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Creating meaningful bodily expression in virtual worlds:
Inquiring methods for designers

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Abstract

This research develops a co-design framework, co-design methods and generative tools for new creation of expressive behaviour by avatars. Influenced by Argyle's (1990) encoding-decoding paradigm of nonverbal communication, a decoding-encoding-decoding paradigm for co-design was proposed. This co-design framework consists of four stages: 1. designers and users decode (analyse) existing examples of nonverbal communication; 2. designers and users encode (co-create) new nonverbal communication; 3. designers reflect on the process of co-creation and encodes (designs) new non-verbal communication in avatar behaviours; 4. the new non-verbal communication is decoded by end-users in decoding.

The detail of the co-design framework, including co-design methods and generative tools, has been developed and evaluated in the two workshop studies that were conducted in Sheffield and Taipei. Workshop Study 1 aimed to look into and refine the co-design methods and generative tools in working with designers and users. Workshop Study 2 aimed to evaluate the effectiveness of two novel generative tools (the video experience note and the video self-recording device) I developed in Workshop Study 1. The result of the two workshop studies indicates that the co-design process appeared to be helpful and suitable for designers of avatar behaviours. In particular, the activity of encoding stage enables designers to learn about users' needs and experience for designing new creation.

The contributions in this thesis to knowledge are: 1.a co-design framework for the creation of expressive behaviours by avatars, supported by 2.methods for the selection of stimulus film clips and non-design participants; 3.two novel generative tools for the co-creative work; 4.a quantified evaluation of the generative tools in action.

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1 Introduction

1.1 Overview

Avatars are the human-like images (either 2D or 3D graphics) used by avatar users to represent themselves in virtual worlds. Photographic realism and behaviour realism are two important factors to enable avatars to resemble human beings. However, behaviour realism seems to be more important than photographic realism when considering social interaction in virtual worlds (Swinth and Blascovich, 2002). Avatars' expressive behaviours created by avatar designers are supposed to support avatar users to deal with unpredictable online interaction. Creating expressive behaviour appropriate for avatar-based interaction seems to be not easy because body movement has high variability.

To deal with the situation, this research proposes that avatar designers may look at the field of nonverbal communication when creating the expressive behaviour by avatars. Based on the description of Argyle (1990), nonverbal communication (NVC) consists of encoding and decoding of nonverbal signals. This research supposes that avatar designers may interpret expressive behaviours in the physical world then create expressive behaviour in the virtual world. The interpretation and performance of expressive behaviour are highly related to personal knowledge.

This research also proposes that people who have insight into nonverbal communication and share their insights with willingness could be seen as co-creators and involved in the generative phase of co-design. In terms of the notion of co-creation, this research sets out to develop methods to enable avatar designers and suitable people to co-create expressive behaviour for avatars. Also, the research investigates what

generative tools would support the co-creation process and tests their efectiveness.

This research firstly reviews literature and previous studies; and then establishes a co-design framework. The research process includes two sets of co-design workshops with these aims:

1. to identify problems which obstruct co-creation by the participants;

2. to develop generative tools for the co-creation process;

3. to evaluate the effectiveness of the generative tools.

By using the co-design framework and methods, participants were able to share their personal knowledge to identify meaning in expressive behaviour and create new animations of expressive behaviour which enhanced the insight of interaction designers and supported their subsequent professional work. The use of generative tools enabled this shared understanding among participants.

The contributions in this thesis to knowledge are:

- a co-design framework for the creation of expressive behaviours by avatars, supported by

- methods for the selection of stimulus film clips and non-design participants;

- two novel generative tools for the co-creative work;

- a quantified evaluation of the generative tools in action.

1.2 Background

With the development of interactive media technology, the medium of interpersonal communication has been extended to computer-mediated communication (CMC). CMC can be considered broadly as any form of information exchanged via computer-mediated formats between two or more participants. Spitzberg (2006) has defined CMC as "*any human symbolic or text-based interaction conducted or facilitated*

through digitally-based technologies" because individuals participate in a computerized process of message interchange (p.630-631).

In terms of operation, CMC can be divided into synchronous and asynchronous modes. In synchronous communication, all participants are online at the same time while asynchronous occurs without time restrictions and participants may be online at different times.

The circumstances of this new type of interaction are different from face-to-face. Face-to-face participants adopt verbal and nonverbal approaches while the computer-mediated participants have generally employed only a verbal approach in early computer-mediated exchanges. As Boberg et al (2008) explained

> "*Avatars are currently a central part of digital environments because they define how the users can act and express themselves. Avatars are not only familiar to players of online games, but are also flourishing in many online applications, mailing systems, 3D Chat rooms, online communities, and web forums. One could imagine that they would become soon part of everyday mobile phone usage as well (p.232).*"

Avatars are increasingly employed for enhancing nonverbal interaction in computer-mediated communication. They are often created to be like humans and appear to use similar cues to face-to-face communication (Figure 1).

Figure 1 Interaction among avatars in virtual world (taken from *Second Life* of Linden Research, Inc)

[3]

Avatars are characters created using either 2D or 3D graphics and they have moved from statics to animated or more richly animated. The use of avatars seems to give avatar users the opportunity to build a feeling of being there, a form of presence within a multi-user virtual world (Schroeder, 1996). Therefore, avatars might be seen as interactive, social representations of users, aiding users to develop and keep interpersonal relationships in virtual worlds.

1.3 Motivation

My early research experience at Tatung University in Taiwan was concerned with the development of online learning software for students learning design software. This led me to an interest in online communication. In my MA project at Sheffield Hallam University, I focused on an investigation on emotional expression in CMC and created animated emoticons for men's conversation[1]. From this project, I identified that users' online communication was a challenge for designers of software. I also found that people were using animated emoticons to express themselves. Reflection on this MA project led me to this PhD research to consider how designers can support self-expression in online environments.

1.4 Focus of the Research

This research is focused investigating how 'co-design' might be applied usefully to the design of avatars, in particular the design of avatars' behaviour.

Photographic realism and behaviour realism appears to be two important factors to aid projection and identity of avatar users in virtual worlds. Tromp et al (1998), in a study of avatars' behaviour experiments in online group discussions, found that the

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[1] This MA project was reported in IASDR 2009 and referee to conference paper (Chen and Rust, 2009).

great realism of avatars' bodies in online interaction is not appropriate to the lack of body movement. When comparing these two factors, researchers such as Blascovich (2002), Swinth and Blascovich (2002) indicated that behaviour realism seems to be more important than photographic realism when considering social interaction in virtual worlds.

In order to create vivid expressive behaviours, the avatar designer seems to share knowledge and techniques with the animator. However, each has a different purpose for their creations. The avatar designer aims to support avatar users to deal with unpredictable online interaction but the animator aims to present a particular story to audiences. Becker and Mark (2002) found that social behaviour in virtual worlds mirror those in the physical world. Researchers such as Salem and Earle (2000), Guye-Vuillème et al (1999), and Gillies et al (2004) suggest that avatar designers should look into the field of NVC when creating the expressive behaviour of avatars.

According to Argyle's (1990) description, the paradigm of NVC[2] consists of encoding and decoding of nonverbal signals. Thus we may say that avatar designers encode signals in behaviour by avatars for viewers to decode. In order to do this encoding, designers may observe and interpret expressive behaviour in the physical world. Then they create expressive behaviour in virtual worlds. Encoding by individual designers appears to be insufficient because emotional expression may vary from person to person and context to context. People may have different interpretations of the same expressive behaviour. In addition, people may perform different nonverbal signals for the same expression of emotions, attitudes, or status.

Co-design is a design approach that enables designers and people from diverse backgrounds such as researchers, (potential) customers and users come together for the activity of co-creation. Sanders and Sappers (2008) took the term 'co-creation' to refer

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[2] The paradigm of NVC will be discussed in greater depth in 2.3.2.

[5]

to "*any act of collective creativity, i.e. creativity that is shared by two or more people* (p.6)", and used the term 'co-design' in a more narrow sense to refer to the "*collective creativity as it is applied across the whole span of design process* (p.6)". For some people, co-design refers to "*the collective creativity of collaborating designers* (ibid, p.6)." Therefore, Sanders and Sappers (2008) used co-design in a broader sense to refer to "*the creativity of designers and people not trained in design working together in the design development process* (p.6)."

In co-design, participants are empowered and encouraged to create artefacts for expressing their thoughts, feelings and ideas (Sleeswijk Visser et al, 2005). Sanders (2002) indicated that 'say', 'do' and 'make' are three different approaches to access people's experiences during a design process, where 'make' is associated with co-design. In interviews, designers focus on what people say and think. Through observation, designers look at what people do and use. In the activity of co-creation, designers could focus on what people make to use in expressing their thoughts, feelings and dreams (Sanders, 2002). Sanders and Sappers (2008) noted that the participant in co-design "*who will eventually be served through the design process is given the position of 'expert of his/her experience', and plays a large role in knowledge development, idea generation and concept development* (p.12)." Through the activity of co-creation, people seem to not only jointly explore and articulate their latent needs but also jointly explore and develop solutions.

To encode and decode nonverbal signals for interpersonal communication is highly related to personal knowledge and experience. From this aspect, people who have insight into nonverbal communication and share their insights with willingness could be brought in encoding and decoding nonverbal behaviour. In addition, these people could be empowered in proposing and creating their expressive behaviours to enable designers to recognize ways to create more relevant expressive behaviours. Co-design seems to be

[6]

a suitable approach for the creation of expressive behaviour by avatars because this approach offers an inclusive, democratic way to draw the experience of participants into the design process. Sanders (1999) suggested that the generative tools in co-designing are projective and they are a new language for designers and uses. In this research I have investigated methods and tools for using co-design in developing avatar behaviour, particularly in the generative stages of a project.

1.5   Aims and Objectives

As discussed above, to encode and decode nonverbal signals for interpersonal communication is highly related to personal knowledge and experience. People who have insight into nonverbal communication and share their insights with willingness could be valuable co-creators in encoding nonverbal behaviour. Their participation might enable enable avatar designers to visualise useful expressive behaviour.

In this research, I set out to discover how users might be involved in the generative phase of the creation of expressive behaviour by avatars. So the focus of this research is on generative tools and methods for co-design. Two workshop studies were conducted systematically to address a single research question as follows:

What methods and tools might be used to enable successful co-design collaborations between designers and users in creating useful new expressive behaviours for online avatars?

The overall objectives guiding this research were:

1.   to investigate the state of the art and current knowledge of avatar design including the creation of avatar's expressive behaviour;

2.   to investigate the role of expressive behaviour in social interaction;

3.   to review previous practical works in the field of participant involvement in design process;

[7]

4. to establish a co-designing framework for generating expressive behaviour;

5. to conduct practical work for a practical exploration of generative tools and methods appropriate for avatar designers working with avatar users in the generative phase of the design development process;

6. to evaluate the validity of the generative tools and methods identified in the research.

There are three novel parts to this research. Firstly, although avatar designers have professional techniques and accepted conventions to create avatars' expressive behaviour so far, the participation of users in the creation of avatars' expressive behaviour is not well explored. This research focuses on the participation of users in the generative phase of the design process. Secondly, a co-design framework of methods and tools for avatar designers working with users for creation of expressive behaviour is developed and evaluated. Thirdly, as part of the tools, the research developed and and evaluated the use of video-sketching by self-recording as a method for participants without drawing or animation skills to participate in co-design sessions focused on the production of animations.

1.6 Definition of Terms

This section provides definitions of key terms used in this thesis. Fuller explanations are provided in following chapters.

**Avatar** in this research refers to the human-like images (either 2D or 3D graphics) used by avatar users to represent them in virtual worlds. These humanoid avatars are animated so avatar users can show their emotions, status, and attitudes through the facial expression and body movements of the human-like images.

**Virtual worlds** in this research refer to the environments in which such avatars exist depicted in the form of 2D or 3D graphics although virtual worlds can be

[8]

text-based. These environments may be instant message software, web-forums, online conferences, video games etc. The general feature of these platforms is allowing for multiple users so that avatar users from different locations can interact with each others.

Bodily expression is expressive behaviour and refers to people's physical behaviour used to convey information such as emotions, status, or attitudes in interpersonal communication. These behaviours include facial expression, eye gaze, postures, and gestures.

Meaningful bodily expression refers to expressive behaviour with meanings tacitly agreed by a group of people. The interpretation and performance of expressive behaviour are highly related to personal knowledge.

Users in this research refer to avatar users participating in workshops. ***End-users*** mean people who use and interact with avatars in online environments.

Generative tools refers to tools used in the generative phase of a co-design process. The function of generative tools is facilitating exchange of participants' ideas in the creation of new material for expressive behaviour by avatars. Typical generative tools include drawing, role play or mockups. This research resulted in the development and evaluation of two generative tools, are the video experience note and the video sketching device.

Interaction Process Analysis (IPA) is a method for analysing communication processes among small team members, proposed and developed by Bales (1950, 1970). In this research Bales IPA is used to analyse interactions in co-design workshops to evaluate the effect of specific generative tools.

Stimulus film clips in this research are the stimulus in the generative phase of the co-design process. They are selected from popular movies and TV dramas by the co-design participants who are asked to identify clear examples if expressive behaviour by actors in interpersonal communication.

[9]

Film clip suggestion questionnaire is a designed questionnaire (Appendix I) with three open-end questions and three closed-end questions used to acquire the possible idea of films and scenes from codesign participants. This questionnaire is also used to identify those participants who are most suitable to participate in the co-creation work.

The video experience note is a paper form (Appendix IV) with two tasks for each individual participant to record their impressions of expressive behaviours in film clips at the start of a co-design workshop. This note enables participants to retain their own ideas during group discussion and ensure that group discussion includes all views of the group, not just the most confident members.

The video sketching device is a tablet computer with a front camera and software[3] for self-recording used in the co-design workshop. It allows participants to record ideas about expressive behaviour without the embarrassment of performing for other people or for a video camera.

1.7   Scope of the Thesis
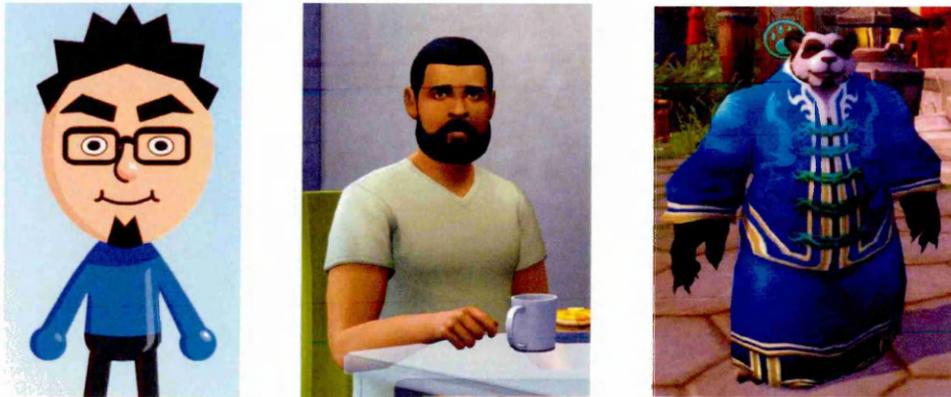
Figure 2 The avatars' appearance are taken from *Mii* of Nintendo (Left), *The Sims* of Electronic Arts (Middle), and *World of Warcraft* of Blizzard Entertainment (Right).

The range of avatars' appearance can be from abstract to animal to humanoid, and from cartoonish to photorealistic (Figure 2). This research is concerned exclusively with

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[3] The app – iMovie that is developed by Apple Inc. was used in this research.

humanoid avatar's expressive behaviour appropriate for online interaction. The research is concerned with providing stimulus and ideas for designers through the co-design process, not with the final design or application of expressive behaviours. The main aim of the research is to identify and assess generative tools appropriate for a co-design process to give designers a wider range of insights and creative thinking. I am not approaching this as an animator but as a design researcher who has discovered this problem from other research. Therefore, this research is not concerned with techniques involved in creating or animating realistic avatars.

In this research, participants were taken from a variety of cultural backgrounds, several nationalities and different professions. However, the focus was on the effectiveness of tools regardless of the cultural variations of the participants. Besides, the aim was not to generate data for animators but tools that might be used in a variety of cultural settings. In practice, participants were able to participate and collaborate in similar ways regardless of backgrounds.

1.8   Structure of the Thesis

Based on the notion of co-design, this research focuses primarily on the development and evaluation of generative tools for the creations of expressive behaviours by avatars in the generative phase of the co-design process. A brief synopsis of each chapter is provided as follows:

Chapter 2 sets out the contextual background of the research, including avatar design, social interaction and user involvement in the design process.

Chapter 3 describes the methods used to address the research questions. This chapter introduces the features of experimental design common to two workshop studies, as well as the method of small group research used to analyse the group communication data. It also addresses the combination of qualitative and quantitative methods of

analysis with particular reference to Bales' (1950) Interaction Process Analysis (IPA).

Chapter 4 presents the procedure and findings of Workshop Study 1 that was conducted in Sheffield. In the beginning, it focuses on the identification of co-design problems occurring in the interaction between participants. Having identified some problems in the co-design process, the video-experience note and the video-sketching device as generative tools were tested to facilitate information exchange between participants. Discussion with participating designers indicated that these tools could be productive in enabling co-design workshops in the generative phase of designing avatar's expressive behaviour.

Chapter 5 presents the procedure and analysis of Workshop Study 2 that was conducted in Taipei. This practical work focuses on the verification of the video-experience note and the video-sketching device applied in the co-designing. In order to evaluate the effectiveness of the generative tools, Bales' IPA was used to quantify and analyse the group communication process.

