizations: art-led, technology-led and equal partnership. The definition in detail could be seen in the Table 2.

Table 2: Content and leadership coding scheme

Code	Abrv	Definition
Artistic parts of the project	Ap	The artistic part of the project could be the aesthetic issues of the project, such as the colour of the light, the movement of the objects
Technological parts of the project	Tp	The technical part of the project could be how artists' ideas could be realized in the software environment
Non-artistic part or non-technological part	Op	Discussions about side topics, which are neither artistic part of the project nor technical part of the project
Artist leading the project	Al	Artists dominate the collaboration
Technologist leading the project	Tl	Technologists dominate the collaboration
Equal leading the project	El	Artists and technologists equally dominate the collaboration

The coding segment for the first code scheme is based on utterances made by a single speaker at one time, which could be very short like "yes" or "no", or last for several minutes. The coding segment for the second coding scheme is slightly different, which is based on a sequence, which is a series of utterances made interactively by several speakers. A sequence is defined by the link between the contexts of each utterance. Each sequence could contain two to several utterances.

The following figure 1 shows a sample of a coded segment. The first column of this figure shows the speaker of each utterance. The second column displays a unique ID of each utterance. The fourth column shows the codes for each utterance based on the first code scheme. The last column shows the series of sequences and what the codes are for each sequence based on the second coding scheme.

Speaker	ID	Transcriptions	Code	
A	72	There's quite a lot of difference in the texture. Do you know what I mean, from here.	JUS, CLAR	
T	73	One of the reasons for that is you're using such a contrasting background. You would feel it's too big. You can't see the definition. And also secondly there are no lights on it. I can add some lighting, it should do...	JUS, HYPO	Sequence 8 (Ap, El)
A	74	The quality of that would be quite nice for other things because I think that translucent quality...	EVA	
T	75	If the object is there, where do you want the object to be lit?	CLAR	
A	76	Somewhere so that it's dramatic lighting.	JUS	
T	77	What's the effect you are trying to achieve. What's the mood you're trying to achieve?	CLAR	Sequence 9 (Ap, Al)
A	78	So that it's hanging in space. It's slightly flat, it's really trying to force that interpretation.	JUS	

Figure 1: A sample of coded segment

In the next section, we are going to present and discuss the preliminary findings drawn from this analysis process.

4. Preliminary findings

In this section, we are going to talk about some preliminary findings drawn from the analysis process where these two coding schemes described in section 3.2 are applied to the data samples described from section 3.1.

The following figure 2 presents the distribution of the artist's communication behaviours under four different circumstances. From figure 2, we can see that the top three communication behaviours the artist conducted most are clarification, hypothesis and acceptation. The percentage of clarification behaviour is increased dramatically when the circumstance is related with technological-part sequences or technologist-led sequences. This led us to suppose that under these two circumstances, the artist was easier to get confused and by solving that, the artist was keener to ask questions.

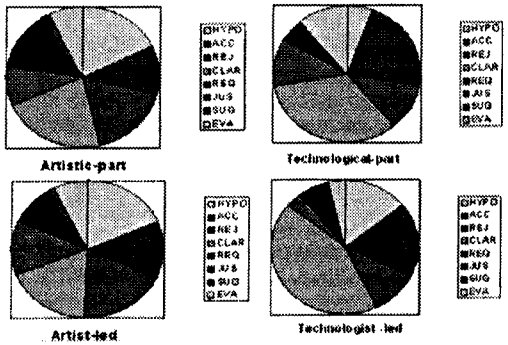

Figure 2: Distribution of the artist's communication behaviours under four circumstances

Comparatively, the following figure 3 presents the distribution of the technologist's communication behaviours under four different circumstances. From figure 3, we can see that the top three communication behaviours the technologist had are clarification, acceptation and justification. The percentage of clarification and justification behaviours in artistic-part and artist-led circumstance is almost doubled than in technological-part and technologist-led circumstance. We can see that the technologist took much more time to ask questions, clarify what the artist means, present and explain those issues in his own words under the circumstances of artistic-part or artist-lead than under the circumstance of technological-part or technologist-lead.

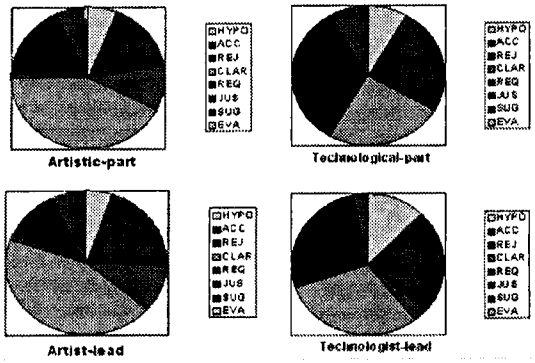

Figure 3: distribution of the technologist's communication behaviours under four circumstances

As the above discussions show the interesting features of communication behaviours of the artist and the technologist separately, it leads us to ask a further question: what are the comparative results between the artist and the technologist? For instance, did the technologist have more clarification behaviours than the artist? If yes, will it be different across circumstances? In order to answer these questions, we made an overall comparison between the artist and the technologist' communication behaviours under each circumstance (see the following figure 4).

