Supporting Collaborative Reflection with Passive Image Capture

Rowanne Fleck, Geraldine Fitzpatrick
University of Sussex

Abstract. Collaborative learning, and the role of reflection in supporting such learning, is gaining attention across a number of domains. We explore the use of a relatively new technology prototype, a wearable passive image capture device called SenseCam, to support this process. Pairs of HCI students were asked to wear the camera on a trip to play arcade games. On their return they had access to the SenseCam images to support their reflection on this learning experience. Analysis revealed interesting insights into how the images supported pairs' collaborative discussion on the topic. There were also observations made by participants that were not or could not have been made without the images.

Keywords. Collaboration, collaborative learning, reflection, reflective practice, experiential learning, passive image capture, SenseCam.

Introduction

Collaborative learning, and the role of reflection in supporting such learning, is gaining attention across a number of domains. Reflection, as a mechanism for learning from experience, is increasingly being thought of as an essential part of the development of professional practice [1]. Similarly there is a growing emphasis on encouraging reflection in the classroom and at university to support students learning from their experiences [2-4]. In this paper we are especially interested in how collaborative reflection on learning experiences within a peer context can be encouraged, in particular with a relatively new technology prototype, a wearable passive image capture device called SenseCam.

To investigate this, we report on a study where pairs of students were asked to collaboratively reflect on a learning experience. The SenseCam was worn during the experience, and the images it captured made available in different ways to support their collaborative reflection. While exploratory in nature and with only a small number of participants, there are non-the-less interesting findings which suggest that the images helped the students consider a wider range of issues, notice things they would otherwise have not noticed, and provide a valuable resource for structuring and grounding their reflective conversations. To present the study and findings, we will begin by presenting a brief review of the background literature including the role of reflection in learning from experience, the way this is supported by peer collaboration and how technology has been used to support this collaborative reflection. We then move on to introduce the prototype technology explored in this research before describing the study and explaining our analysis and findings.

Background Literature

1.1. Reflection on experience and peer collaboration

Reflection is considered to play an integral role in learning from experience, indeed it has been suggested that you cannot learn from experience without reflection [5]. Kolb [6] discusses the importance of grounding our ideas and experiences in the world through reflection. He developed an experiential learning cycle which starts with an experience, moves on to reflective observations about that experience in order to form abstract concepts from it which then guide a stage of active experimentation and so more concrete experiences; and so the cycle continues. Therefore in his view reflection is the process that allows for the formation of concepts from experience. This process can be encouraged and supported in a variety of ways.

Peer collaboration could encourage reflection on experience in a many ways. If peers have shared the experience, they can return to it together and discuss their own interpretation of what happened. Where they have had different but similar experiences they can compare and contrast. It may be that one person notices something another has overlooked. Also, often during reflection people can become stuck looking at a situation from one perspective and fix on a given interpretation [2] and peers can offer a fresh view point. Each peer will have to argue his own point of view, negotiate with and attempt to convince his partners [7]. Mercer and Wegerif [8] found that the most productive talk between peers in terms of learning outcomes, which they term 'exploratory talk', is talk in which partners 'engage critically but constructively with each other's ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered' (P 85). We look now at how technology has been used to support reflection on experience and in particular the role of peer collaboration and how it is supported.

1.2. Technology support of reflection on experience

Many researchers advocate the use of recording techniques, ranging from simple pen and paper journals [4], to electronic portfolios [3, 9], automatic data logging technologies [10] and video [3] for the support of learning from experience. These techniques all provide a record that can be returned to and re-examined, often when there is more time. Wolf [4] for example suggests that a pen and paper journal can support the stages of learning from experience, with an initial journal entry made soon after the event based on the memory of the student. Boud et. al. [2] argue that it is important that learners initially focus on exactly what happened before moving onto reflection. This is often difficult, as in fact, what their attention was on and how they were feeling at the time will have affected their perception of it. Recording events as they occur throughout the experience, by taking notes or using video might provide a more accurate picture.