Chapter 6 discusses the overall findings and the implications that can be drawn from them. In the end, Chapter 7 draws conclusions and gives suggestions for continuing research. The process flowchart of this research is presented as Figure 3.
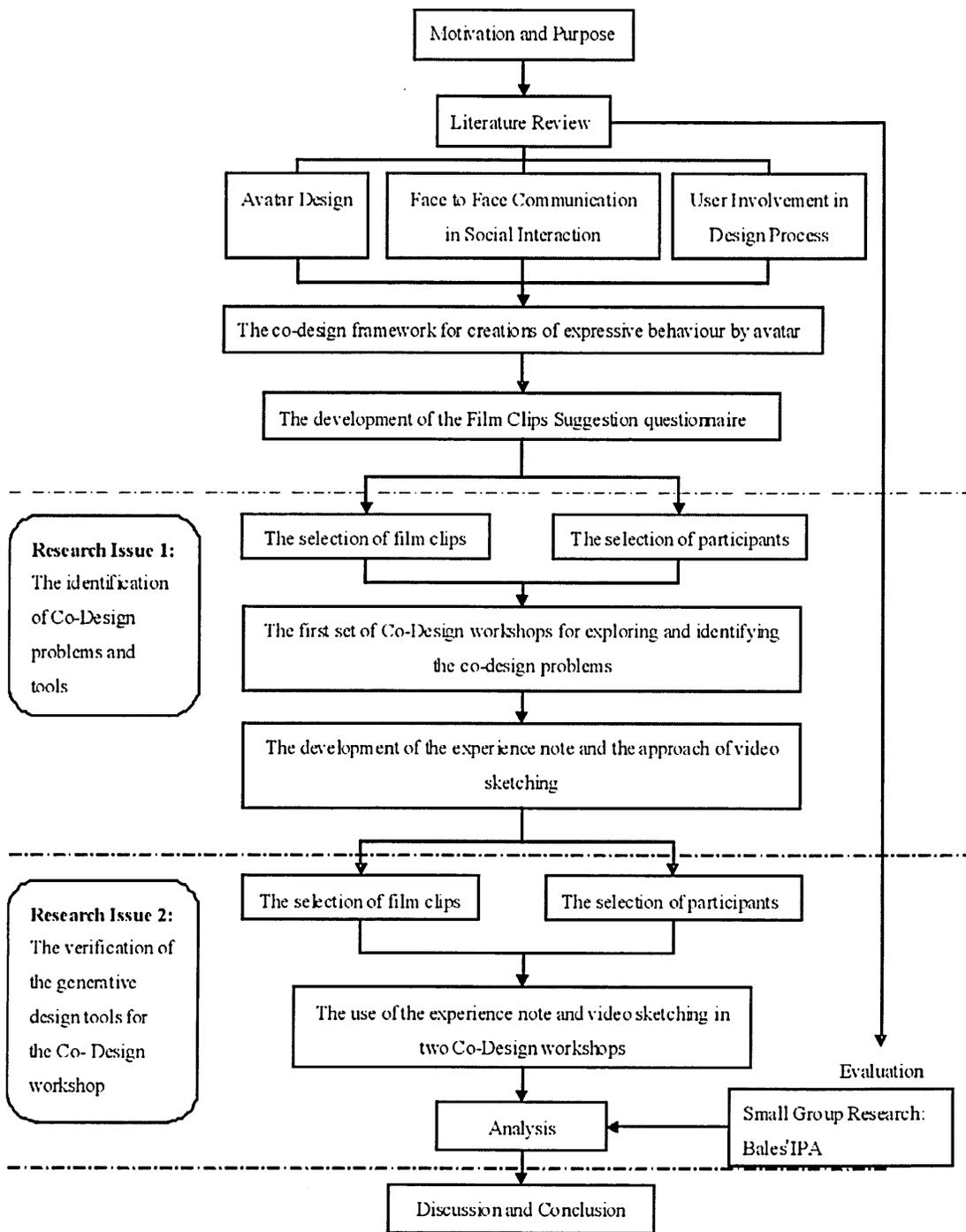
Figure 3 The research process flowchart in this research

2 Literature Review

2.1 Introduction

This chapter contextualises the research by discussing relevant literature and it is divided into four main sections. Section 2.2 presents the methods and techniques of avatar design. Avatar designers share many creative methods with animators so it focuses on how animators create the appearance and expressive performance of avatars. Section 2.3 discusses how humans use various channels to communicate non-verbally in social interaction. The influence of emotion in nonverbal communication is explored, and the components of nonverbal behaviour (facial expression, eye gaze, gesture and posture) are discussed. Section 2.4 reviews participatory design and user-centred design for user involvement in design process. The advantages and disadvantages of both are weighed up. Also, the technique of mock-ups and generative tools for the investigation of the user is reviewed. According to these fields of knowledge, the research problem is contextualised by discussing the need for co-designing expressive behaviour by avatars with diverse people in section 2.5. In this section, a co-design framework for this research is also proposed.

2.2 Avatar Design

Virtual worlds are computer-based simulated environments capable of supporting human-to-human communication. These environments allow online users to interact with the space and with others via the representation of avatars. Thalman (2001) noted that avatars have three outstanding functions including *"the visual embodiment of the user, means of interaction with the world, and means of sensing various attributes of the*

[14]

world (p.24)." Avatars are considered as interactive, social representations of users, aiding users to develop and keep interpersonal relationships in virtual worlds.

The origin of avatar is a Sanskrit word in Hinduism meaning an incarnation of an immortal being. Hindus believe that God takes birth in a human body when it comes to this world. Similarly today the term 'avatar' is used to describe a virtual character that represents a person when they enter a computer-generated virtual world. Figure 4 shows the history of popularisation of avatar.
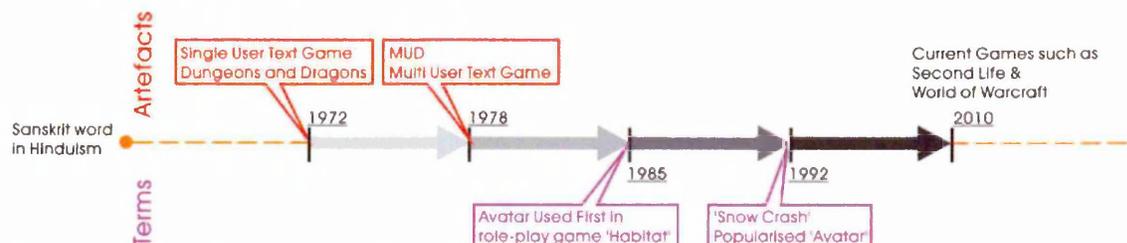
Figure 4 The history of popularisation of Avatar

It is believed that the first practical Avatar-like construct, in 1972, was in role-play in the text game Dungeons and Dragons. In 1978, Roy Trubshaw and Richard Bartle developed the first computer-based multi user-game (MUD) at Essex University. It was the first time that players could control their 'characters' to interact with others. One of the first references of avatars as digital representations was in the 1985 game **ULTIMA IV: QUEST OF THE AVATAR** (Figure 5). The goal of this game is to focus on the main character's development in virtuous and become an 'Avatar' – a spiritual leader and an example to the people of the world of Britannia. In this game it was not until later versions that the user's representation was called an avatar.

Figure 5 The cover art (Right) and screenshot (left) of *Ultima IV: Quest of the Avatar* (taken from IGN - http://www.ign.com/articles/2010/01/16/the-reason-i-became-a-gamer-ultima-iv).

The first use of the term avatar in its current incarnation is possibly the computer game Lucasfilm's **HABITAT** in 1986. The development of this game began in 1985 and sketched out a virtual world where each player had an in-game 'avatar' – a word defining a graphical character for the on-screen representation of the player. As shown as Figure 6, these graphical characters in the same region (denoted by all objects and elements shown on a particular screen) could see, speak (through onscreen text output from the players), and interact with one another.

Figure 6 The screenshot of *Habitat* (taken from Gamasutra - http://www.gamasutra.com/php-bin/news_index.php?story=21883)

Following Habitat, the visual persona of players became well established in later games. In 1992, Neal Stephenson's novel **SNOW CRASH** used the term 'Avatar' to mean

[16]

an online virtual person, possibly the first example of this usage. In the last 20 years, the term 'avatar' then has been applied to videogame, computer-mediated communication (CMC) and related fields.

As shown as Figure 7, these created characters and virtual worlds were depicted in the form of text initially. The rise of graphic processing technology has enabled increasingly complex 2D and 3D characters and artefacts in virtual worlds (Figure 8). They play an essential role in virtual environments and enable avatar users to use empathy put themselves into the experience.

Figure 7 *Trade Wars* lunched on Bulletin Board System in 1984 (taken from Fields and Cotton, 2011:p.10)

Figure 8 A graphic character and graphic artefacts in the virtual world (taken from *SmallWorlds*)

In order to enable avatar users to immerse themselves in diverse virtual worlds, avatar designers have methods and techniques to create vivid and distinctive characters. Below I will discuss the relationship between avatar users and avatars. Then, the appearance and the expressive behaviour of avatars will be contextualised. Finally, I will discuss creative methods and techniques that avatar designers use to create compelling characters.

2.2.1   Projection and Identity

The appearance of graphic characters in virtual worlds can range from animal to humanoid. These characters are divided into two terms – avatars and embodied agents (Gerhard, 2003). Bailenson and Blascovich (2004) gave a clear schematic (Figure 9) to describe the difference between avatars and embodied agents. Avatars are directly controlled by human beings but embodied agents are controlled by a computational algorithm (ibid). Visually, avatars and embodied agents may not be distinguishable. However, we still can judge the difference both between them when we consider social

[18]

interactions, responsiveness and simply the psychological effect of conversing with a human.
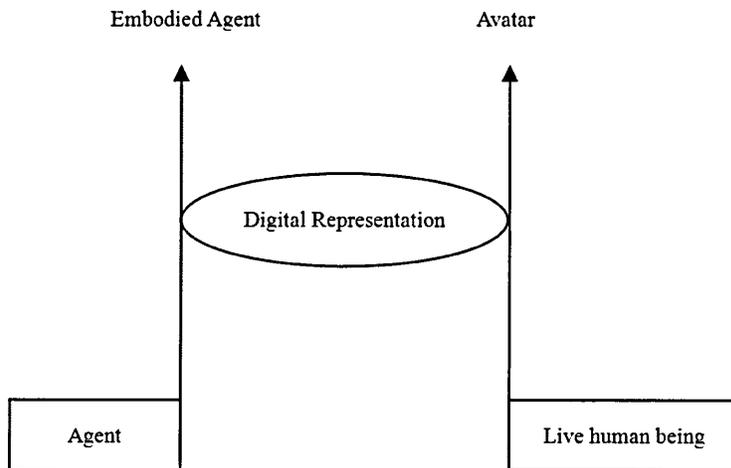
Figure 9 A representational schematic of avatars and embodied agents (taken from Bailenson and Blascovich, 2004).

Schell (2008) discussed that projection is the extent to which storytellers compel the audience to use their powers of empathy and imagination to put themselves into the experience. He explained that characters created by storytellers are strangers to the audience in the beginning. When the audience get to know these characters, the audience begins to care about what happens to these characters. Then the audience might even mentally put themselves in the place of these characters, bringing them to the height of projection. When avatars are controlled by users in virtual worlds, projection appears to be important to connect the relationship between users and avatar (ibid). As noted by Schell (2008)

> *"There are times when the player is distinctly apart from the avatar, but other times when the player's mental state is completely projected into the avatar, to the point that the player gasps if the avatar is injured or threatened. This should not be completely surprising – after all, we have the ability to project ourselves into just about anything we control* (p.312)."

The power of empathy is important to establish projection into an avatar (ibid).

Besides projection, identity seems to be another key to establish the relationship between avatar and users. Benford et al (1995) pointed out that an avatar's body image

[19]

might convey identity at four distinct levels of recognition. Firstly, it is perhaps easy to recognise at a glance that the digital representation is representing a human being as opposed to some other kind of object. Secondly, it is possible to distinguish between distinct users in online interaction, even if avatar users don't know who they are. Thirdly, avatar users might be able to recognise other avatar users again if they have learned others' identities. Finally, users might be able to get to know someone through an avatar's body image. When avatar users identify with their avatars, invest time on them, create relationships, and establish reputation in virtual worlds, the avatars become very important for them.

Bailenson and Blascovich (2004) stated that photographic realism and behaviour realism are two facts to enable avatars to resemble human beings. Photographic realism and behaviour realism are important to projection and identity of avatar users in virtual worlds. Therefore, the appearance and the expressive behaviour of the avatar will be discussed in the following subsections.

2.2.2 The Appearance of an Avatar

In terms of appearance of an avatar, Schroeder (1996) indicated that *"it is not only the shape of virtual bodies that matters in the experience of virtual worlds, but also the level of detail with which they are represented* (p.64)." Schroeder (ibid) suggested that the appearance of an avatar may provide information for others to better understand the identity of the avatar user. It also may give the opportunity to build a feeling of being there, a form of presence within a multi-user virtual world (ibid).

In general, the appearance of avatar concerns two dimensions: morphology and photorealism (Garau, 2003). Avatar morphology in virtual worlds ranges from humanoid to anthropomorphised animals to abstract shapes. As for photorealism, avatars can range from cartoonish forms to highly realistic forms. Figure 10 illustrates

[20]

two dimensions of avatar appearance design. Avatar morphology and photorealism influence an avatar user's perceptions and their interaction in virtual worlds. However, as will be seen below, the appearance of avatars seems to be less significant for, their success in social interaction, than their behaviour.
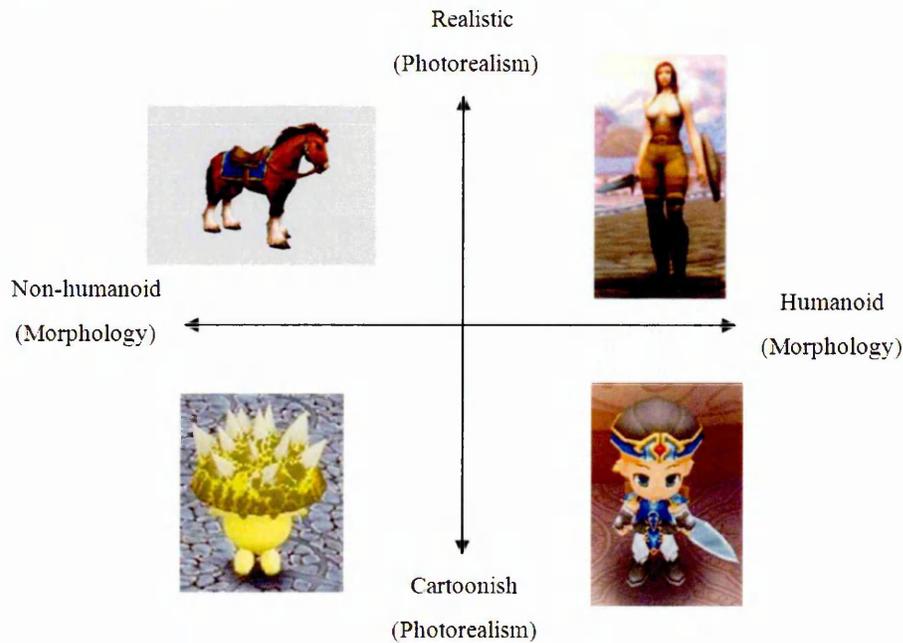
Figure 10 The dimensions of avatar appearance design (The upper right and the upper left are taken from *World of Warcraft* of Blizzard Entertainment; the lower right and the lower left are taken from *Concerto Gate* of Square Enix)

2.2.3 The Expressive Behaviour of an Avatar

Besides the appearance, expressive behaviour in virtual environments is another important consideration for users because avatar users engaged in online interaction imitate face-to-face rules for spatial behaviour. After looking for the presence of social conventions in several virtual environments, Becker and Mark (2002) found that many social behaviours in the virtual environment mirror those in the physical environment. They also claimed that socializing in virtual worlds is indeed affected by nonverbal cues. By using the expressive behaviour of an avatar, virtual social encounters could be facilitated.

[21]

Machado and Paiva (2000), investigated children's role-playing in a collaborative virtual environment – *Teatrix*. They did not initially focus on emotional expression. However, they later found that avatar's poor emotional expression, in particular facial expression, was the main obstacle for effective interaction. They claimed that interaction in virtual environments needs rich expressive behaviour.

Tromp et al (1998) used three different simple avatars labelled Red, Blue, and Green (Figure 11) to investigate small group interaction in a collaborative virtual environment. The Red and Blue avatars were lower-realism but the Green avatar was higher-realism. Apart from colour and appearance, the avatars had limited movements and no capability for any kind of emotional expression. Participants from different locations used these avatars and met in a virtual environment to perform a puzzle-solving task.
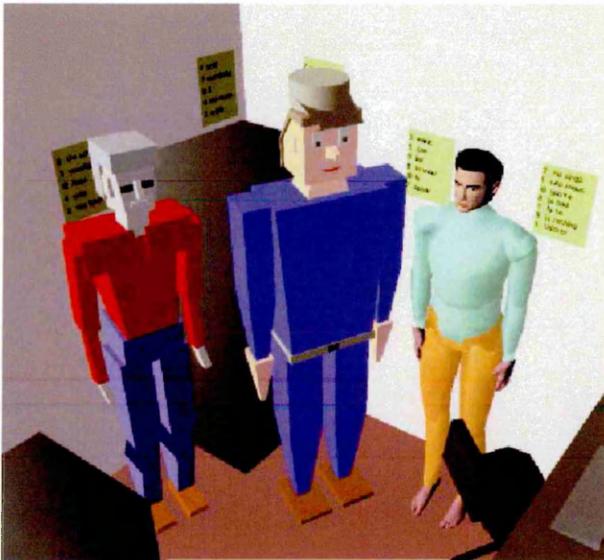
Figure 11 Avatars used in Tromp et al study (taken from Tromp et al, 1998)

According to participants' feedback, the Green avatar was described as a zombie although it was like a realistic human. As for the Red and Blue avatars, participants assumed both of them were robots rather than real people. Tromp et al (ibid) pointed out that "*the greater realism of the Green body wasn't appropriate to the lack of body movement and this was disconcerting* (p.61)." They concluded that an avatar's realistic appearance may lead users to have heightened expectations for an avatar's behaviour. It

[22]

indicates that more expressive behaviour will be needed if avatars become more photoreal.

Other researchers indicate that behavioural realism seems to be more important than photographic realism when considering social interaction in virtual worlds. As Blascovich (2002) noted,

> *"we typically build digital IVEs[4], including interpersonal ones, using visual media, we tend to think of realism in terms of photographic realism. Although important, photographic realism does not equate with behavioural realism and is, in fact, less important (p.131)."*

Swinth and Blascovich (2002) also explained that

> *"more important than photorealism, and perhaps even anthropomorphism, is an avatar's behavioural realism. Behavioural realism refers to the extent to which avatars and other objects in a virtual environment behave like their counterparts in the physical world (p.329)."*

From this point, behavioural realism appears to be the higher priority for communication purposes. Avatar designers seem to deal with avatars' behavioural realism carefully.

Isbister (2006) reported an interview with Ryoichi Hasegawa and Roppyaku Tsurumi of Sony Computer Entertainment Japan. Ryoichi Hasegawa described how Disney animators' techniques influence Japanese game designers for the creation of game characters' behaviours in 1990s. As he said

> *"Long ago, there was a game for the Sega Genesis called Aladdin (1993). From what I know, that was the first time that an American production company used a Disney animator to develop a game. Before then, when we animated a 2D character swinging a sword, we were drawing several pages of the animated motion of the arm at equal intervals throughout the whole movement.*
> *But with Aladdin, they used the same devices as Disney animation to make the arm movements look good, so they shortened the animated sections when an arm starts to move, and lengthened them for when an arm is extended. This is the same technique as those used to make real animated*

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[4] IVEs is the abbreviation for immersive virtual environments.

cartoons in the studio. This was shocking for a lot of the Sega creators. At the time, I was in charge of localizing Aladdin, and a lot of designers from the arcade-game machine development team were coming to study these animation patterns.

That was a time when 3D CG was being used for arcade games, and 3D fighting-games projects like Virtual Fighter (1993) were being developed."

Avatar designers have creative methods to address the issue of behavioural realism in virtual worlds. Ryoichi Hasegawa's interview indicates that avatar designers' creative methods for addressing the issue of behavioural realism in virtual worlds seem to be mainly drawn from animators' techniques. Therefore, animators' techniques for the creation of human movements will be discussed in the following subsection.

2.2.4   Animators' Techniques for Realistic Movements

Walt Disney said *"Animation can explain whatever the mind of man can conceive* (Thomas and Johnston, 1984; p.13)." Because animators create the characters' performance in the animation, Thomas and Johnston (ibid) stated that *"Basically, the animator is the actor in animated films* (p.18)." Although the animator could be viewed as an actor in this way, the two roles are visibly distinct in their practices. Hooks (2003) explained the distinction between animators and actors as below: "...*When creating a character, an actor tends to work from the inside out; animators, by contrast, tend to work from the outside in* (p.45)."