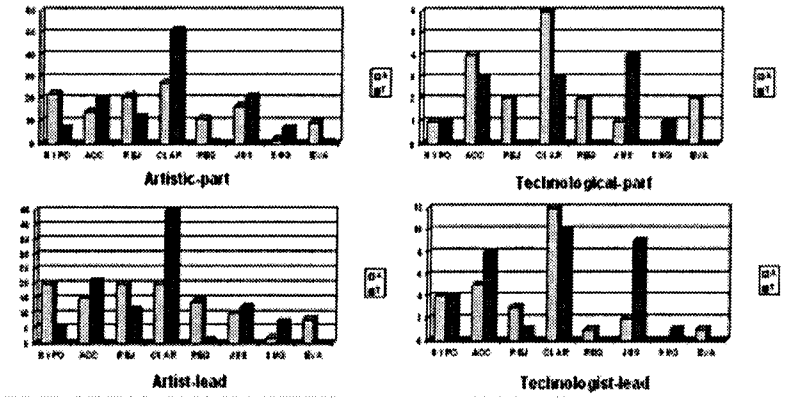

Figure 4: Comparisons between the artist' and the technologist' communication behaviours under four circumstances.

From figure 4, we can see that there exist two patterns between these four circumstances:

- The artist had more hypothesis, rejection and evaluation behaviours than the technologist had.
- The technologist had more suggestion and justification behaviours than the artist had.

Moreover, we can also see that the artist had more clarification behaviours than the technologist under artistic-part circumstance and artist-lead circumstance; however, the technologist had more clarification behaviours than the artist under technological-part circumstance and the technologist-lead circumstance.

Therefore, the preliminary results reveal that what the artist's and the technologist's the most popular communication behaviours and the least popular communication behaviours are during this protocol. It also points out that the participants' communication behaviours under

artistic-part sequences are quite different from those under technological-part sequences. All these findings contribute to provide a better understanding about the complicated phenomena: how the artist pursued the creation of a digital artefact with a technologist' assistance through communication.

5. Conclusion and future work

The study presented in this paper aimed to understand how artists communicate with technologists during the process of collaboration by conducting a protocol analysis study on a data sample selected from an artist-in-residency project. The analysis process was conducted under two coding schemes: one is generally applied in analysing communication behaviours during the creative process and the other one is specifically designed for art-technology collaboration. The findings described in this paper show that the differences and similarities between the artist's and the technologist's communication behaviours under different circumstances. These findings will be investigated further when more data from COSTART project is applied with this analysis framework. Moreover, new data about collaborative work in art and technology will be also collected and analysed under similar conditions.

References

Autodesk, *3D Max*, viewed Nov 2006 <http://usa.autodesk.com/adsk/servlet/index?id=5659302&siteID=123112>.

Candy, L. & Edmonds, E.A. 2002a, *Explorations in Art and Technology*, Springer-Verlag, London.

Candy, L. & Edmonds, E.A. 2002b, 'Modeling Co-Creativity in Art and Technology', *Proceedings of the Fourth International Conference on Creativity and Cognition*, eds T. Hewett & T. Kavanagh, ACM press, New York, pp. pp 134-141.

COSTART 2002, viewed Oct. 2006 <http://research.it.uts.edu.au/creative/COSTART/>.

Cross, N., Christiaans, H. & Dorst, K. 1996, *Analysing design activity*, Wiley, Chichester.

Edmonds, E.A., Candy, L., Fell, M., Pauletto, S. & Weakley, A. 2005, 'The Studio as Laboratory: Combining Creative Practice and Digital Technology Research', *International Journal of Man-Machine Studies, Special Issue on Creativity and Computational Support*, vol. 63, no. 4, pp 452-481.

Ericsson, K.A. & Crutcher, R.J. 1991 'Introspection and verbal reports on cognitive processes - two approaches to the study of thought processes: A response to Howe', *New Ideas in Psychology*, vol. 9, pp 57-71.

Hannula, M., Suoranta, J. & Vaden, T. 2005, *Artistic Research- theories, methods and practices*, Academy of Fine Arts, Helsinki, Finland.

Harris, C. 1999, *Art and innovation : the Xerox PARC artist-in-residence program*, MIT Press, Cambridge, Mass.

Herbsleb, J.D., Klein, H., Olson, G.M., Brunner, H., Olson, J.S., Harding, J. & Consulting, H. 1995, 'Object-Oriented Analysis and Design in Software Project Teams', *Human-Computer Interaction*, vol. 10, no. 2&3, pp 249- 292.

Mumford, M.D., Scott, G.M., Gaddis, B. & Strange, J.M. 2002, 'Leading creative people: Orchestrating expertise and relationships', *The Leadership Quarterly* vol. 13, pp 705–750.

Neill, T.M., Gero, J.S. & Warren, J. 1998, 'Understanding Conceptual Electronic Design Using Protocol Analysis', *Research in Engineering Design*, vol. 10, pp 129-140.

Olson, G.M., Olson, J.S., Carter, M.R. & Storrosten, M. 1992, 'Small Group Design Meeting: An Analysis of Collaboration', *Human-Computer Interaction*, vol. 7, pp 347-374.

Olson, G.M., Olson, J.S., Storrotsen, M., Carter, M., Herbsleb, J. & Rueter, H. 1996, *The structure of activity during design meetings*, Lawrence Erlbaum Associates, NJ: Hillsdale.

Robillard, P.N., d'Astous, P., Détienne, F. & Visser, W. 1998, 'An empirical method based on protocol analysis to analyze technical review meetings', *The Centre for Advanced Studies on Collaborative research*, IBM Press, Toronto, Ontario, Canada.

Steinheider, B. & Legrady, G. 2004, 'Interdisciplinary Collaboration in Digital Media Arts: A Psychological Perspective on the Production Process', *Leonardo* vol. 37, no. 4 pp 315–321.

Suwa, M., Purcell, T. & Gero, J. 1998 'Macroscopic analysis of design processes based on a scheme for coding designers' cognitive actions', *Design Studies*, vol. 19(4), pp 455-483.

Synapse 1999-, viewed October 2006 <http://www.synapse.net.au/>. Wellcome 1997-, viewed July 2006 <http://www.wellcome.ac.uk/doc_wtd003431.html>.