Video is a technology that has been advocated for many years to support reflection on experience [11], especially in the field of teaching. Groups of trainee teachers who met regularly to discuss pieces of video from one another's classrooms were found to, over time, notice and discuss many aspects of their teaching considered important for expertise [9]. Similarly, others found groups of vocational trainers used video of their

training sessions to make links between different experiences and led to them making links between their experience and the training manuals [12]. Video has also been used with groups of school children to provide context for their field trip work to learn about pollution in the local environment [10].

However, there are some issues to be considered with the use of video to record an experience. For example, the video camera must either be statically located or else must be carried around, directed and focused. Tapes are of finite length and may need to be changed at inopportune moments, also reviewing the collected footage takes time. Given the success of video as a tool to support collaborative reflection, but also the issues involved in using it, we are interested to explore whether a new technology, the SenseCam, which captures a series of still images might similarly provide support for this kind of activity.

2. SenseCam

The SenseCam (SC) is a prototype device presently under development at Microsoft Research in Cambridge [13]. It is a small wearable device, worn around the neck like a pendant, combining a digital camera with a number of built in sensors [figure 1]. The sensors, which measure light, motion, sound, infra-red and ambient temperature, are used to trigger digital still images (around 3 or 4 a minute) to be taken at 'good' times - when changes in sensor readings indicate something interesting may be happening. The camera also has a very wide angle, fish-eye lens which captures most of what is the field of view of the wearer from a first person perspective [Figure 2]. These combined features allow the wearer to passively capture a whole day's worth of images without having to press a trigger or aim the camera, leaving their hands and attention free to get on with their everyday tasks. It is this aspect of the SenseCam, as a passive image capture device, that we focus on in this study, rather than the detail of which images are triggered by what data. When downloaded to a PC, the images can be viewed using a rapid serial visualization tool and the whole day may only take around 10 minutes to review.

Figure 1. SenseCam

Figure 2. Example SenseCam image

Previous research has shown the SenseCam to be an effective tool in supporting people with severe memory-loss [13] and even to trigger the recall of events for those with a normal memory [14]. We suggest that it might also provide a useful tool not for just aiding recall, but for supporting reflection on a learning experience. Like other recording technologies it should provide a more accurate record of what really happened in an experience and encourage sharing of this experience with others. As the amount of storage required for this kind of data is quite small, especially when compared to video, it is conceivable that a learner could have all their learning

experiences stored in this manner. The wearable passive nature of the SenseCam will allow it to be used in situations where video or other recording techniques would be less appropriate, for example on a field trip.

The field trip we describe here is based on an exercise usually given to students studying Human Computer Interaction (HCI) at Masters level at the University of Sussex. It involves them taking a trip to a local arcade to play and observe others interacting with the games there, and is intended as an engaging exercise to encourage students to consider how the theoretical principles of HCI design taught in the classroom apply to real world examples. Given the role of peer discussion as part of the reflective process, we anticipated that the SenseCam images collected on such a field trip would support a collaborative reflective exercise carried out on their return to the classroom.

3. Study

Eight students who had previously taken a module HCI took part in this study. None of them had previously done the exercise described above, they were between the ages of 18 and 31, and coincidentally all male.

The present study took place in 2 stages; an initial learning experience at the arcade followed later by a reflection session back at the lab. In the first stage, the participants were asked to go down to the arcade in pairs to play and observe others interacting with two arcade games. The two games were car racing game and a skiing game, and were chosen for their similar full body interaction style which differed enough from each other to provide a good comparison between them. One of each pair wore the SenseCam as they did this. They were also informed they would later be asked to do a follow up exercise based on their experience and were instructed to think about HCI issues in relation to the games during their visit.

The second stage, the reflection session, took place back at the lab within 2 hours of their pier visit and lasted approximately 30 minutes. A short time between experience and reflection was chosen as this is favored in the literature on reflective practice [11]. This stage was split into 2 parts and there were 2 conditions, Initial SenseCam (ISC) and Post SenseCam (PSC). ISC groups had access to the SenseCam images they collected on their trip throughout both these parts but the PSC groups did not. For Part 1, all pairs were asked to discuss and write down what they did on their trip. This part was intended to encourage a ‘returning to experience’ as advocated by [2] and [4]. Part 2 consisted of three questions designed to get them to reflect on HCI terms and issues in relation to the games and their design. They were also provided with a ‘crib sheet’ which outlined the HCI design principles and guidelines they had learned about on their course.