The actor is taught characters' emotion and body movement that are appropriate to the moment. Then the actor has to consider how to show internal feelings through movement. However, the animator has to consider how to display external evidence that indicate characters' emotion and status to the audience. Thomas and Johnston (1984) also pointed out that the actor and the animator are standing on two different situations to deal with characters' performance: 1. the actor can interrelate with other actors to project the characters' unique energy simply because they are real people; 2. the

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animator directs all the characters and their interactions. From this point of view, the challenge of the animator seems to be more complex than the actor.

2.2.4.1 Basic Principle of Animation

The animator and the actor's considerations of a character's performance are different. Most professional animators use a simple set of standard techniques to present characters' expressive behaviour. Thomas and Johnston, two senior Disney animators, writing about the methods developed in the Disney studios, stated

> *"The animators continued to search for better methods of relating drawings to each other and found a few ways that seemed to produce a predictable result. They could not expect success every time, but these special techniques of drawing a character in motion did offer some security. As each of these processes acquired a name, it was analysed and perfected and talked about, and when new artists joined the staff they were taught these practices as if they were the rules of the trade* (1984, p.47)."

Thomas and Johnston (1984, pp.47-69) outlined what they called the "twelve basic principles of animation". Nearly every book on animation mentions these basic principles.

1. **Squash and Stretch** are used to give the illusion of weight and flexibility to a character's movement. Thomas and Johnston took a bouncing ball as an example (Figure 12): 1. the ball is squashed when it hits the ground; 2. the ball is stretched is falling and rebounding in the air.
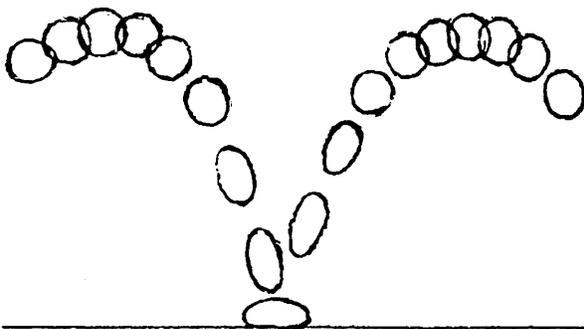
Figure 12 The illusion of the 'Squash and Stretch' (taken from Thomas and Johnston, 1984: p. 51)

[25]

2. **Anticipation** is achieved by preceding each main action with a specific movement that prepares for the audience understanding what is happening. Before running, for example, a man shifts backward and sinks his weight onto the back foot (Figure 13).

Figure 13 The illusion of the 'Anticipation': Donald Duck draws back with raised leg in anticipation of running (taken from Thomas and Johnston, 1984: p. 52)

3. **Staging** refers to communicating the character's attitude, mood, idea or action clearly. Animators have to concern how characters relate to each other, how a character moves, when actions happen in relation to other events, and how the scene is viewed clearly. These can help animators telling the story.

4. **Straight Ahead Action and Pose to Pose** are two different approaches to animation (Figure 14). Straight ahead action is starts at the first drawing and works frame by frame to the end of a scene. Pose to pose is more planned out and starting with few key frames then filling in the intervals.
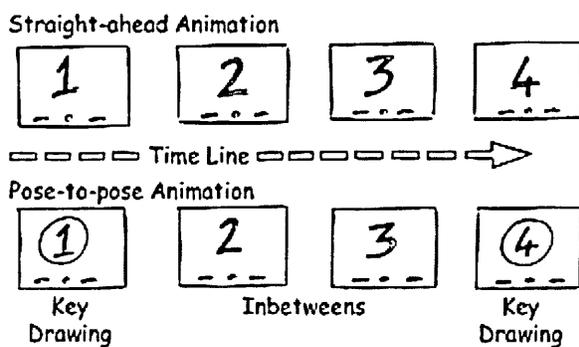
Figure 14 The illustration of 'Straight Ahead Action and Pose to Pose' (taken from Webster, 2005: p.25)

[26]

5. **Follow Through and Overlapping Action** deal with the character's movements more realistic when the character stops main body and other parts continue to move (shown as Figure 15).
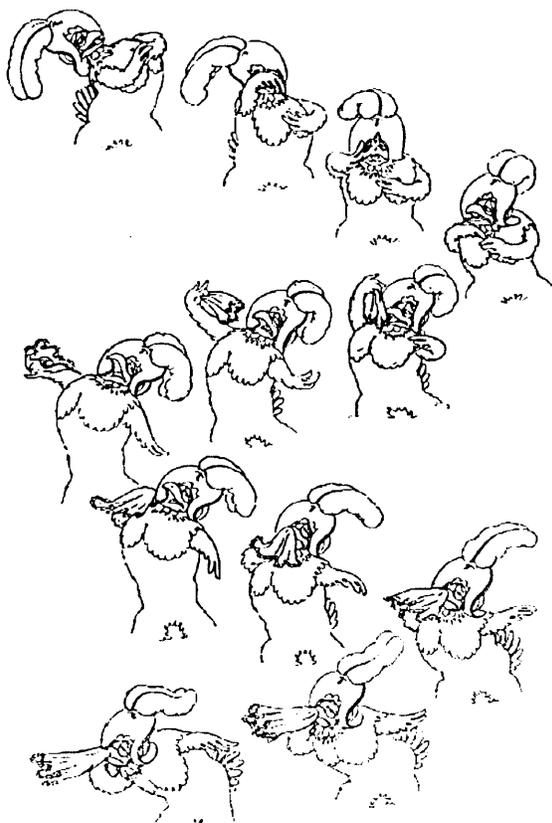
Figure 15 The illustration of 'Follow Through and Overlapping Action': the feather and other parts give a feeling of weight and living form (taken from Thomas and Johnston, 1984: p. 59)

6. **Slow In and Slow Out** are used to soften the action because both of them change the speed of an object when it is moving (Figure 16).
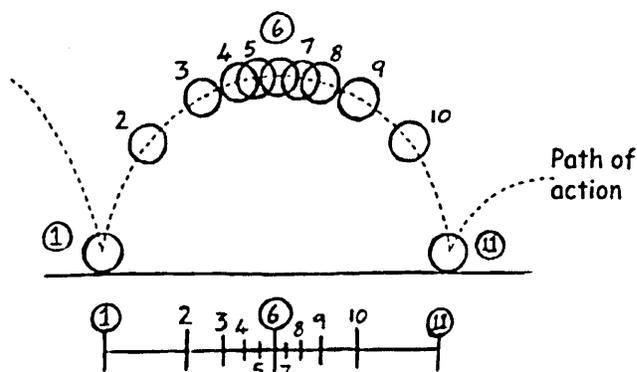
Figure 16 The illustration of 'Slow In and Slow Out': The movement of the ball form number 1 to number 6 is 'slow in'; the movement from number 6 to number 11 is 'slow out' (taken from Webster, 2005: p.31)

7. **Arcs** refer to the visual path of movement showing an arc (shown as

   Figure 17). Animators need to concern action in the arc path because "*the*

   movements of most living creatures will follow a slightly circular path (ibid,

   p.62)."

Figure 17 The illustration of the 'Arcs': the action of a hand gesture with a pointing finger follows a circular path (taken from Thomas and Johnston, 1984: p. 62)

8. **Secondary Action** is used to support and enrich the main action so a scene

   is given more life. In addition, the character's emotion and status is

   actually emphasized because of secondary action (shown as Figure 18).

Figure 18 The illustration of the 'Secondary Action': One dwarf shows he is flustered through his actions. The primary action is the body jumping up and down, but his confusion is shown by having his arms follows a different pattern from his body (taken from Thomas and Johnston, 1984: p. 63)

9. **Timing** refers to the place in which actions occur. Animators use the

   number of drawings or frames for a given action to present the speed of the

   action.

[28]

10. **Exaggeration** is used to dramatize a character's motion through the extreme of natural movement (Figure 19).

Figure 19 The illustration of 'Exaggeration': Donald Duck is hit in the face with a scoop of ice cream (taken from Thomas and Johnston, 1984: p. 64)

11. **Solid Drawing** refers to the consideration of forms in three-dimensional space. Animators need to understand the basics of three-dimensional shape, weight and balance. A character's shape, weight and balance is always changed when it moves in space.

12. **Appeal** is used to capture and involve the audience's interest in characters. Appeal in a character of animation corresponds to charisma in an actor. In animation, a character's appeal can be presented through its design, drawing or personality so the audience can understand and enjoy watching.

The above twelve principles support an illusion of characters adhering to the basic laws of physics on the screen. On the other hand, they are used to address more abstract issues such as emotional timing and characters' appeal. Although the basic principles are applied to traditional hand-drawn animation originally, they still are essential guidelines for today's prevalent computer animation (Liverman, 2004).

2.2.4.2 How Animators Address Expressive Behaviour

Walt Disney said "*In our animation we must show not only the actions or reactions of a character, but we must picture also with the action…the feeling of those characters* (Thomas and Johnston, 1984; p.473)." The animator is concerned about how to convey the character's feeling to his audience through expressive body movement based on the

[29]

story (ibid). In this respect, the animator might be thought of as a kind of actor, sharing the actor's interest in conveying feeling through performance.

For aiding the animator to understand acting, Ed Hook's book ACTING FOR ANIMATORS (2003; pp1-10) provides seven "*essential concepts*":

- *Thinking tends to lead to conclusions; emotion tends to lead to action.*

- *Acting is reacting. Acting is doing.*

- *The character needs to have an objective.*

- *The character should play an action until something happens to make him play a different action.*

- *All action begins with movement.*

- *Empathy is the magic key. Audience empathize with emotion.*

- *A scene is a negotiation.*

The animator and the actor should create empathy with the audience so the character is real in the audience's mind. Each of them has a comparable knowledge of acting, Thomas and Johnston (1984) pointed out that the animator has three special and noticeable issues in acting: 1. understanding the character's reaction in a particular condition; 2. skilful drawing to capture that understanding; 3. retaining the 'fleeting, delicate thought' of the moment over the several days it may take to animate the scene. Thomas and Johnston (ibid) stated that when the actor feels right in their emotion and action, they perform it within the moment. The animator needs to stop the time to capture subtle expressive movement, dissects it, recreate it, sketch it on the paper and discuss it in a group discussion (ibid).

As discussed in 2.2.3, Ryoichi Hasegawa of Sony Computer Entertainment Japan indicated that game designers use animators' techniques for the creation of characters' behaviour. In the aspect of creating characters' realistic movements, the avatar designer appears to share the same techniques with the animator. Avatars' realistic movements in

virtual worlds could be supported by animators' techniques. However, animators and avatar designers have different purposes to create realistic movements. The animator aims to tell a particular story but the avatar designer aims to support users to address unpredictable online interaction.

2.2.5   Section Summary

Photographic realism and behaviour realism seem to enable humanoid avatars to resemble human beings. However, behaviour realism appears to be more important than photographic realism when considering online interaction. Social behaviours in the virtual environments seem to mirror those in the physical environment. To create expressive behaviour by avatars, researchers such as Salem and Earle (2000), Guye-Vuillème et al (1999), and Gillies et al (2004) suggested that avatar designers should focus on the field of nonverbal communication. Salem and Earle (2000) discussed that

> *"With a human-like avatar, it is possible to exploit some of the non-verbal communication (NVCs) capabilities, facial expressions, hand gestures and, body postures. At the same time these NVCs will be perceived and easily understood by the other participants in the CVE* [5] (pp.94-95)."

The real world communication involves other nonverbal channels of communication such as face expression, eye gaze, duration of glances and facial expressions, postures and gestures. These nonverbal channels play an important part in social interaction and could be applied in online interaction. Therefore, nonverbal cues in face-to-face communication and relevant theory will be discussed below.

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[5] CVE is the abbreviation of Collaborative Virtual Environment.

2.3 Face-to-Face Communication in Social Interaction

Expressive behaviour in face-to-face communication serves two important functions in social interaction: the communication of emotion and conversation management. As Picard (1997) stated, *"emotions not only contribute to a richer quality of interaction, but they directly impact a person's ability to interact in an intelligent way* (p.2)." The communication of emotion is integral to the regulation of communication and interaction. Garau (2003) explained that conversation management concerns the use of body movements to ensure the smooth flow of social interaction. Body movements such as facial expression, gesture and posture give structure and rhythm to the conversation. They are essential to maintaining a sense of mutual understanding (ibid).

2.3.1 Emotion

Emotions are our natural instincts and every factor in our life may arouse these natural instincts. As Lupton (1998) discussed *"...emotions are phenomena that are shaped, experience and interpreted through social and culture processes* (p.2)." Emotions, which include emotional mental states and emotional bodily processes, arise from highly negative or positive appraisals (O'Shaughnessy and O'Shaughnessy, 2003: p21). Our daily life has been weightily influenced by emotions and they are reflected in physiology, expression and behaviour.

Emotions are an important part of social communication and play a significant role in interpersonal interaction. From Plutchik's perspective, emotions have two main functions: the first function is to provide information about intentions or probable behaviour to others and the second function is to increase the opportunity of survival when individuals faced with emergencies (Strongman, 2003). Ekman (1999) also

[32]

discussed that the primary function of emotions is to stimulate the organism to cope with important interpersonal conflicts rapidly. Based on these perspectives, emotions could be considered as protective reactions to adjust ourselves to circumstances and aid us to develop social relationships.

We might assume that emotions can be divided into positive emotions and negative emotions. In terms of classification of emotions, from the past to the present, psychologists and sociologists still debate whether emotions should be identified as separate primary states. One of the most important classification approaches in the investigation of emotion is the three-dimensional circumplex model of emotion developed by Robert Plutchik (Figure 20).
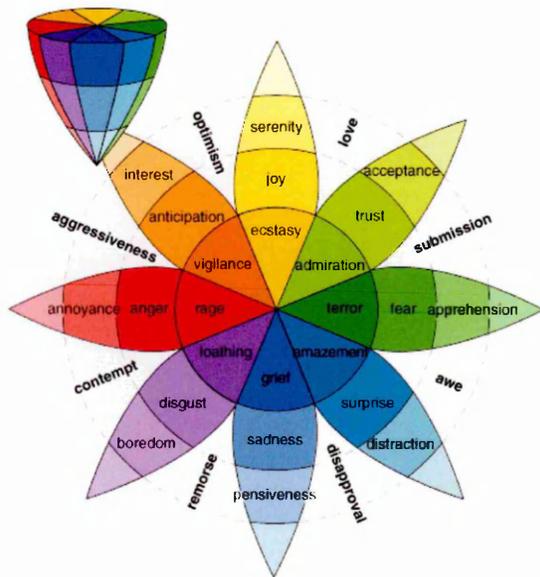
Figure 20 Plutchik's three-dimensional circumplex model of emotion (taken from Plutchik, 2001)

Plutchik (1980, 2001) considered that emotion is multidimensional and the dimensions are intensity, similarity and polarity. He listed eight primary emotions: joy, anger, anticipation, disgust, sorrow, fear, surprise, and acceptance. The eight primary emotions are biologically primitive and have evolved in order to increase the reproductive fitness of the animal. By using the cone-shaped model and the wheel model in 1980, Plutchik described how emotions are related. He suggested these

[33]

primary bipolar emotions as follows: 1. joy and sadness; 2.anger and fear; 3. trust and disgust; 4.suprise and anticipation. Then he developed his circumplex model to link the idea of an emotion circle and a colour wheel. The circumplex model shows that the primary emotions can be expressed at different intensities and mix with another to form different emotions.

Another classification approach is Millenson's (1967) three-dimensional model of emotional intensity. Millenson abstracted anxiety, elation and anger as three basic emotions that can be regarded as vectors to form a three–axis system. Applied and removed stimulus with different facets of emotional experience is associated in this system. As shown as Figure 21, S+ represents an applied positive stimulus, $+ represents a removed positive stimulus, S- represents an applied negative stimulus, and $- represents a removed negative stimulus. Millenson placed an emotional archetype along each axis: the x-axis with anger, the y-axis with anxiety, and the z-axis with elation. He acknowledged that these three emotions cannot account for the sum total of emotional experience. Therefore, he compensated for this in two approaches: 1. some emotions are indistinguishable from each other only in terms of their intensity; 2. anxiety, elation and anger are basic emotions and other emotions are simply compounds of these.
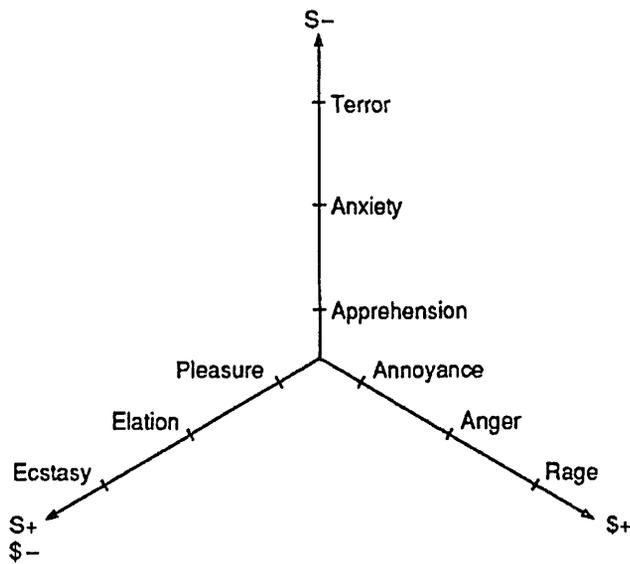
Figure 21 Millenson's three-dimensional model of emotional intensity (taken from Strongman, 1995)

Plutchik's three-dimensional model of emotion and Millenson's three-dimensional model of emotional intensity are dissimilar but both of them pointed out other emotions are derived from primary emotions. Many researchers also proposed their perspectives on the classification of basic emotions based on their research. For example, Ekman and Friesen (1978) considered that individuals' face can present six basic affects: happiness, sadness, fear, anger, surprise, and disgust by observing the photographs of facial expressions. Table 1 shows the selection of lists of basic emotions from these researchers' studies. Ortony and Turner (1990) concluded that anger, happiness, sadness, fear and disgust are basic emotions because these emotions are most commonly adopted in the study of psychology.

Table 1 The selection of lists of basic emotions

Researchers	Basic Emotions
Millenson (1967)	Anxiety, Elation and Anger
Izard (1977)	Anger, Contempt, Disgust, Distress, Fear, Guilt, Interest, Joy, Shame, and Surprise
Ekman & Friesen (1978)	Happiness, Sadness, Fear, Anger, Surprise, and Disgust
Plutchik (1980)	Joy, Anger, Anticipation, Disgust, Sorrow, Fear, Surprise, and Acceptance
Panksepp (1982)	Expectancy, Fear, Rage, and Panic

[35]

| Tomkins (1984) | Anger, Interest, Contempt, Disgust, Distress, Fear, Joy, Shame, and Surprise |
| Shaver et al. (1987) | Love, Surprise, Joy, Sadness, Fear, and Anger |

Emotional responses are an important part of social communication and play a significant role in interpersonal interaction. O'Shaughnessy and O'Shaughnessy (2003) described that the appraisal of emotive stimuli causes emotional responses which include cognitive effects, arousal of feelings, behavioural expressions/displays, and affect-driven individuals' action. These emotional responses are influenced by individual characteristics (e.g. personality, perceptions, attitudes and needs), environment (e.g. culture, subculture and family), and genetics (Chaudhuri, 2006). Emotional responses could be regarded as the form of emotional expressions. Emotion and expressive behaviour seem to be connected closely so avatar designers may need to look into the field of emotion when creating expressive behaviour by avatars.

As discussed above, psychologists and researchers proposed diverse classifications of basic emotions, e.g. Ekman & Friesen (1978), Plutchik (1980), and Shaver et al (1987). These emotion classifications may usefully aid people to interpret and classify the meaning of expressive behaviour. In this research, participants were asked to observe, analyse and interpret actors' expressive behaviour in the film clips. These psychologists and researchers' emotion classifications were used in the pilot study of this research (3.3.2). However, these classifications of basic emotions seemed to limit participants to describe their feelings and interpret actors' acting. For this reason, this research did not use these psychologists or researchers' basic emotion classifications in the two workshop studies (Chapter 4 & 5).

2.3.2   Nonverbal Behaviour

Compared with verbal communication, nonverbal communication (NVC) appears to be more spontaneous and harder to fake (Knapp and Hall, 2010). Its signals usually

complement verbal communication because it can elaborate and support the verbal aspects of message. Sometimes, nonverbal signals may signify emotions, attitudes or experiences that are difficult to express through a verbal approach (Argyle, 1990). The common channels of NVC includes facial expression, gaze, gestures, posture, bodily contact, vocal behaviour, clothes, and other aspects of appearance. However, some apparently 'nonverbal' communication has a linguistic form. The sign languages of deaf people, for example, are made up from hand movements but these gestures have a linguistic structure (Knapp and Hall, 2010). Thus, NVC is defined as the process of communication by means of sending and receiving messages without linguistic form.

The field of NVC is extremely complicated because of meaningfulness. Argyle (1990) described that the basic paradigm of NVC includes encoding and decoding of nonverbal signals (see Figure 22). A nonverbal signal of a sender's state is encoded then this signal may be decoded by a receiver. Then, there are some possibilities (ibid):

1. The sender and the receiver communicate with a shared code.

2. The receiver incorrectly decodes the signal because the poor ability of the sender or the receiver, or both.

3. The sender delivers a deceptive message.

4. The sender does not intend to communicate at all but his behaviour contains information that could be decoded by the receiver.

5. The sender does not intend to communicate and the receiver decodes erroneously because of the incorrect beliefs about the meaning of NVC.
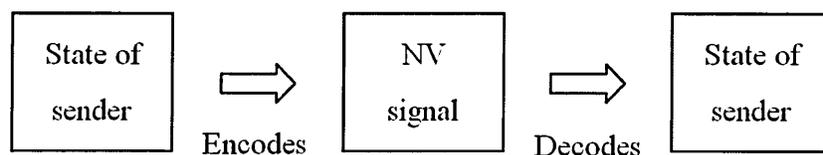
Figure 22 The paradigm of NVC (taken from Argyle, 1990)

Between encoding and decoding, there are a great many issues that we could explore. In encoding studies, researchers aim to find out how emotions, attitudes to

[37]

other people, or other states are encoded into nonverbal signals (ibid). The purpose of decoding studies is to study how subjects perceive, interpret, or react to nonverbal signals (ibid). Basically, the contribution of this encoding-decoding paradigm is aiding investigators to distinguish between focus on encoding and on decoding.

The role of encoder and decoder are always shifting in interpersonal interaction because of alternate sending and receiving. We have varying degrees of awareness and control in this process of communication (Knapp and Hall, 2010). We might carefully encode our nonverbal behaviour and we are very much aware of what we are doing. On the other hand, we may respond more automatically with little conscious or unconscious, especially when rapid response is important. According to the intention of nonverbal behaviour, Ekman and Friesen (1969) provided two general categories for behavioural messages that are the 'informative act' and the 'communicative act'[6]. These two categories on the part of both encoder and decoder may be misinterpreted because of role and context.

A simple paradigm that is provided by Mackay (1972) explains why we construe or misconstrue nonverbal behaviours in interpersonal communication (see Figure 23). The encoder expresses goal-directed and non-goal-directed signals but the decoder may confuse these categories (Figure 23).

Nonverbal signals
- goal-directed (g-d) — interpreted as g-d
- non-goal-directed — not interpreted as g-d
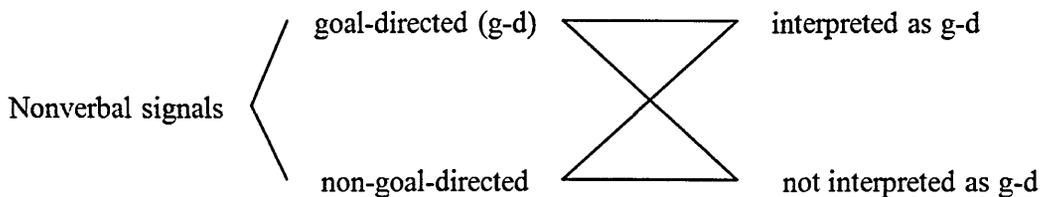
Figure 23 The goal-directed and non-goal-directed paradigm (taken from Mackay, 1972)

On the whole, people can show emotional expressions, attitudes, and status in the various nonverbal behaviours that are manifested by the body. Knapp and Hall (2010)

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[6] According to Ekman and Friesen, in the 'informative act', the encoder may be aware or unaware his behaviour to inform unintentionally signals to the decoder. However, the encoder attempts intentionally to send a specific message through the 'communicative act'.

[38]

pointed out that body movement and position include gestures, posture, touch behaviour, facial expression, eye behaviour and vocal behaviour. Each of these body movements functions in a distinctive approach (Argyle, 1990) and some researchers have focused on specific movements - e.g. work on facial expressions by Ekman and Friesen (1978) or investigation in gesture and posture by Lamb and Watson (1979), Pease (1984), and Kendon (2004).

Although these specific movements are subtle, they are essential competences in holistic activity. In order to make animation convincing, Disney animators found that it is necessary to consider the overall pattern of facial and bodily movement rather than individual features (Thomas and Johnston, 1984). Therefore, avatar designers should look into how these competences in a synergy address the issue of interpersonal communication when creating expressive behaviour in the virtual world.

As discussed above, Argyle's encoding-decoding paradigm describes how people encode and decode nonverbal behaviour in face-to-face communication. This paradigm appears to indicate how avatar designers transform people's expressive behaviour into an avatar's expressive behaviour. Avatar designers are supposed to encode the avatar's expressive behaviour for viewers to decode. To encode the behaviour by avatars, designers may observer and interpret expressive behaviour in the physical world then create expressive behaviour by avatars in the virtual world.

Avatar designers might observe expressive behaviour in the physical world and interpret the meaning by themselves. Because expressive behaviour presented in interpersonal communication may vary from person to person and context to context, the interpretation of expressive behaviour given by individual designers appears to be limited and insufficient. As shown as Figure 23, designers may construe or misconstrue nonverbal behaviours in interpersonal communication. In response to this problem, a wider range of people, representing the range of users, might be involved in the design

[39]

process of expressive behaviour by avatars. Avatar designers may then have the opportunity to consider different interpretations and perspectives on expressive behaviour in the physical world. Therefore, methods and techniques for user involvement in the design process will be discussed in 2.4.

2.3.2.1 Facial Expression

In social interaction, facial expressions are an efficient carrier of emotions. As Russell and Férnandez-Dols (1997) stated, production and recognition of facial expressions is considered as an effective signalling system between humans. The intensity of positive emotions and negative emotions in experience and in facial expression express more clearly than in tone of voice (Argyle, 1990). Facial expressions reflect interpersonal attitude and provide feedback on others' comments. Therefore, facial expression is considered as the primary source of information after human speech.

Darwin (1872) was the first person to propose that facial expressions of emotion are universal and inherited. He suggested that emotions and their expressions are biologically innate and evolutionarily adaptive. However, later researchers such as Klineberg (1938, 1940) and LaBarre (1947) recognized that facial expressions varied between cultures.

More recently, the greatest amount of emotional research has been devoted to facial movement and expressions. Researchers attempted to objectively describe and quantify all visually different units of facial action seen in adults. They also argued that facial expressions are universal and inherited. For example, Friesen's (1972) study documented that the same facial expressions of emotion were produced spontaneously by subjects who were from different cultures when watching emotion-eliciting films. Ekman & Oster (1979) stated that newborn infants have the same facial musculature as adult humans have and it is fully functional at birth. Congenitally blind subjects' facial

expressions are the same as sighted subjects when emotions are spontaneously aroused (Cole et al, 1989; Galati et al, 2001). Matsumoto et al (2008) reviewed these studies and noted that over 75 studies demonstrated that these very same facial expressions are produced when emotions are elicited spontaneously.

In the study of facial expression, there is a noticeable system – the Facial Action Coding System (FACS) to analyse and categorise facial expressions. FACS is developed by Ekman and Friesen (1975, 1978) to describe the visible muscle activity in the face comprehensively. According to Ekman and Friesen's definition, Action Units (AUs) are a contraction or relaxation of one or more muscles. A facial expression can be considered as a high level description of facial motion and decomposed into the specific action units. FACS is based on highly detailed anatomical studies of human faces and results. Therefore, the system is a common standard to systematically categorise the physical expression of emotions in the face and applied to the field of social psychology and computer animation (e.g. Argyle, 1994; Bartlett, 1998; Terzopoulous and Waters, 1993; Fabri and Moore, 2002, 2004, 2005).

An avatar's head and shoulder may fill the screen when an avatar user engages in one to one conversation with another person. In this situation, the face is the important medium for the online interaction. The avatar user may connect emotionally to the avatar's face and avatar designers have the opportunity to provide users with a wide range of expressive behaviour that might reflect both generic expressions used by most people and local cultural variations.

2.3.2.2 Eye Gaze

The simulation of eye gaze seems to be the key to create realistic avatars in online conversation. As Gillies et al (2004) discussed that eye gaze is fundamental in showing interest levels between characters and as means of anticipating events so it is important

[41]

to an animated character's realism and believability. Indeed, eye gaze is an informative behaviour in face-to-face communication. After reviewing the research of Kendon (1967) and Argyle and Cook (1976), Garau (2003) pointed out that eye gaze in face-to-face conversation serves communicative functions as follows: regulating conversation flow, providing feedback, communicating emotional information, communicating the nature of interpersonal relationships, and avoiding distraction by restricting visual input.

Although eye gaze involves facial features, it is different to the facial expression. The perception of eye gaze direction depends on "*the the position of the irises within the looker's eyes*" and "*the orientation of the looker's head*" (Todorović, 2006). Before showing behaviours such as speaking or moving toward, a person will look to another.

The making and breaking of mutual gaze regulates the beginning and ending of social encounters (Argyle, 1990). Eye gaze is an important precursor to interpersonal interaction. In conversation, eye gaze allows a speaker to monitor others for attention and understanding. A listener usually spends a large proportion of time looking at the speaker to signal interest and attention. However, a lack of eye gaze towards the speaker is an obvious message of the lack of interest of the listener towards the speaker. Kendon (1967) stated that a speaker makes longer eye contact towards the end of his turn and selects the next speaker by ensuring that a mutual gaze is established with that person. It shows that eye gaze regulates turn taking in conversation.

Eye gaze seems to serve the same communicative functions in virtual worlds. For example, the avatar's eye gaze could be used to show the avatar user where to focus. Also, the avatar's eye gaze could indicate the avatar user's attitude. Avatar designers may design faces with very 'readable' eyes, for example high contrast between pupils and whites of eyes so avatars' gaze direction would be easy to determine.

[42]

2.3.2.3 Gestures and Posture

The face plays the complex role in face-to-face communication because of facial expressions and eye gaze. In addition to the face, the body can be considered as another communicative carrier for conveying information about emotion. For example, De Silva and Bianchi-Berthouze (2004) demonstrated that most participants could recognize the affective message displayed by actors without a defined context and facial expressions. Ekman and Friesen (1969) suggested that body movements ('acts') convey additional information about the intensity of an emotion while the face communicates information about the nature of an emotion.

We often rely on the face to express and understand emotions in conversation. However, the judgement of facial expression appears influenced by affective body movement when face and body display conflicting emotional information to individuals (Meeren et al, 2005). The reason may be that awareness and control of facial expression is keener than for bodily behaviours. Bodily behaviour contain gestures and posture: gestures refer to the movement of the body and posture refers to the position of the body.

Face-to-face conversations are usually accompanied by gesture. Thompson and Massaro (1986) indicated that listeners rely on gestural cues when speech is ambiguous or in a speech situation with some noise. Salem and Earle (2000) stated that gestures are "*the most comprehensive NVC skill* (p.96)." According to communicative functions, gestures can be classified as follows: 1. Symbolic gestures; 2. Metaphorical gestures; 3. Pointing gestures (ibid). Symbolic gestures are used consciously and intentionally because they encode meaning in conventionalized movements of the hands to substitute with a word or phrase, for example 'thumb-up' and 'thumb-down'. Metaphorical gestures are visual representation of abstract ideas. They provide salient and additional

[43]

information to explain the aspect of the conceptualization. Pointing gestures are a common and intuitive approach to get a person's attention to a direction of a certain object.

People change their posture depending on the situation so posture is situation-relative (Fast, 1970). Posture is also relevant to longer-term aspects of conversation rather than to micro-momentary feedback (Garau, 2003). Scheflen (1973) reported that posture shifts and other body movements seem to mark the points of change between one major unit of communicative activity and another. In addition, there is a connection between postures and certain attitudes (Bull, 1983). In a conversation, for example, a person shows his positive sentiment with a forward lean. However, he shows boredom with a backward lean, lowering of the head or leaning the head on one's hand, outstretched legs, and turning the head away (ibid).

As discussed above, avatars' gestures and postures may have their functions in the virtual world: 1. postures could be used to express the general state of the avatar; 2. gestures seem to be more closely integrated with the flow of conversation between avatars. Gestures and postures could be useful to convey additional information about the intensity of an emotion when avatars have the conversational distance. Because posture refers to the position of the body, gesture animations could be generated using the same body animation system as postures.

2.3.3   Section Summary

Nonverbal behaviour appears to be indispensable to face-to-face communication. Avatars' ability to convey such nonverbal cues seems to affect how they are perceived as well as their contribution to online interaction. Argyle's encoding-decoding paradigm (Figure 22) provides a framework of avatar designers transform people's expressive behaviour into an avatar's expressive behaviour. Avatar designers may decode examples

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of expressive behaviour in the physical world to gain the understanding needed to encode useful expressive behaviour in avatar behaviours which are then further encoded by avatar users in actions to be decoded by other users. Because expression may vary from person to person and context to context, interpreting by individual designers may not be sufficient. This research suggests that avatar designers could work with suitable people for the creation of expressive behaviour by avatars. The following section will discuss methods and techniques for user involvement in the design process.

2.4   User Involvement in the Design Process

Since the early 1970's manufacturing companies have increasingly focused on user involvement in the design process to look deeply into the needs of users. From the 1970s to today, many design methods have been developed and applied in design research to investigate users' needs and perspectives. Participatory design and user-centred design are two significant approaches to this (Sanders and Stappers, 2008).

In this section, I will discuss both user-centred and participatory design but my work in this thesis has focused on developing and evaluating methods for participatory design.

2.4.1   Participatory Design

The term participatory design was initiated in Scandinavia in the 1970s and initially named cooperative design. In early Scandinavian projects, researchers collaborated with trade unions to embody the existing skills of workers in the design and use of computer-based systems. The Norwegian Iron and Metal Workers Union's NJMF project was the first project to move from traditional research to working with users, and changing the role of local unions in research (Ehn and Kyng, 1987). In these

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projects, these users had no experience in system design so researchers employed a range of methods in practical work. For example, Ehn and Kyng (1991) used mock-ups with language games to develop and refine workers' needs in the UTOPIA project.

Participatory design is an approach to involve the user as the co-designer in the design process in order to ensure products or systems designed meeting users' needs. Spinuzzi (2005) provided the explanation of participatory design: "...*the approach is just as much about design – producing artifacts, systems, work organizations, and practical or tacit knowledge – as it is about research* (p.164)." The main feature of participatory design is co-research and co-design in the design process. Hence I use the term 'Inquiring Methods for Designers' in the title of this thesis.

Schuler (2008) stated that

> "*participatory design is an integration of three interdisciplinary concerns that span research and practice: the politics of design; the nature of participation; and method, tools and techniques for participation* (p.211)."

This approach attempts to inspect the invisible and tacit aspects of human activity that can be produced through designed artefacts, work arrangements or work environments. Various research methods including ethnographic observations and interviews together with creative workshops may be used to iteratively construct the emerging design. In the design process, designers and researchers attempt to empower users in making their own decisions. On the other hand, designers and researchers are developing and refining their understanding of the activity with users. In participatory design, designers and researchers have to come to conclusions in conjunction with users (Spinuzzi, 2005).

Because users involved in the design process are considered as co-designers, Sanders and Stappers (2008) pointed out that the participatory design approach is a 'user as partner' approach. As shown as Figure 24, the designer, the researcher and the user are emerging in the designing process through participatory design. In fact, the

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designer and the researcher may be the same person (ibid). These people are giving the position of expert of his/her experience to share their knowledge in the design group (ibid). The participatory designer and researcher respect the expertise of the user in co-designing. Therefore, participatory design appears to be more about designing with people (Sanders, 2006).
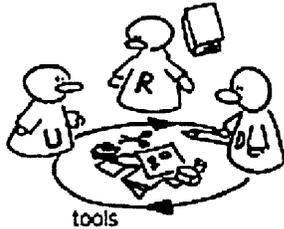
Figure 24 Designers, researchers and users are merging in the design process through participatory design (adopted from Sanders and Stappers, 2008)

As discussed above, participatory design involves users as co-designers in the design process. Therefore, this approach has its advantages and disadvantages to the design team. The advantages include:

- Users bring important knowledge of their context in designing so the design team potentially obtain more accurate information to inform their work.

- The design process is democratic decision making and users have more opportunity to influence the design decision.

- Designers could obtain users' immediate feedback on design ideas.

- There is potential to generate more or better ideas than designers alone.

- This approach gives every participant a sense of participation in the design process.

The disadvantages include:

- The design process takes a long time.

- The democratic decision making may force designers to compromise design.

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- Users may be able to come up with problems but not solutions.

- The design process may exacerbate personality conflicts between designers and users.

2.4.1.1 Co-Design

This research focuses on a specific aspect of Partisipatory Design – Co-Design.

As Sanders and Stappers (2008) stated "...*in the area of participatory design, the notions of co-creation and co-design have been growing* (p.6)." In the collaborative and cooperative sense, co-design may refer to the collective creativity of collaborating designers and other professionals as well as collaborating designers and users: "*the creativity of designers and people not trained in design working together in the design development process* (ibid: p.6)."

Co-design is a collaboration between designers and other stakeholders. In this research, the co-design stakeholders are users of avatars and online environments. In professional practice a wider range of stakeholders may be involved.

2.4.2 User-centred Design

The term user-centred design originated in the area of human-computer interaction at the University of California San Diego in the 1980s (Norman and Draper, 1986). In the book THE PSYCHOLOGY OF EVERYDAY THINGS (Norman, 1988), Norman uses the term user-centred design to explain that things should be designed with the need and the interests of the user. Besides, he emphasizes on the usability of design – making products that are easy to use and understand. He detailed that design should (ibid, 1988: p.188):

1. *Make it easy to determine what actions are possible at any moment.*

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2. Make things visible, including the conceptual model of the system, the alternative actions, and the results of actions.

3. Make it easy to evaluate the current state of the system.

4. Follow natural mappings between intentions and the required actions; between actions and the resulting effect; and between the information that is visible and the interpretation of the system state.