There was an additional Part 3 in which only the PSC groups took part, and this was when these groups were finally given access to their SenseCam images and invited to look through them and add to their answers to Part 2 if they wished. They were instructed to use a different colored pen for these notes so that they could be easily identified during analysis.

3.1. Analysis

All pairs were video recorded during the lab part of the study in order to catch their conversation and the images as they looked through them. Two main strands of analysis were undertaken, one to establish the 'goodness' of answers provided by participants with and without the support of the images, and a second to try and build up an understanding of *how* the images were being used to support the collaborative reflective process.

In order to gain some measure of how 'good' the answers were, a score was given by an independent academic responsible for teaching the HCI course. The additional answers the PSC groups gave in Part 3 were omitted in order to provide a fair comparison of answers made with and without the aid of the SenseCam images. Marks were allocated as though this were part of an exam and took into consideration demonstration of understanding and correct application of HCI design principles to the situation. It was expected that the ISC groups might give better answers because they had access to the images to support their discussion and reflection. To supplement this, spoken comments were transcribed and analyzed to identify issues raised relevant to the questions posed – these were categorized as new (an issue raised that hasn't been before), related (an issue directly borne out of or related to a previously discussed issue) or repeated (a repeat of a previous issue). It was expected that the ISC groups, with access to the images, would raise a greater number of new issues.

To understand more about *how* the SenseCam images were actually used to support participants' reflection on their experience, a detailed analysis of the video of participants viewing and discussing the images was also conducted. It was expected that the images would support reflective discussion by providing an accurate record of the experience and precipitating conversation about it in much the same way video did, but we did not make any strong predictions about how this might happen. As the study was exploratory in nature, the data was approached in an open way inspired by a grounded theory approach [15].

4. 'Goodness of Answers'

The marks allocated by the independent marker to the written answers in Part 2 (ISC groups 43% and 43%, PSC groups 48% and 50%) show a small difference between groups, however not in the expected direction. In fact, the PSC groups seem to have provided better written answers than the groups with access to the images whilst answering the questions. This would seem to suggest there is no advantage, and even a disadvantage, to having access to the images whilst answering the question. However, further analysis of issues raised during conversation suggests this may be too simplistic a view as a number of points raised in discussion never made it onto the answer sheet. This is partly because some of the points participants raised they did not agree on, or decided were not directly relevant to the question posed. These comments are still important for us to consider, as effective learning discussion will include learners justifying their own ideas, taking into account their partner's suggestions and eventually rejecting failed solutions [8].

On the contrary, the breakdown of the issues participants raised in discussion around the images whilst answering the questions in Part 2 suggests that the ISC groups raised slightly more new issues (ISC 14 and 12, PSC 10 and 10), though the overall difference is not significant. Also, PSC groups managed to add to their previous answers (4 issues each) when they finally saw the images in Part 3. These findings may indicate that the images enabled groups to notice and discuss a wider range of points, something that would not be picked up on looking at only the final answers.

5. Use of Images

Looking at how the images were used by participants to answer or add to answers in Part 2 and 3 of the study, we observed that this occurred in two main ways; discussion-led use and image-led discussion (Table 1):

Table 1. Use of images to answer questions in Parts 2 and 3

Discussion-led use of images	**Image-led discussion**
• **Pointing** at images to ensure both partners talking about same thing (grounding conversation).	• Images **trigger memory** of something (previously forgotten) and lead to discussion
• To provide an **objective record** where memories disagreed	• Images **confirm/disconfirm** (a comment made earlier from) memory
• To demonstrate something **not noticed at time by partner**	• Images **reveal something not noticed at the time** of experience and trigger discussion

We describe occasions where images are brought in to support an ongoing discussion as ***'discussion-led' use of images***. One way this happens is when participants point to something in the images to make sure the other person was clear what they were talking about, for example one participant pointed to an image showing the controls and displays around the main game display area as he talked about "all this stuff around here". This is not unlike the more usual discussion around photographs in a domestic setting, where pictures are often pointed at to establish 'mutual orientations' [16]. The need to establish the identity of a referent in conversation, often described as 'grounding', is vital for another person to understand what is said and pointing to a place in an image is a cheap and efficient way to do this [17].