The user is placed at the centre of the design process. The designer is to facilitate the task for the user and to ensure that the user use the product as intended with a minimum effort to learn how to use it (ibid).

User-centred design is a design approach in which the user influences how to shape the design in the design process. The designer in this process designs products and services for a specific purpose in terms of operations and the tasks that users request (Rubin, 1994). This approach aims to increase the use, success and performance of the designed product in order to meet the satisfaction of the users. Designers (often working with researchers) are required to not only analyse and design in the view of users but also test and evaluate the validity the prototypes with actual users in different design phases. Therefore, the design team requires a lot of experts from different disciplines, particularly psychologists, sociologists and anthropologists whose job it is to understand users' needs (Abras et al, 2004).

User-centred design places the users at the centre of the design process, Sanders and Stappers (2008) pointed out that the user-centred design approach is a 'user as subject' approach. Figure 25 presents the role of user, researcher and designer in the classic user-centred design approach. The user is the object of study in the design process. The role of researcher brings knowledge from theories in the design process. More knowledge is developed by the researcher through observing and interviewing the user. The designer obtains the knowledge in the form of a report and *"adds an*

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understanding of technology and the creative thinking needed to generate ideas,

concepts, etc (ibid, p.12)." User-centred design approach seems to be more about

designing for people (Sanders, 2006)
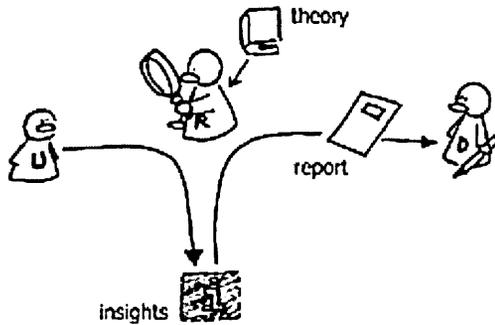
Figure 25 The role of users, researchers and designers are in the classic user-centred design approach (adopted from Sanders and Stappers, 2008)

In user-centred design, there are several advantages and disadvantages to the

design team. The advantages may include:

- The development of products focuses on the usability so products are more

  efficient, effective, and safe.

- It helps designers manage users' expectations and levels of satisfaction

  with the product.

- Users develop a sense of ownership for the final product so products

  require less redesign and integrate into the environment more quickly.

- More creative design solutions to problems could be generated through the

  collaborative process.

On the other hand, the advantages may include:

- The design process takes more time to gather data from and about users.

- The design team requires resources including financial and human.

- Expert members in the design team must learn to communicate effectively

  and to respect each other's contributions and expertise in the design

  process.

- Some types of data may be difficult to translate into design.

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- The product may be too specific for more general use and not readily transferable to other clients.

2.4.3   Relevance of Participatory Design to Online Communication

As Gulliksen et al (1999) stated

> "*It may seem that User Centered Design (UCD) and Participatory Design (PD) are very similar, almost equivalent terms, with PD being a subset of UCD. However, what came to light during the workshop was that these are two overlapping sets, with an uncertain amount of overlap. Some cases were presented in the workshop which were user-centered, but which had no true sense of user participation (in the design process), whilst other projects were discussed where the user participation was in no true sense user-centered* (p.8)."

Participatory design and user-centred design are similar in the fact that they involve users in designing. However, there are different in some fundamental ways. Here, I use Sanders's map of design research to discuss the difference between participatory design and user-centred design (Figure 26).
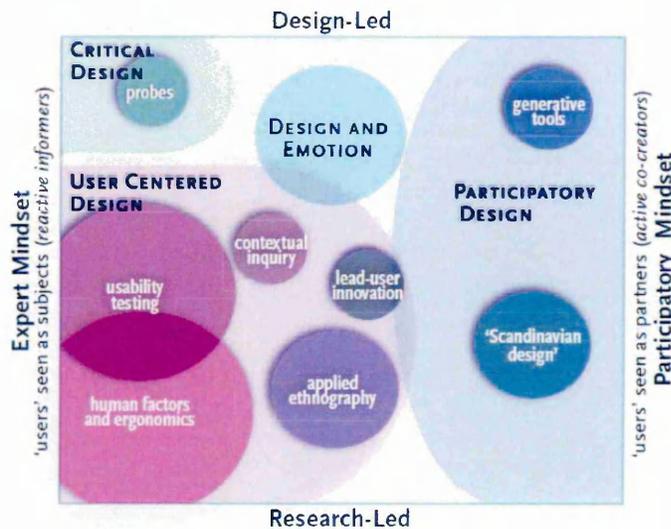
Figure 26 Topography of design research (taken from Sanders, 2006)

This map is defined by two dimensions: the vertical dimension is defined by approach and the horizontal dimension is defined by mindset. Approaches to design research have come from a research-led perspective and a design-led research. Two

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opposing mindsets are evident in the practice of design research: expert mindset and participatory mindset. Participatory design and user-centred design are two larger zones in this map.

In user-centred design, designers and researchers see users as subjects because they place the users at the centre of the design process. Designers and researchers use research-led approaches with an 'expert' mindset to collect, analyse, and interpret data from users. Also, they test and evaluate concepts and prototypes with users. Users have limited power because they are not given decision power and only consulted in the design process. In participatory design, users are seen as true experts in domains of experience such as living, learning, and working. Designers and researchers use research-led and design-lead approaches with a participatory mindset to value the users as co-creators in the design process. Users are empowered in making their own decisions so the design decision can be influenced by users.

As discussed in 2.2.3 and 2.3, avatar designers are suggested to focus on the field of NVC for the creation of expressive behaviours by avatars because socialising in virtual worlds is indeed affected by nonverbal cues. In 2.3.2, the paradigm of NVC (Figure 22) proposed by Argyle (1990) indicates that this paradigm consists of encoding and decoding of nonverbal signals. Avatar designers have the ability to encode nonverbal signals for their creations. However, encoding by individual designers appears to be insufficient because emotional expression may vary from person to person and context to context. According to Mackay's goal-directed and non-goal-directed paradigm (Figure 23), designers may construe or misconstrue nonverbal behaviours in interpersonal communication. Suitable people who have insight into nonverbal communication and share their insights with willingness could be seem as participants and involved in the design process.

To encode nonverbal signals for interpersonal communication is highly related to

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personal knowledge and experience. Avatar users may have different interpretations of the same expressive behaviour. They also may encode different nonverbal signals for the same expression of emotions, attitudes, or status.

On the other hand, these users might be empowered to propose and create expressive behaviours and thus enable avatar designers to recognize more potential expressive behaviours. These proposed expressive behaviours may have potential to be applied in virtual worlds if a suitable method could be found to allow these users to influence designing. To explore this, I chose to investigate participatory design methods for creating avatars' expressive behaviours.

2.4.4 Mock-ups

The technique of mock-ups initially used in participatory design research is introduced by Ehn and Kyng (1991). In the UTOPIA project, Ehn and Kyng focused on the future of computer-supported newspaper production and invited journalists and typographers (the stakeholders) in the participatory design of new computer systems for newspaper layout. Ehn and Kyng produced a series of detailed system descriptions for the stakeholders but the stakeholders could not understand the system descriptions.

As Ehn and Kyng (ibid) stated, *"The descriptions did not remind the user of familiar work situations...The experience of using these descriptions did not relate to their work experiences* (p.179)." The stakeholders could not use the system descriptions to work out possible solutions in their work situations. Therefore, Ehn and Kyng used 'mock-ups' as simulations of technical artefacts to overcome the problem.

These 'mock-ups' were basic materials and existing objects. For example, they stuck a label of 'Desk Top Laser Printer' on a cardboard box (Figure 27). In addition to 'mock-ups', a design-by doing language game is also used in the activity of designing (Figure 28). The design language game in the UTOPIA project had a family

resemblance to other language games. The stakeholders' conversations and activities occurred around mock-ups have resemblance to their conversations and activities occurred around real machines.

Figure 27 A mock-up of a laser printer (taken from Ehn and Kyng, 1991)

Figure 28 Designers and potential future users envisioning the future of page make up playing with the UTOPIA mock-up (taken form Ehn and Kyng, 1991)

As Ehn and Kyng (ibid) noted,

> *"design artefacts such as mock-ups can be most useful in early stages of the design process. They encourage active user involvement, unlike traditional specification documents. For better or worse, they actually help users and designers transcend the borders of reality and imagine the impossible* (p.172)."

They also stated that the advantages of mock-ups are:

1. Hands-on experience: Mock-ups enable participants to experience the environment and develop new designs for this experience.

2. Understandable: All participants have no confusion between the simulation and the real thing. They also have the competence to modify mock-ups.

3. Cheap: Mock-ups are basic material and existing objects so design projects

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can be conducted without huge investments.

4. Fun: Mock-ups enable participants to with others through design language games.

In general, mock-ups are made of cardboard or other low-fidelity materials. Designers use mock-ups mainly to obtain feedback from users about designs and design concepts in early design process. By using mock-ups, users provide valuable feedback about understanding, functionality or usability of the basic design ideas.

For the present research, I proposed that avatar designers and suitable users work together to analyse nonverbal cues in the physical world and create nonverbal cues for online interaction. In movies and TV dramas, nonverbal cues in face-to-face communication may be observed through actors' performances. Suitable film clips (3.3.5) with actors' acting in face-to-face communication might be considered as ready-made mock-ups. Film clips may enable participants to express their perspectives but do not enable participants to create expressive behaviour in the discussion. In such design process, participants appear to need tools to create artefacts for discussing their ideas. Generative tools, including mock-ups, will be discussed in the next subsection.

2.4.5 Generative Tools

To empower users in proposing and generating design ideas, generative tools (also known as 'Make Tools') are a 'design language' for users and designers in the process of co-design (Sanders, 1999). They are used to facilitate exchange between the people who experience products, interfaces, systems and spaces and the people who design for experiencing. Therefore, generative tools focus on the aspect of experience rather that the aspect of form in designing.

The technique of generative tools is introduced by Sanders (1992) and she used the term of 'projective techniques' initially. As she suggested,

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> *" Finally, we must examine the researcher's most challenging task, discovery of those needs consumers can't describe, many of which may be only latent. We've found the use of projective techniques, with materials specifically designed for discovery in the product development process, to be promising. Projective measures involve the use of research materials having ambiguity of meaning and a multiplicity of responses* (ibid: p.53)."

The use of generative tools seems to reveal people's tacit knowledge and expose latent needs. In particular, generative tools are useful in generative research that occurred in the generative phase of the design development process (Sanders, 1999).

Generative tools are both visual and verbal so they connect the thoughts and ideas of people from distinct backgrounds and perspectives. As shown as Figure 29, generative tools can be in the form of: "*two-dimension components (e.g. paper shapes and colour photographs)*" and "*three-dimensional components (Velcro-covered forms together with Velcro-backed buttons, knobs and panels)* (Sander, 2000; p.6)." Whether two-dimension or three-dimension, generative tools are designed and used to elicit the expression of stories and narratives. The creation and refinement of generative tools is a design process by itself (Sanders, 2000).
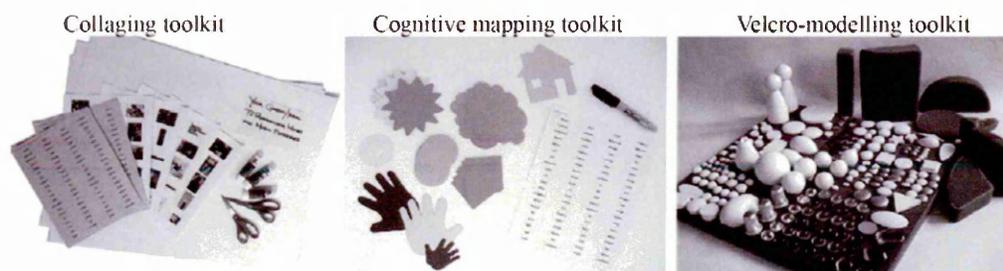
Figure 29 Generative techniques used in practice by SonicRim (taken from Sleeswijk Visser et al, 2005)

Sanders (1999, 2000) also divided these generative toolkits into two categories: 'emotional toolkits' and 'cognitive toolkits'. Emotional toolkits are designed to elicit people's emotional response and expression. By using emotional toolkits, people make artefacts such as collages or diaries that show or tell stories and dreams. Therefore, these tools are extremely effective in accessing emotional states and unspoken feelings from people.

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As for cognitive toolkits, they are designed to uncover meaning and cognitive understanding. Also, they can display the intuitive relationships between system components. Through cognitive toolkits, people make artefacts such as maps, mappings, diagrams of relationships, flowcharts of processes and cognitive models. The descriptions associated with the artefacts from the cognitive toolkits inform how people understand and misunderstand things, events and places.

In summary, generative tools are used to make artefacts designedly by participants in the generative phase of the design development process. As discussed in 2.4.4, film clips might act as ready-made mock-ups in this research. These film clips engage participants in interpreting expressive behaviour. In this design process, participants could be empowered in proposing and creating their expressive behaviours to enable avatar designers to recognize more potential expressive behaviours.

Participants may be users so they may need generative tools to create their own artefacts for expressing their ideas of nonverbal cues. In the practical work below (Chapter 4 & Chapter 5) it will be seen that Generative tools enabled groups of participants in design workshops to work together and express their ideas. The mock-ups gave participants the time and space to listen to each other's ideas, facilitating more effective collaboration.

2.4.6   Tacit Knowledge

Tacit knowledge is knowledge that we cannot readily express in words but can act upon. As Michael Polanyi stated in his book THE TACIT DIMENSION (1966), our knowledge start from the fact that "*we can know more than we can tell* (p.4)". This knowledge is subtle because it is formed from our experiences, emotions, insights, intuition and observations. On the one hand, it involves learning and skills because it contains four aspects – the functional, the phenomenal, the semantic and the ontological

of tacit knowing. On the other hand, it is difficult to transfer to other people through verbalising so we may feel it is difficult to share.

In respect of this ineffable knowledge, Polanyi termed it as 'tacit knowledge' and discussed as below:

> *"To hold such knowledge is an act deeply committed to the conviction that there is something there to be discovered. It is personal, in the sense of involving the personality of him who holds it, and also in the sense of being, as a rule, solitary; but there is no trace in it of self-indulgence. The discoverer is filled with a compelling sense of responsibility for the pursuit of a hidden truth, which demands his services for revealing it. His act of knowing exercises a personal judgement in relating evidence to an external reality, an aspect of which he is seeking to apprehend (p.25)."*

Polanyi (ibid) suggested that tacit knowledge as personal knowledge creates a meaningful relation between the sensory information and the particular movements. This meaningful relationship allows holistic understanding so we can make sense of the particular phenomena. The description can explain why we can deal with exploratory acts through the informed guesses, hunches, and imaginations. Besides, our movements could generate knowledge that can be valuable to others.

In the aspect of participatory design / co-design, tacit knowledge contributes new ways of thinking to designers. Based on Polanyi's concept, Rust (2004) proposed that designers use their professional knowledge or experience in observing participants' actions to gain tacit knowledge that is valuable to a design project.

As discussed in 2.4.5, by using generative tools it is possible to observe tacit or latent knowledge arising from people's experience. This research used the notion of co-design (2.4.1.1) to investigate how a group of participants collaborate to study NVC for the creation of expressive behaviour by avatars.

2.4.7   Section Summary

This research suggests that a participatory design approach could be applied to the creation of expressive behaviours by avatars. People who have insight into nonverbal communication and share their insights with willingness could be involved in the design process. Suitable film clips with actors' acting in face-to-face communication as ready mock-ups would be used for engaging designers and participants in interpreting expressive behaviour. These participants could be empowered in proposing and creating their expressive behaviours to enable designers to recognize more potential expressive behaviours. However, these participants may be users so they may need generative tools in the co-design. Through suitable generative tools, participants would express their ideas of nonverbal behaviour for the creation of expressive behaviour. The process of decoding-encoding nonverbal behaviour is highly related participants' tacit knowledge.

2.5   Research Problem: Generatvie Tools and Methods

The avatar is a representation of the avatar user's identity. To reflect avatar users' personality or cater for experimentation with an imaginary identity, avatar users desire to create distinctive and diverse avatars. In most virtual worlds, users have some control over the representation and the extent to which the persona resembles themselves. From this point, the use of avatar in virtual world is highly user-centric.

Avatars' nonverbal behaviour appears to be a central function in avatar-based online environments. Avatars' social behaviours in the virtual world seem to mirror those in the physical world. Researchers such as Salem and Earle (2000) indicated that the design of avatar expressive behaviour should focus on the field of nonverbal communication. Argyle's encoding-decoding paradigm of NVC (Figure 22) provides an

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explanation of how avatar designers transform people's expressive behaviour into an avatar's expressive behaviour.

As discussed in 2.3.2, avatar designers could interpret expressive behaviour in the physical world and give the value of expressive behaviour based on their knowledge and experience. Because expression may vary from person to person and context to context, the interpretation of expressive behaviour given by individual designers appears to be limited and insufficient. Mackay's (1972) goal-directed and non-goal-directed paradigm (Figure 23) also indicates that designers may construe or misconstrue nonverbal behaviours in the physical world. Therefore, this research suggests that the participatory design approach may offer avatar designers an opportunity to consider different interpretations and perspectives from diverse people (2.4.3).

To encode and decode diverse nonverbal behaviours for interpersonal communication is highly related to personal knowledge and experience. When thinking about the methods for co-design workshops, I moved from Argyle's concepts of encoding and decoding (Figure 22) to a decoding-encoding-decoding paradigm for co-design (Figure 30). This decoding-encoding-decoding paradigm consists of four stages:

1. designers and users decode (analyse) existing examples of nonverbal communication;

2. designers and users encode (co-create) new nonverbal communication;

3. designers reflect on the process of co-creation and encodes (designs) new non-verbal communication in avatar behaviours;

4. the new non-verbal communication is decoded by end-users in decoding.

Decoding	Encoding		Decoding
Designers + Users	Designers + Users	Designers	End-Users.
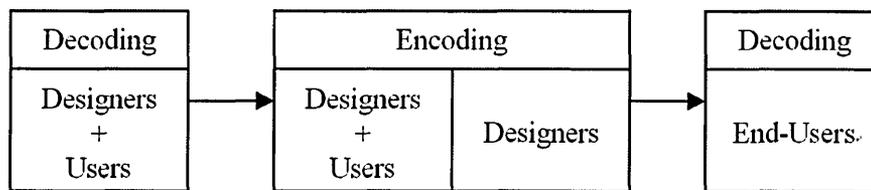
Figure 30 The decoding-encoding-decoding paradigm for co-design

In particular, the first stage of decoding is the activity where designers learn about users' needs and experience in the codesign workshop. The detailed content of the workshops is developed and discussed in chapter 3.

Sanders (2006) suggested that co-desugn (2.4.1.1) requires generative tools that both designers and users can use (2.4.5). In particular, generative tools are useful to the participant who is not educated in design. As Prahalad and Ramaswamy (2004) stated, *"High-quality interactions that enable an individual customer to co-create unique experiences with the company are the key to unlocking new sources of competitive advantage (p.7)."* Generative tools are critical tools to bring designers and users into high-quality interactions. The research question is proposed as follows:

What methods and tools might be used to enable successful co-design collaborations between designers and users in creating useful new expressive behaviours for online avatars?

Two workshop studies (Chapter 4 and 5) were conducted systematically to address the research question. Therefore, this research concentrates on creating and refining the generative tools and methods that are effective in the co-design framework (Figure 30) for creating avatar's expressive behaviour.

2.6 Chapter Summary

Avatars' behaviour realism is an important factor in online environments. Online social behaviours in the virtual environment mirror those in the physical environment. Based on Argyle's paradigm of NVC (Figure 22), avatar designers are supposed to

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encode the avatar's expressive behaviour for viewers to decode. Avatar designers may observe and interpret expressive behaviour in the physical world by themselves to create expressive behaviour by avatars in the virtual world. Expressive behaviour presented in the interpersonal communication may vary from person to person and context to context so diverse user could be involved in the design process. A co-design framework (Figure 30) is proposed for avatar designers and participants to create expressive behaviour by avatars. In this co-design framework, participants need generative tools and methods to share knowledge and facilitate the design work. Therefore, this research focuses on the research question:

What methods and tools might be used to enable successful co-design collaborations between designers and users in creating useful new expressive behaviours for online avatars?

Two workshop studies (Chapter 4 and 5) were conducted systematically to address the research question. The following chapter on methodology will discuss the approach taken towards the two workshop studies.

3 Methodology

3.1 Introduction

I will follow Clough and Nutbrown's (2002) approach of methods being "*...some of the ingredients of research, whilst methodology provides the reasons for using a particular research recipe (p.22).*"

As Sanders (2000) stated "*Creating and refining the generative toolkits is a design process by itself* (p.7)." This research involves designing and evaluating tools, which are themselves used for designing, so it can be confusing to keep a clear picture of research methodology (inquiry) and design methodology (subject of inquiry). The two workshop studies in this research focused on the creation, improvement and evaluation of generative tools helpful in co-creating avatar's expressive behaviour through iterative co-design practices. My role in the workshop studies shifted back and forth between designer and researcher requiring me to consider the roles of the participant observer.

This chapter will discuss the choice of methods used to deal with the research questions. Section 3.2 will review methodologies of practice-led research and action research. Section 3.3 will focus on methods of data collection. It will detail the strategies used to design and pilot the workshop studies, as well as the procedures common to the two workshop studies. Section 3.4 will focus on methods of data logging and analysing. The data gathered in the workshop studies was design protocols including audio-visual recording, pen sketches and video sketches. Analysis methods for evaluation of generative tools will be described.

3.2 Relevant Methodology

3.2.1 Practice-led Research

Practice-led research is a mode of enquiry where design practice is used to create an artefact base for something demonstrated or found out (Pedgley, 2007). Rust et al. (2007) provided a simple definition for practice-led research in the field of art, design and architecture: *"Research in which the professional and/or creative practices of art, design or architecture play an instrumental part in an inquiry* (p.11)." This form of enquiry is important to academically competent designers because they have been empowered both to use their design expertise and to take ownership of design research.

The emergence of practice-led research was indicated by Frayling (1993), who drew on Herbert Read's work on art education and practical examples to describe his perspective on three different approaches to research: research into art and design, research through art and design, research for art and design. Frayling's colleague – Bruce Archer (1995) advanced the model to discuss possible relationships between practitioner activity and research activity in particular.

In Archer's description, practitioner activity such as creative practice might be considered research activity but not all practitioner activity fits in with the criteria of research – *"systematic enquiry whose goal is communicable knowledge* (ibid, p.6)." In order to accord with the academic criteria, he proposed three possible relationships between research and practice:

- research about practice
- research for the purpose of practice
- research through practice

Research about practice can be several types of study area including humanities,

social science, and science disciplines so the methodology will come from the crosscutting discipline (Archer, 1995). When inquiries in design practice are recognized as research activity, these inquiries have to *"employ the methods, and accord with the-principles, of the-class to which they happen to belong* (ibid, p.11)." Similarly, research activity conducted for the purpose of practitioner activity can also be categorised into science or humanities discipline and undertaken based on the principles of its field (ibid). The practitioner activity is in a systematic inquiry so that it could be viewed as research (ibid).

Referring to one of Archer's public speeches, Pedgley and Wormald (2007) discussed that design and research are incompatible because of design's inability to accommodate a 'nil result'. Research and design appear to have much in common[7] but *"the operational rules for the practice of design are different to those for the practice of research* (p.73)." To deal with a debate on academic credibility of design, a more modest arrangement is to involve a researcher undertaking a design practice subservient to stated research aims and objectives (Pedgley and Wormald, 2007; Rust et al, 2007).

Practice-led research is centred on the creative practices of the self so it is highly personal (Pedgley, 2007). From Archer's (1995) viewpoint, research through practitioner action could be considered as Action Research (3.2.2). The findings of Action Research are highly 'situation-specific' and generalisable to a very limited degree (ibid). However, the insights that are produced from these findings can advance more generalisable research by proved case account material. Archer (1995) concluded that

> *"research through practitioner action, despite its being highly*
> *situation-specific, can advance practice and can provide material for the*
> *conduct of later, more generalisable, studies, provided the research is*
> *methodologically sound, the qualifications are clearly stated and the record*

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[7] Pedgley and Wormald (2007) discussed that *"designing and researching both draw heavily upon investigative techniques, and both are forms of educative enquiry (p.73)."*

[65]

is complete (p12).”

Archer's proposal above indicates that the design researcher should move from understanding their research aim to identifying suitable methods. Starting with preconceptions about practice-led research is not helpful but he implies that experienced designers should look for opportunities to exploit their design skills as research tools. Pedgley (2007) discussed that practice-led research is autobiographical research methodology, or 'ethnomethodology'. He suggested that

> *"the intertwined nature of autobiographical enquiry brings a heightened responsibility on researchers to provide methodological clarity, particularly regarding data validity, reproducibility, effectiveness, and the degree of generalisation that can be safely associated with data* (ibid, pp.464-465).”

Therefore, the contribution to design area is the knowledge associated with the artefact rather than the artefact itself (Rust et al., 2007).

My inquiry in this research is guided by the debate I have described above and my approach has elements of Archer's “research about practice” and “research through practice”. In 2.5, I proposed a co-design framework (Figure 30) for co-creating expressive behaviour by avatar. The co-design framework was the subject of this research to respond to my research goals – inquiring and evaluating appropriate generative tools for co-creating expressive behaviour. Some ethnographic methods such as focus group (3.3.4) and observation record (3.3.8) were adopted to obtain the data during workshop sessions. The evaluation of the design methods called for a more quantified approach using social science methods (3.4).

3.2.2   Action Research

Archer (1995) suggested that research through practitioner action, considered as 'Action Research', can advance practice and provide transparent methods, data and knowledge. There are similarities between my research and Action Research but I prefer

[66]

to say the practical work in my research has features of Action Research. Here, I want to discuss how my research relates to Action Research. Archer defined Action Research as *"systematic investigation through practical action calculated to devise or test new information, ideas, forms or procedures and to produce communicable knowledge* (ibid, p.6)." It aims to improve the way of addressing issues and resolving problems in a collaborative progressive practice through acting and reflecting. This methodology is usually employed in practitioner-based environments such as classroom, social, and community settings and undertaken by practitioners who want to become experts in the field.

Action Research is both proactive and reactive for a practitioner researcher (Craig, 2009). In a proactive research process, a practitioner researcher uses expertise to identify potential problems and then conducts systematic inquiry in order to improve conditions when operating naturally in the environment (ibid). In reactive research process, a practitioner researcher identifies an existing problem and then conducts systematic inquiry to correct the problem and improve conditions when interacting naturally in the environment (ibid). Through this 'learning by doing' approach, people who are involved in the practitioner-based environment employ their expertise and knowledge to construct systematic inquiry and action for improving conditions and practice.

Kurt Lewin is generally considered the first researcher to use the term 'Action Research' and he described Action Research as *"a comparative research on the conditions and effects of various forms of social action, and research leading to social action* (Lewin, 1946: p.35)." He also proposed that Action Research proceeds in a spiral of steps each of which consists of a circle of plan, action, and reflection. The form of Action Research, therefore, is a central cycle of action and critical reflection. The critical reflection on the action then informs further iterative cycle. These cycles may

[67]

overlap but the steps within the cycle occur repeatedly (shown as Figure 31).
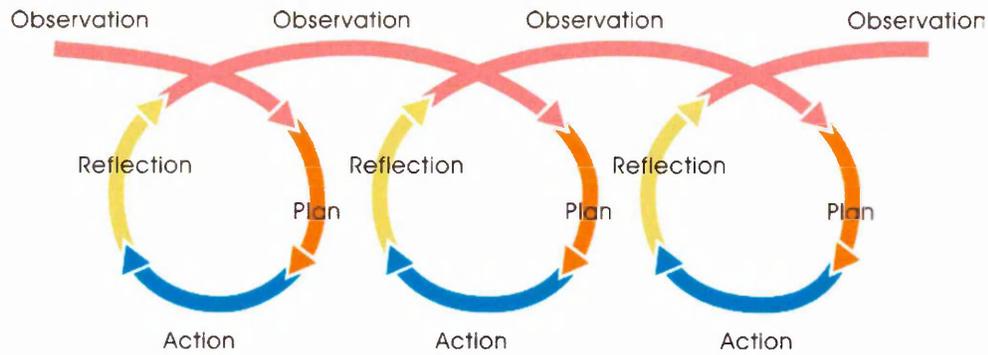
Figure 31 The basic routine of Action Research (modified from Stringer, 1999)

This research has a number of features in common with Action Research. Firstly, it is practitioner-based inquiry. My role in this research had been both designer and researcher. Designers and avatar users (3.3.7) were invited in the workshop studies in this research. I did not have an existing ongoing work environment available as this is a new kind of activity for designers so the setting of the practical work in this research was an artificial 'laboratory', unlike Action Research that takes place in a 'natural' setting.

Secondly, the process of this research, like Action Research, consists of four elements – observation, plan, action, and reflection to identify and refine the practical design methods and understanding. My role in this research shifted back and forth between designer and researcher. To support this dual role I was able to use regular progress meetings with my supervisor and fellow-postgraduates to reflect on the observation aspects of this work. In later stages of the work (chapter 5) I did not take a participatory role, and also had separate sessions with the professional designer who participated, to reflect on what occured in the co-design sessions. Unlike some descriptions of action research (eg Kurt Lewin's central cycle of action and critical reflection), the process of four elements in this research is not linear or iterative but overlapping (shown as Figure 32) [8].

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[8] Some design researchers such as Nicola Wood (Wood et al 2009) have discussed how practice-led research in design differs from Action Research in the degree of openness about purpose and outcome.
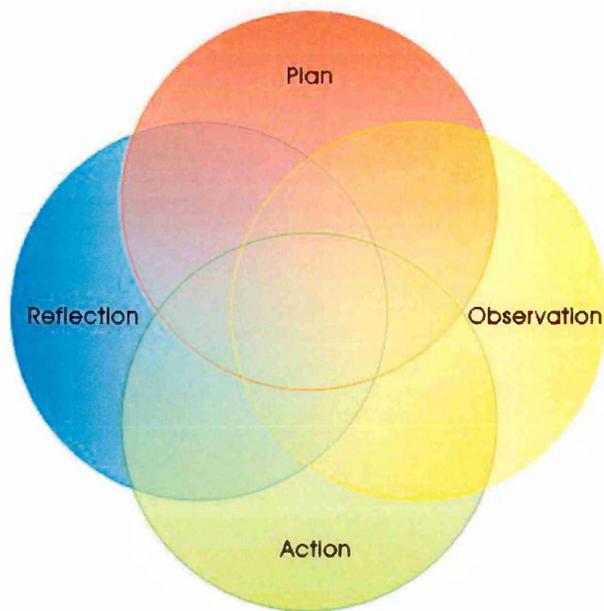
Figure 32 Parallel processes in this research (modified from Wood, 2006)

3.3 Data Collection

This section covers aspects of experimental design and procedure common to two workshop studies in this thesis. Additional details particular to each workshop study will be explained in chapter 4 and 5.

3.3.1 Defining the Research Goals and Expectations

The two workshop studies had a common theme, namely the development of generative tools suitable for co-creating avatar's expressive behaviour in the generative phase of the design process. However, the two workshop studies had different goals: Workshop Study 1 focused on identifying the generative tools and Workshop Study 2 concentrated on confirming the validity of the identified generative tools. The anticipated outcomes were generative toolkits and practical methods that were identified and evaluated in the course of this research. I expected these outcomes would be of interest to designers working on avatar-based online interaction environments such as instant message systems and online games.

[69]

3.3.2 Piloting

Before the two workshop studies, a small group of volunteers were invited to participate in the pilot study. The process of piloting was a necessary step in the process of designing the workshop studies. The purpose of these pilot studies was to explore possible research methods and gain experience with different aspects of experimental design including procedure, questionnaire items, the selection of participants and stimulus films. Many modifications were made to the workshop studies as a result of observations and feedback from the piloting session. This piloting is actually an early cycle in the action research, helping me identify and refine possible elements of the toolkit in the co-design framework (Figure 30) for creating avatar's expressive behaviour. Its emerging findings and understandings provided me the confidence to use stimulus films and the co-design framework in the two workshop studies.

The pilot study consisted of two stages: 1. first explorations of possible practical methods; 2. pilot workshop to test proposed method. In the first stage, three possible methods for observing people's expressive behaviour were tested: observations in public places, role-play with video, stimulus film clips. From my observations, the three methods appeared to have advantages and disadvantages as shown Table 2.

Table 2 Possible practical methods tested in the first stage of the pilot study

Method	Advantage	Disadvantage
Observations in public places	directly captures people's behaviour	captures negative expressive behaviour with difficuty
Role-play with video	directly captures participants' behaviour, allows them to explore ideas	self-consciousness inhibited performance, might have worked with right sort of enabler but not my area of skill
Stimulus film clips	directly observes professional performances with diverse emotions (e.g. happiness, sad, anger, joy)	needs suitable people to suggest potential film clips

The pilot observations indicated that viewing and discussing stimulus film clips is

a useful approach to engage people in observing and analysing expressive behaviours. To adopt the method – the use of stimulus film clip, a film clip suggestion questionnaire (3.3.6) was created to obtain potential film clips (3.3.5.1) and suitable participants (3.3.7.1). Because of the piloting experience, in the end I was able to re-introduce video role play once I had created a suitable setting and tools that overcame the inhibitions observed in the pilot (4.5.1.1).

In the second stage, one workshop involving three volunteers was conducted to focus on how they might analyse[9] actors' expressive behaviour in two film clips. After the workshop, in my participant role as designer, I created two new animations of expressive behaviours based on participants' analysis. Although the animations were quite basic, this experience gave me confidence that the approach could be productive so I went forward to the next stage described in Chapter 4.

3.3.3 Ethical Considerations

Prior to running the two workshop studies it was necessary to submit details of the experimental design and procedure for clearance from the Sheffield Hallam University (SHU) ethics committee. When most details of the workshop studies had been finalised, ethical clearance of the research took place towards the end of the piloting phase. This research followed the SHU research ethics policy (Appendix X). These are the sections of the guidelines that were particularly relevant to this research:

- Informed consent: Participants must be provided with sufficient information about the research project and procedure so that they can make an informed decision about participating. Besides, they must give their consent to participate before the data collection phase.
- The right to withdraw: Participants must be informed that they are free to

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[9] In the piloting workshop, participants were not asked to undertake any design activity.

withdraw from the research at any time.

- Confidentiality: The participants' information that is acquired in the course of research must be maintained confidential. Also, participants' identities must be protected.

- Deception: The researcher must not deceive the participants.

The two workshop studies conformed to ethical guidelines. Before starting each co-design workshop in this research, a brief PowerPoint presentation was arranged to explain the purpose and procedure of the workshop to participants. Then participants were asked to sign a consent form (see Appendix III). They were also instructed that they were free to withdraw from the research at any time without giving any reason. Because the workshop sessions used copyright material, clips from movies and TV dramas, it was necessary to establish that the activity was allowed under 'Copyright, Designs & Patents Act 1988'[10] Section 32.

3.3.4 Focus Group

Typically, in co-design, three different types of sessions could be used: group sessions, pair sessions, and individual sessions. In Sleeswijk Visser et al (2005), the advantages and disadvantages of these are shown in Table 3.

Table 3 The advantages and disadvantages of group, pair or individual sessions (taken from Sleeswijk Visser et al, 2005: p.128)

Type of Sessions	Advantages	Disadvantages
Group	1. Participants can react to each other's experiences. 2. A global view of the context and various user experiences will be created. 3. A large amount of diverse information is generated in one session.	1. Without professional moderation, one dominant participant can influence the group. 2. It is difficult, although possible, to obtain individual responses.

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[10] The 'Copyright, Designs and Patents Act 1988' is an Act of the Parliament of the United Kingdom received Royal Assent in 1988.

[72]

Pair	1. Participants feel comfortable because they are with a friend, spouse, parent, etc. 2. Participants may reveal things about each other. 3. The session can take place at the participant's home or workplace.	1. Less diversity in the total range of participants since members of the pair are related or acquainted.
Individual	1. A lot of attention and time can be devoted to a participant and this can bring out detailed information. 2. The session can take place at the participant's home or workplace.	1. A participant can feel inhibited, because it may feel as if a psychologist is testing him/her about feelings, experiences and needs. 2. It is more time-consuming than groups.

In the pilot study (3.3.2), I used individual discussions and a focus group to test the use of film clips (3.3.5) in creating avatar's expressive behaviour. I could obtain participants' feedback through these two approaches but their responses and attitudes seemed to be different. Participants in individual discussions sometimes seemed self-conscious in response. By contrast, participants in the focus group appeared to chat comfortably. I also recognized that rich information was produced in the focus group because participants not only shared perspectives but also discussed their responses. Participants might have different opinions but insightful information was generated in the group discussion as explained by Litosseliti (2003).

A focus group appears to stand in a middle ground between participant observation and in-depth interview (Morgan, 1992). Lazar et al (2010) suggested

> "...Group discussions support interactivity, with participants ideally balancing each other. Participants can encourage each other to speak up, either in support of or opposition to earlier statements. This highly dynamic situation can stimulate participants to raise issues that they might not have identified in one-to-one interviews (pp.192-193)."

In this aspect, I could obtain participants' perspectives and observe how participants interact with others in workshops.

In general research practice, the size of a full group is from eight to ten people and

the size of mini group is four to six people (Greenbaum, 1998). Larger groups would be useful to obtain more participants' opinions for brainstorming but they are not easy to manage, moderate and analyse successfully (Litosseliti, 2003). As for mini groups, they are not only more suitable to explore complex, controversial, emotional topics but also to encourage detailed account (Litosseliti, 2003). Based on these considerations, the mini focus group approach was applied in the workshop studies.

As discussed above, a focus group was used to test the use of film clips for the creation of expressive behaviour by avatars in the pilot study. In this focus group, participants were only asked to present their viewpoints on the actors' expressive behaviour. In later workshop studies (Chapter 4 and 5), participants were asked not only to present their viewpoints on the actors' behaviour but also to do practical tasks as well as discussion. Through the workshop studies, I developed the focus group approach to allow me to mix group discussion with practical design tasks (e.g. video self-sketching).

3.3.5 The Stimulus Film Clips

The use of films as stimulus in emotion studies has a long history. Some researchers such as Lazarus et al (1962), Notarius and Levenson (1979) used films to elicit emotional reactions. Some researchers such as Hubert and de Jong-Meyer (1990) used films to elicit emotional states of a desired valence and intensity. Gross and Levenson (1995) stated that films are useful in emotion studies because they have:

> 1. "*the desirable properties of being readily standardised, involving no deception, and being dynamic rather than static* (p.87)";
> 2. "*a relatively high degree of ecological validity[11], in so far as emotions are often evoked by dynamic visual and auditory stimuli that are external to the individual* (p.88)."