We discussed earlier the importance of the role of a peer to challenge their contemporary's views and point out things that they may have overlooked. The images supported participants in doing this in conversation by providing an external objective record when there was a disagreement in memory, or to prove an observation that had not been noticed by the other. For example, the images were referred back to by one pair who initially disagreed about the aesthetics of the game they were discussing. On another occasion, one participant had noticed the seats in the car racing game were adjustable, but the other had not, so they flicked back through to see if the images revealed this. However, as the images did not provide a complete picture of the experience, and as there was still the need for a certain amount of interpretation they did not completely remove the space for negotiation, considered as essential to productive collaborative interactions [7].

The ***images were also found to lead discussion*** in three main ways. Firstly they often reminded participants about something they had forgotten to talk about earlier, for example one participant commented on how long he had to spend reading the game instructions when he saw the sequence of images of him doing this. Secondly there were a number of occasions where the images acted to confirm or disconfirm a comment made earlier from memory by the PSC groups. For example when early on in discussion one participant talked about how he had come in 32nd both times in the car racing game. When they looked through the images though, it became apparent he had come in 38th the first time, then 32nd. This then triggered a discussion about the 'learnability' of the game. Finally, images sometimes also made them aware of something they had not even noticed at the time. One participant commented, "It's quite useful for getting a look at what you're actually doing, because like we didn't use those buttons…[indicating by pointing to the buttons around the edge of the game screen]". In this way, the images almost acted as a third peer, providing yet another point of view which sometimes confirmed or disconfirmed those of the participants. The participants clearly saw the value of the images at times, one commenting that "it makes you realize how you're interacting… it's kind of you're going on automatic aren't you, and not realizing that you're actually driving". Through drawing attention to these overlooked issues, they became open for discussion.

6. Conclusion

Although the independent marker did not consider the groups who had access to the images whilst answering the questions gave better answers than those who did not, they may have raised more issues in discussion. We also found that the SenseCam images were not just used as memory aids, but acted as a resource for supporting the collaborative reflective discussion on experience of our participants. They did this in two main ways; firstly by acting as reference point to ground conversation, and by illustrating or proving one of the participant's points; and secondly by structuring and triggering conversation. We found that the ISC groups used images mainly in the former, discussion-led way, whilst the images often triggered discussion and answers when the PSC groups finally saw the images in Part 3. This is perhaps not surprising as we might expect images to trigger discussion mainly the first time they are seen. Another more interesting possible explanation for this is that attempting to answer the questions without the aid of the images makes the participants more aware of how the images support or disagree with their memory of the experience. Where they disagree the resulting cognitive dissonance will make them more inclined to try to resolve this inconsistency, described as a central mechanism for change in the practice of video self-confrontation [11]. This then might suggest that the images would be better used after the initial reflection session for maximum effectiveness, something we seek to explore further in future research. Further research will also involve coding the conversation for effective aspects of peer discussion using schemes such as [18] and recruiting more participants to increase the validity of findings.

This research suggests that the SenseCam has potential to support reflection and may be particularly suited to learning situations that video is not. In the case of the present study, it allowed participants to interact normally with the arcade games they were analyzing. In particular, it proved successful at making participants aware of their

interaction with the games in a way they were not at the time of the experience. This suggests that it may be a helpful tool in other situations where reflection after the event is required, perception at the time is limited and a video camera is not practical. The authors are presently considering its use as a tool to support reflective teaching practice. Also, it may be of value in situations where interaction over a period of time is of interest, for example ethnographic research.

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