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[11] Bernal, Bonilla and Bellido (1995) draw on Bronfenbrenner (1977) to define ecological validity as "*the degree to which there is congruence between the environment as experienced by the subject and the properties of the environment the investigator assumes it has* (p.69)."

[74]

In McHugo et al (1982), Philippot (1993), Gross and Levenson (1995), film segments from commercial films were used to analyse actors' expressive behaviour. My own pilot studies (3.3.2) showed that film clips provided an engaging resource for provoking the kind of design debate I was looking for. Therefore, the idea of stimulus films was adopted to allow observation and discussion of expressive behaviour for the co-design framework (Figure 30) in this research.

In general research practice, film segments used in emotional experiments are selected by researchers (e.g. McHugo et al, 1982; Philippot, 1993; Gross and Levenson, 1995). In this research however, the list of film clips was suggested by user participants, as described below (3.3.5.1), although final selection was by myself as researcher.

3.3.5.1   The Selection of Stimulus Film Clips

Selecting suitable stimulus film clips used in the co-design process was a big challenge, given the great number of films and TV dramas available. I decided that suggestions from avatar users with an interest in movies and TV dramas would be a good approach to help me select suitable footage with actors' expressive behaviour. In the pilot study (3.3.2), I thought online movie forum users could give me ideas to select film clips. This method seemed to be unproductive because very few forum users responded to requests for suggestions. Besides, their responses were general and did not give insights into specific film segments with actors' expressive body movements. To identify useful films and film segments containing expressive body movements, a semi-structured questionnaire was seen as a possible method. I used snowball recruitment to look for volunteers via my personal contacts to test this idea. A questionnaire (3.3.6) with open-ended questions and closed-ended questions was developed in the pilot study and the responses indicated that this questionnaire (Appendix I) was useful to identify specific scenes containing suitable expressive

behaviour.

In the two main workshop studies, to recruit a group of avatar users with an interest in movies and TV dramas, a snowball approach was adopted as follows: 1. I asked acquaintances to identify and recommend their acquaintances who were experienced in online environments and watched at least two movies or TV dramas in a week; 2. I also asked the identified avatar users to identify and recommend others. The volunteers were invited to complete the film clip suggestion questionnaire (3.3.6).

Before respondents completed this questionnaire, I provided a briefing to them, including an explanation of the research, and answered any questions. Because the questionnaire contained open-ended questions, respondents were given one week to complete the questionnaire. Most spent 4 to 5 days including some who took time to study the movies they had selected. Engaging scenes and performances with insights were provided in their responses. Indeed, a lot of recommendations were provided from the respondents to the questionnaire. However, some suggested film clips with scenes of actors' interpersonal performances were unsuitable for the workshop studies, for example fight scenes. Also, respondents did not consider the 'framing' of sequence shots and the visibility of the actors' expressive behaviour.

Framing refers to the location and scale of the actor's facial expression, eye gaze and bodily behaviour. Full shots, medium shots, and close-ups are the universal units of composition used to describe actors' emotions and status (Figure 33, Figure 34, Figure 35).

Figure 33 Full shot (taken from 'Forrest Gump', 1994)

[76]

Figure 34 Medium shot (taken from 'Mr. Bean's Holiday', 2007)

Figure 35 Close-up (taken from movie 'Forrest Gump', 1994)
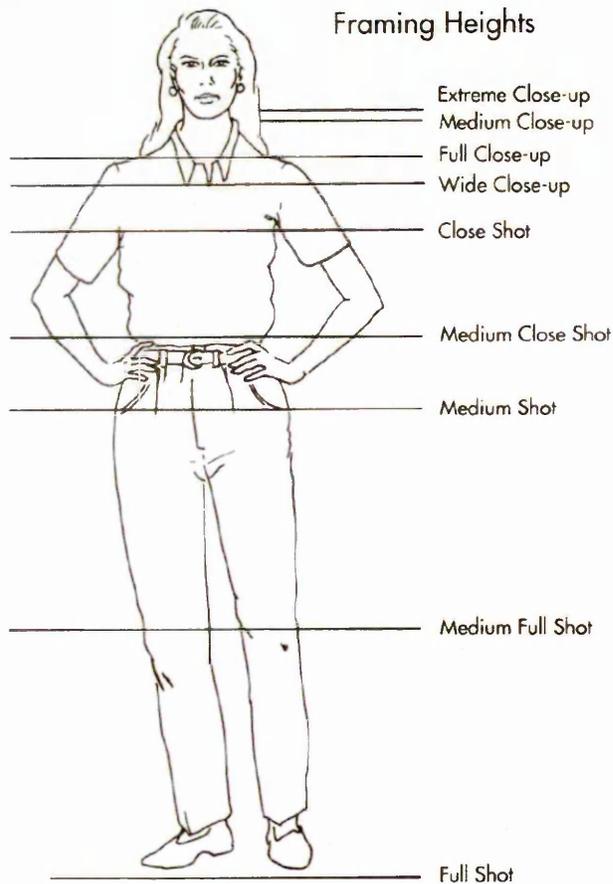
Figure 36 Basic framing heights for the human figure (taken from Katz, p.122)

Katz (1991) provided the figure of basic framing heights (Figure 36) to discuss the

size of shots for the human figure. The close-up is used to bring the audience into closer

contact with actor's subtle action, usually focusing on the actor's facial expression (Katz, 1991). The actor's eyes, mouth, and ears are given the close-up shot to advance some specific part of the narrative (ibid). The disadvantage of the close-up is missing other parts of body movements. The full shot captures the actor's whole body and allows the actor to use body language (ibid). However, this type of shots may miss the actor's subtle facial expression (ibid).

As for the medium shot, this type of composition combines valuable features of the full shot and the close-up. As Katz (ibid) discussed "...*Like the full shot, the medium shot captures an actor's gesture and body language, but is still tight enough to include subtle variations in facial expression* (p.127)." The actor's body in the medium shot seems to be appropriate for observation of expressive behaviour because it not only presents the actor's gesture and posture but also provides the quality of facial expression.

To pick suitable film clips from respondents' recommendations, I made a strategy with two considerations: 1. actors' interpersonal performances with expressive behaviour; 2. the size of actor's body and the camera angles in sequence shots. These selected film segments were trimmed to be film clips by Free Video Dub software[12] (Figure 37).

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[12] Free Video Dub is a free video editing software that is developed by DVDVideoSoft Limited (see http://www.dvdvideosoft.com/). This free software supports many MPEG files such as MPEG 1, MPEG 2 and MPEG 4 AVI. It also keeps original quality after editing video.

[78]

Figure 37 A sample of trimmed clip

As discussed in 3.3.1, the two workshop studies in this research had different goals. Workshop Study 1 focused on identifying the generative tools and Workshop Study 2 concentrated on confirming the validity of the identified generative tools. In Workshop Study 1, each film clip in Workshop Study 1 was about 10-25 seconds (4.3.2). Several film clips only contained one or two nonverbal signals.

During Workshop Study 1, as described in 4.4.4 below, I identified the need for a tool, the 'video experience note' to help participants analysing expressive behaviour in film clips. One or two nonverbal signals in the film clip seemed to be insufficient to evaluate the video experience note. In Workshop Study 2, therefore, each clip contained more nonverbal signals (5.3.2).

3.3.6   Film Clip Suggestion Questionnaire

Having decided to recruit avatar users to identify useful films and film segments with actors' body movements, I considered that a semi-structured questionnaire could be a possible method to aid them. I will discuss the development of this questionnaire in this section. I will describe the development and testing of this 'film clip questionnaire' (Appendix I) in this section.

I considered the use of closed questions. Usually, closed-ended questions offer

[79]

several options that can be formed simple alternatives or more complex answers (Oppenheim, 1992). However, it was apparent that participants interests varied greatly and it did not seem possible to frame any lists of closed responses that would allow participants to explain or elaborate on their choices of film clips. In contrast open questions allow users to use their own language and express their own ideas (ibid). I decided to use closed questions to obtain basic information but I also needed to complement these questions with open questions.

With open questions the answers can indicate: 1. the respondent's level of information; 2. what is salient in the respondent's mind; 3. the strength of respondent's feelings (Foddy, 1994). Although the researcher may obtain rich information via open-ended questions, its main disadvantage is that they are time-consuming to the respondent.

In the beginning, four questions that consisted two closed and two open were developed as below:

1. What are your favourite movies?

2. Would you explain why you love the movies?

3. In these movies, could you describe which scenes attract your attention?

4. Would you tell me why these scenes impress you?

A small group of volunteers were invited to answer these questions and provided their opinions. These volunteers stated that these questions were not asking specific behaviour in films. They also suggested that the questions could focus on specific characters in films then focus on specific body movements.

Based on volunteers' feedback, two additional questions were developed and these six questions are listed as below:

1. What are your favourite movies?

2. Would you explain why you love the movies?

3. In these films, could you describe which characters impress you?

4. Would you explain why these characters impress you?

5. Could you describe which scenes attract your attention?

6. Would you tell me why these scenes impress you?

The volunteers were invited to answer the six questions and provided their feedback. They considered that Question 1 and 2 focused on movies so the answer would be only from movies. Also, they suggested that specific actors' body movements could be asked in Question 5 and 6. These questions had been revised several times. Finally they were improved as below:

1. What are your favourite films? (Movies, TV series etc)

2. Would you explain why you love the films? (Movies, TV series etc)

3. In these films, could you describe which characters are impressive?

4. Would you explain why these characters are impressive?

5. Could you describe which scenes with actors' behaviour attract your attention?

6. Would you tell me why these scenes with actors' behaviour attract your attention?

These questions required respondents to take time to respond so I allowed respondents answering the questionnaire (Figure 38) a few days (normally 4-5 days). Then, I made appointments with these respondents to collect their responses for the selection of stimulus film clips (3.3.5).
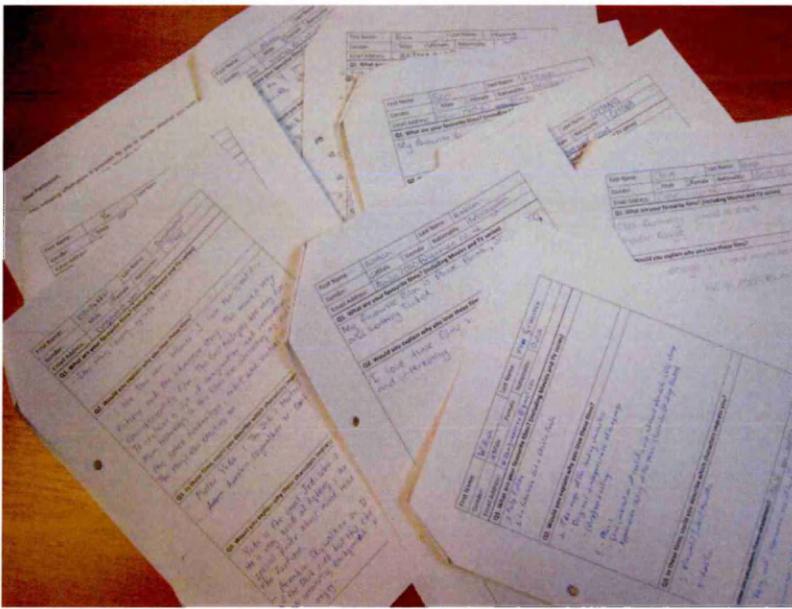
Figure 38 Completed questionnaires from respondents

3.3.7 The Participants

The participants in the workshop studies consisted of designers and avatar users who had insight into nonverbal behaviour. The aim of the research was to investigate generative tools and methods of engaging individuals in co-design rather than to directly support particular design projects. On the other hand, I was conducting research that could only be done with small groups. I considered that by involving participants from different cultural backgrounds, I might at least get an indication of whether cucltural differences influenced their participation even if this would not be definitive. Therefore I sought to involve participants from a variety of cultures in this research.

In the course of the two workshop studies, seven designers were invited through my personal contacts. These designers all have at least two years of professional experience as a designer including animation as well as 3-4 years of professional education in design. Therefore, they understand how to use their design skills, express their ideas and explain their design thinking. More detail on the designers' background is given in 4.3.1 and 5.3.1.

[82]

In addition to designers, avatar users were invited in the workshop studies. These users might be not educated in art and design but they were expected to have a willingness to share their perspectives and ideas in group sessions. Suitability of participants to the activity of the research is very important because "*conversation and interaction with the right people can be both a hugely important source of insight and a significant challenge* (Lazar et al, 2010; p178)". In following sub-section, I will explain how I identified suitable avatar users to be participants in the workshop studies.

3.3.7.1 The Selection of Avatar Users to be Participants

As discussed in 3.3.5.1, avatar users with an interest in movies and TV dramas appear to be appropriate for the suggestion of stimulus film clips. To recruit a group of avatar users with an interest in movies and TV dramas in each workshop study, a snowball approach was adopted as follows: 1. I asked acquaintances to identify and recommend their acquaintances who were experienced in online environments and watched at least two movies or TV dramas in a week; 2. I also asked the identified avarar users to identify and recommend others. The identified avarar users were invited to complete the film clip suggestion questionnaire (3.3.6). Because the questionnaire contained open-ended questions, each respondent had 4 to 5 days to complete the questionnaire.

Initially, these respondents had not been seen as potential participants in the workshop stage of this research. However, they provided their insights into actor's interpersonal performances to indicate a sense of interpreting expressive behaviour. Some respondents played DVDs to show their suggested scenes when I collected complete questionnaires. I then recognised that these respondents could be potential participants in the co-design workshops. I expected that participants in the workshops should be willing to share their opinions and knowledge to other participants. Therefore,

[83]

I needed an approach to identify potential participants from these respondents.

To select suitable participants involved in the co-design workshops, I arranged to meet each individual to review their questionnaire. I paid close attention to their willingness to share opinions. In general, respondents answered my additional questions but some respondents showed greater willingness to discuss in detail. Also, these respondents showed their ability to propose their own questions in the discussion. Respondents who proposed their own questions in the discussion seemed to be more active in discussions. Therefore I invited these active respondents to attend the co-design workshops.

Thus the film clip questionnaire has two functions, supporting the selection of both film clips and participants. Although it has not been evaluated formally, from the experience of this research, it appears to be a very useful tool for this codesign process.

3.3.8   Observation Record

As discussed in 3.3.1, the two workshop studies in this research had their goals: 1. to identify generative tools appropriate for the co-design framework (Figure 30) in Workshop Study 1; 2. to evaluate these generative tools in Workshop Study 2. To achieve these goals, observation was used to collect data about participants and co-design process during the workshop sessions.

During the process of observation, several recording methods such as field notes, detail records, sound recording or video recording can be used to record the fieldwork.

Video recording can provide permanent and detailed evidence[13] because video is an audio-visual medium. However, video recording lacks flexibility when compared with the human observer (Simpson and Tuson, 1995). The video recorder may miss the key events because of unpredictable situations. To take account of these unpredictable

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[13] Digital video and specialist software allows easy review and annotation for data analysis.

situations, two video recorders are suggested to put in different places for capturing the process of the event (Simpson and Tuson, 1995). In the pilot studies of this research it was seen that participants might be nervous when they first become aware of the video recording. However, participants appeared to ignore the camera and feel comfortable after few minutes.

During workshop sessions, video recording was employed to record the interaction among participants. Canon Digital IXUS 850 IS, Nikon CoolPix S510 and Sony NEX-5 cameras with 640x480 30fps video mode were used. As shown as Figure 39and Figure 40, two tripods were applied to fix these digital cameras in two different places in case the camera was blocked by participants during the workshop sessions.
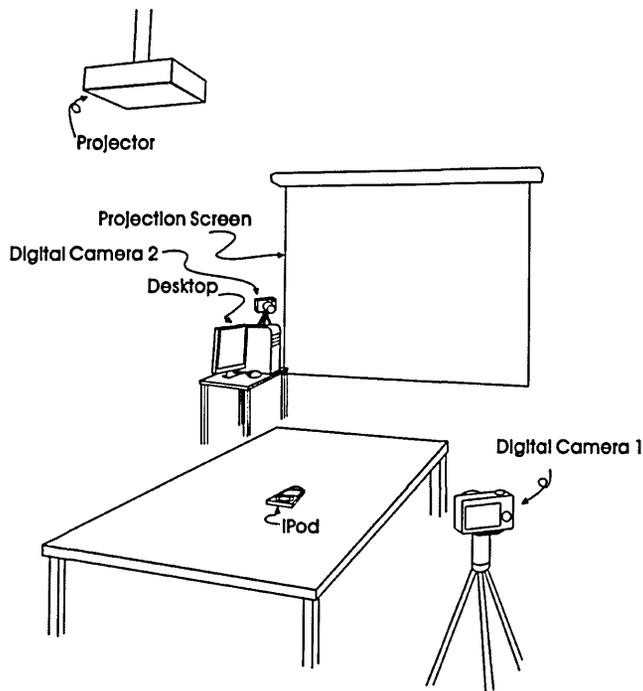
Figure 39 Two digital cameras with tripods used in Workshop Study 1
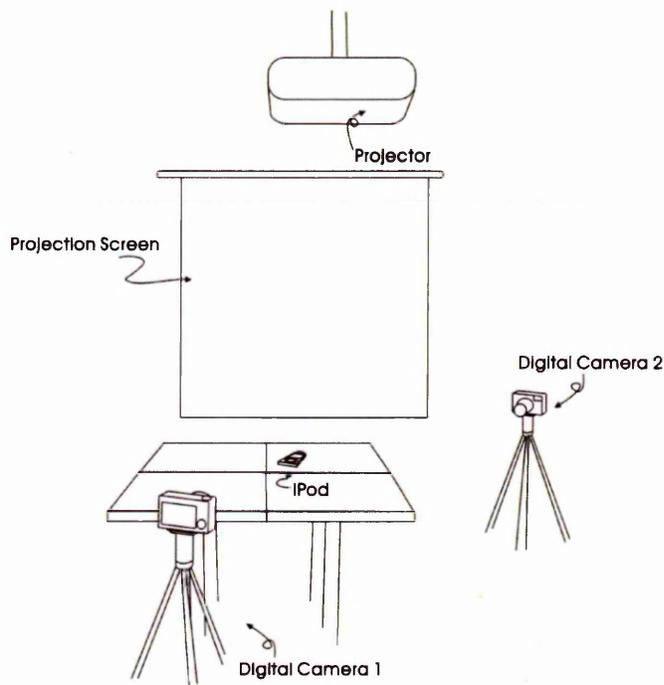
Figure 40 Two digital cameras with tripods used in Workshop Study 2

Although current digital cameras have internal microphones that are sufficient for some observational records, sound quality will be influenced by different conditions such as the distance between the camera and the informant. Pink (2007) suggested that the researcher may consider using an external microphone to achieve good sound quality. Therefore, a 20 GB iPod Classic fitted with an external microphone (Figure 41) for sound recording were applied in the workshop studies (see Figure 39and Figure 40).

Figure 41 A iPod Classic with an external microphone used for sound recording

3.3.9 Experimental Procedure

The two workshop studies in this research consisted of six co-design workshops:

four workshops in Workshop Study 1and two workshops in Workshop Study 2. On arrival, participants were greeted and led to the co-design workshop space (Figure 42 & Figure 43).

Figure 42 The workshop space for the 1st workshop study
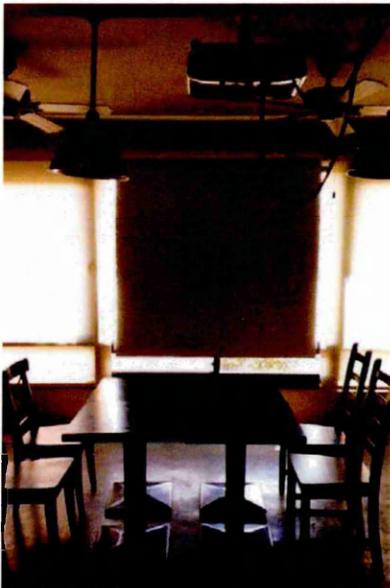
Figure 43 The workshop space for the 2nd workshop study

Before starting each workshop, I arranged around twenty minutes to explain the detail of the co-design workshops and confirm participants' understanding. The detail of the workshop procedures was shown on the projector screen. Participants were informed that all data including audiovisual records would only be used for the purpose of data analysis and would be confidential. Then, they were asked to sign a consent form if they did not have any questions about the workshop procedures and purposes.

[87]

Besides, they were instructed that they were free to withdraw from the research at any time without giving any reason.

After completing each workshop, I interviewed each participating designer individually to review the process of the workshop. These interviews were aimed at obtaining designers' feedback for the following workshop. Designers also provided their viewpoints on the generative tools in these interviews.

This section has given the aspects of procedure that were common to the two workshop studies. However, there were necessarily a number of variations in procedure because of the different aims of each workshop study. Further details are presented in the descriptions of the individual workshop study in chapters 4 and 5.

3.4   Data Logging and Analysis

This section covers: 1. the methods used to the data logging approach to reviewing and analysing activities in both workshop studies; 2. how I used Bales' (1950, 1970) Interaction process analysis to quantify and analyse the manner in which different kinds of tools affect group communication process for analysing and creating expressive behaviours in Workshop Study 2.

3.4.1   Design Protocol Logging

Protocol analysis is an empirical research method and was applied in the field of psychology initially. Since Eastman's pioneering work studying architectural spaces in the late 1960s, protocol analysis has become the prevailing experimental technique for looking into the understanding of design processes and cognitive activities involved in designing. Design protocols are usually in the form of recording of designers' overt behaviours such as verbalization, sketches and audio-visual recordings captured by

[88]

cameras.

Tang, Lee and Gero (2011) draw on Ericsson and Simon (1993) to explain that two types of protocols have been divided according to the way experiments proceed: concurrent protocols and retrospective protocols. In concurrent protocols, the subject is asked to verbalize his/her thinking while he/she is undertaking tasks. In retrospective protocols, the subject is required to verbalize his/her recall of thinking after he/she has finished tasks. Dorst and Dijkhuis (1995) suggested that concurrent protocols tend to stress the process-oriented aspect of designing and retrospective protocols tend to look into the cognitive content aspect.

Both concurrent protocols and retrospective protocols have benefits and limits. The benefit of concurrent protocols is to obtain details of sequences of information processes reflecting the subject's short-term memory (Ericsson and Simon, 1993). However, Lloyd et al. (1995) argued that concurrent verbal method interferes with design thinking. As for retrospective protocols, subjects focus on their tasks but may

> *"tend to selectively report what is relevant to the retrieval cues given in the reporting task and/or what is relevant to their purposes and intentions while reporting, neglecting other thoughts which might have occurred during the design session* (Suwa and Tversky, 1997; p.397)".

To reduce subject's selective recall, Suwa and Tversky (ibid) proposed video retrospective protocols.

In this research, retrospective protocols have included participants' group discussions about their co-design work, both their emotional reactions to the work and their reasoning about it. In the two workshop studies, the protocol in the co-design team was not the collection of the thinking processes of individual participant but the collection of the communicative and argumentative processes of all participants. The process of obtaining protocols was natural when participants communicated verbally to carry on the design process. On the other hand, participants discussed their design work including pen-based sketching and video sketching by a retrospective approach.

[89]

A large number of design protocols such as audios, videos, and sketches were produced within the workshop studies. To sort out these design protocols, I adopted the technique of event logs developed by Wood (2006). The technique of event logs consists of 2-column tables. One column is for the time code from the video source and the other column is for a description of the event. As Wood stated

> "*The descriptions summarised both activities and speech, aiming at a clear and concise narrative of the proceedings rather than a complete record. Whilst this was still a time-consuming process it had two outcomes, the first an immediate review of the session that would inform the next stage of the research, the second was to facilitate subsequent review of the material* (ibid, p.23)."

After capturing them on a computer each digital file was logged in a digital diary of the project with a brief description of events including dialogues and actions while still fresh in my memory (an example shown as Table 4) [14]. As well as allowing some initial reflection on material while still fresh, this logging activity allowed me to consider connections with other design protocols from the research. Because of the immediate reflection, I could notice emerging issues during the investigation and alter my plans in response. For example, users had difficulty with pen-based sketching in the encoding stage in Workshop Study 1 (4.4.3.2).

Table 4 Events log from the Design workshop in Workshop Study 1

Time	Events
00:04:10	I reminded participants they had 30 seconds to deal with their note.
00:04:47	All participants stopped to write their opinions on their notes and I asked participants how they thought about this clip based on their notes.
00:05:19	Huiyu described his observation then provided 'angry, shaking, sad, worried and disappointed' these words.
00:05:46	Suraya said her feeling about the actress in the clip and imagined the actress's situation – 'doing something wrong'.
00:06:15	Peter mentioned the word 'annoyed' in the beginning then he described his observation on the actress's facial expression in detail. (Peter also did the same facial expression as well.)
00:06:34	Mai used the same word 'worried and angry'. Also, she provided another word 'nervous'. Then she imagined the actor made the actress

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[14] Sample event logs are also presented in Appendix VI. References in the text to specific instances in event logs of the co-design workshops take the form [SHF2.1 t0.06]: SHF = the abbreviation of the workshop location; 2.1 = the 2nd workshop, tape 1; t0.06 = time code 6 minutes.

	angry or worried.
00:07:12	Kingin imagined that the actress was angry, sad, lose temper and crazy because the actress couldn't accept some truths. (All participants were laughing.)

In addition to these logs, I transcribed all the individual discussions and group sessions in the course of this research. In some research, such transcriptions could be the basis of coding activity[15], but for me, through the process of reading and, especially writing, they provided 'recollections' of the activity. They reminded me that I was participating in these co-design workshops. From transcriptions, I could reflect on and re-inspect my experience of participating in design activity that aimed to develop the generative tools for creating expressive behaviours by avatars in the first workshop.

When one participant stated their opinion, it sometimes caused another person to hold back from saying what they had thought, so keeping some ideas out of the discussion (4.4.3.1). Also, users seemed to have difficulty with pen-based sketching (4.4.3.2). I reviewed the process of the workshop with designers to identify the problems and develop the generative tools (4.4.4).

Due to the quantity of design protocols including logs and transcriptions, NVivo[16] (shown as Figure 44) was used to organize and link these design protocols for synthesis of co-design activity in the workshop studies.

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[15] The transcriptions of the second workshop study in this research were coded by Bales' Interaction Process Analysis (3.4.2).
[16] NVivo is a qualitative data analysis computer software which is developed by QSR international.
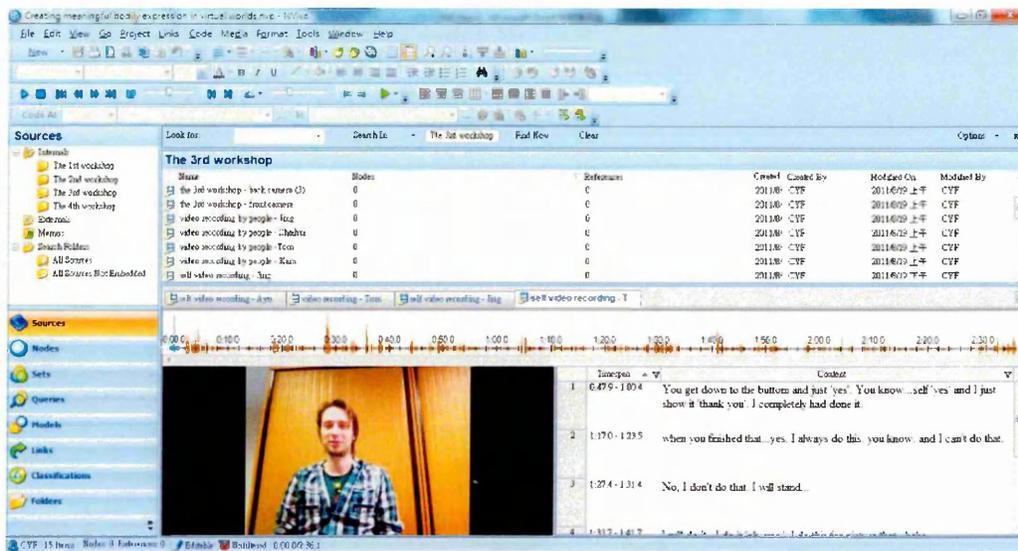
Figure 44 Managing documentary sources of this research through NVivo

3.4.2   Interaction Process Analysis (IPA)

A large variety of coding schemes have been developed in design protocol studies. Some have been used to understand the process-oriented aspects of designing while others have been applied to understand the content-oriented aspects of designing. For example, Gero and McNeill (1998) developed their coding scheme that consists of problem domains and design strategies highly related to design processes. Their coding scheme was used to explore the process-oriented aspects of designing. To understand the content-oriented aspects of designing, Suwa and Tversky (1997) used the approach of information categories to analyse what designers see and possibly think. The major dichotomy in their categories was between visual information and non-visual information.

Previous design protocol studies focus on designers' design thinking and activities so researchers developed their coding scheme to analyse their data. In this research, I did not intend to analyse designers' designing. On the one hand, the content of this research was based on the concept of co-creation. The workshop studies involved the participation of users. On the other hand, designers and users shared their knowledge

[92]

and information in the workshops. Therefore, it would not be relevant to analyse designers' designing. Instead I focused on the interaction between designers and users to see if the generative tools identified in Workshop Study 1 affect their interaction process. To quantify the manner in which generative tool forms affect group communication process in Workshop Study 2, I used Interaction Process Analysis (IPA) which was developed by Bales (1950).

Bales' IPA is an influential method for analysing communication processes among small team members. Keyton (1997) stated that IPA emphasizes *"the difference between task-oriented interaction (a focus on achieving the goal) and relational interaction (a focus on the interpersonal relationships among group members* (p, 240)." Bales' IPA consists of 12 complementary-paired process categories for communication acts (Bales, 1950; Bales, 1970). These 12 processes categories are further subdivided into 4 major functions, as shown in Table 5.

Table 5 System of process categories in the IPA (adapted from Bales, 1950; p.258)

Function	Process Categories	Addressing central problems of:
Social-Emotional Area: Positive Reaction	1. Shows solidarity, raises other's status, gives help, reward	Integration
	2. Shows tension release, jokes, laughs, shows satisfaction	Tension-management
	3. Agrees, shows passive acceptance, understands, concurs, complies	Decision
Task Area: Attempted Answers	4. Gives suggestion, direction, implying autonomy for other	Control
	5. Gives opinion, evaluation, analysis, expresses feeling, wish	Evaluation
	6. Gives orientation, information, repeats, clarifies, confirms	Orientation
Task Area: Questions	7. Asks for orientation, information repetition, confirmation	Orientation
	8. Asks for opinion, evaluation, analysis, expression of feeling	Evaluation

[93]

	9. Asks for suggestion, direction, possible action	Control
Social-Emotional Area: Negative Reactions	10. Disagrees, shows passive rejection, formality, withholds help	Decision
	11. Shows tension, asks for help, withdraws out of field	Tension-management
	12. Shows antagonism. Deflates other's status, defends/asserts self	Integration

Six categories are social-emotional acts with three positive and three negative types of expressions of sociability and affect. Positive social-emotional content expresses: (1) solidarity or friendliness; (2) tension relief or dramatizing; (3) agreement and understanding. Negative social-emotional content shows: (10) disagreement and passive rejection; (11) tension; (12) antagonism. Categories 1 and 12 are addressing the problems of Integration. Categories 2 and 11 are addressing the problems of tension-management. Categories 3 and 10 are addressing the problems of decision.

The other six categories are task-oriented acts as questions and answers aimed to complete a task. Three question types of task-oriented acts are: (7) asking for task information or orientation; (8) asking for an opinion (9) asking for a suggestion. Three answer types of task-oriented acts are: (4) giving a suggestion or command; (5) giving an opinion; (6) giving task information or orientation. Categories 4 and 9 are addressing the problems of control. Categories 5 and 8 are addressing the problems of evaluation. Categories 6 and 7 are addressing the problems of orientation.

As Bales (1950) described,

> *"the heart of the method is a way of classifying behaviour act by act, as it occurs in small face-to-face groups, and a series of ways of analysing the data to obtain indices descriptive of group process, and derivatively, of factors influencing that process (p.258)."*

The IPA uses the single 'act' as the unit for coding and analysis. Bales considered that the IPA can be applied to non-verbal interaction though *"verbal interaction accounts for the largest part of the score* (ibid, p. 262)." Therefore, an act is a single

[94]

simple sentence or its equivalent such as nonverbal behaviour for a communication or an indication that may be understood by another member.

As discussed in 2.4.5, generative tools used in co-designing are to designedly by enable participants to co-create in the generative phase of the design development process. Through generative tools, participants' ideas and tacit knowledge may be elicited through communication acts including social-emotional acts and task-oriented acts. Participants' social-emotional acts and task-oriented acts drive the interaction between individuals, thus a highly interactive co-design process indicates appropriate generative tools.

In order to evaluate the effectiveness of the generative tools developed in this research, the data analysis in Workshop Study 2 focused on the interaction among participants. The IPA was used to quantify the manner in which different kinds of tools affect the group communication in the co-design workshops. The frequency of participants' communication acts with different generative tools was used to evaluate how these tools engaged participants in the co-design workshops.

In Workshop Study 2, participants' verbal communications and nonverbal behaviour were collected and coded for the data analysis. Most participants' nonverbal behaviour was accompanied with verbal communications. Therefore, the coding work was based on the transcription of verbal communications to avoid repeating to code the same acts (an example shown as Table 6). Two coders who were postgraduate students[17] trained in accordance with the IPA coding scheme developed by Bales (see Appendix VII). The detail of coding work for Workshop Study 2 will be described in 5.3.4. After the coding work, participants' social-emotional acts and task-oriented acts were analysed with Chi-square goodness-of-fit test. The result will be described in 5.4.3 and 5.5.3.

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[17] By using independent coders I hoped to avoid any bias from myself as participant observer and developer of the generative tools.

[95]

Table 6 Transcription with the IPA coding scheme from the 1st workshop in Workshop Study 2 (coded by coder A)

Participants	Dialogue	Communication acts code
Yi-Ching	Could you tell us your opinion?	8
Sheng-Yi	Me? Huh…I watched this film before but I can't remember the detail.	11
Tze-Yin	Don't worry. I think it's fine.	1
Sheng-Yi	Obviously, the woman is the bride. She has the flowers and hits the man by using the flowers.	6
Yi-Ching	Right.	3
Sheng-Yi	She appears to be very angry and she vents on this man.	5
	She seems to express her strong dissatisfaction but doesn't want to hurt this guy.	5
Sheng-Yi	This man seems to explain something but he is shocked.	6
Wen-Cheng	I got the same feeling.	3
Wen-Cheng	This man wants to tell something to this woman but she doesn't want to listen.	6
Wen-Cheng	I think they are arguing something and…this guy is shocked so he doesn't know how to respond to the woman.	5
Sheng-Yi	True!	3

3.5 Chapter Summary

The research described in this thesis consists of two workshop studies developing and evaluating generative tools for co-creating avatar's expressive behaviour through iterative co-design practices. The first part of this chapter reviewed relevant methodologies: practice-led research and action research. The second part described aspects of experimental design and procedure common to the two workshop studies. The data generated in the workshop studies was design protocols including audio-visual records, transcriptions, pen-based sketches and video sketches. These design protocols produced in the workshop studies were managed and logged by NVivo. In order to confirm the validity of the generative tools identified in Workshop Study 1, Bales' IPA was used to quantify and analyse communication processes among co-design team

members in Workshop Study 2.

3.5.1 Reading Guide to Chapter 4, 5 and 6

The two workshop studies are reported in chronological order. Chapter 4 describes Workshop Study 1 that focused on identification of generative tools. In this workshop study, participants from diverse cultures were invited to attend in four co-design workshops in Sheffield, UK. Chapter 5 describes Workshop Study 2 that concentrated on evaluation generative tools. All participants from Taiwanese culture were invited to attend in two co-design workshops in Taipei, Taiwan. Chapter 6 explains the findings from the two workshop studies.

4　Workshop Study 1: Developing Generative Tools

4.1　Introduction

In 2.5, I proposed a co-design framework (Figure 30) that consists of decoding and encoding sessions for creating avatar's expressive behaviour. To make this process in a participatory design approach (2.4.1) requires engagement with diverse suitable participants (3.3.7) to reveal the tacit knowledge in interpersonal communication. My pilot study (3.3.2) indicated that stimulus films clips (3.3.5) were likely to be a good method to engage participants to observe and analyse actors' expressive behaviour.

Then I started to plan two workshop studies to investigate the generative tools and methods in working with designers and users. Workshop Study 1 (this chapter) focused on the identification of co-design problems occurring in the interaction between participants. Also, the generative tools and methods were refined in this workshop study. Workshop Study 2 (chapter 5) focused on the verification of two tools developed, the video-experience note and the video-sketching device.

Workshop Study 1 was conducted in Sheffield, UK. The purpose was to look into and refine the co-design methods in working with participants. It consisted of four co-design workshops: the Orientation workshop, the Design workshop, the Design Review workshop, and the Evaluation workshop. In the Orientation workshop (4.4), I identified problems from my observations as well as discussion with designers. To deal with these problems, I applied two new generative tools, the video experience note and the video self-recording device in the Design workshop (4.5). These generative tools were productive in that participants presented more personal opinions and tacit ideas in the discussion. After the Design workshop, two short animations with expressive

behaviour were created from participants' ideas and discussions. I then arranged the Design Review workshop (4.6) and the Evaluation workshop (4.7) to refine these creations and obtained participants' feedback.

4.2 Workshop Study Aims

This workshop study was conducted based on the co-design framework (Figure 30). Four co-design workshops[18] as shown as Table 7, each co-design workshop had different aims.

Table 7 Four co-design workshops and their aims

Co-design Workshops	Aims
Orientation workshop	To identify co-design problems occurring in the interaction between participants
Design workshop	To create ideas and images for two animated expressive behaviour
Design Review workshop	To evaluate these animated expressive behaviours and the approach of the video self-recording
Evaluation workshop	To evaluate all the animated expressive behaviour created in the workshops

The Orientation workshop, as a pilot, enabled me and designers to identify potential problems occurring in the interaction between participants (designers and users). To deal with the co-design problems, two new generative tools were developed. These were then used for the activity of co-creation in the Design workshop. The Design workshop was aimed at creating ideas and images for two animated expressive behaviour.

Visual materials including sketches and self-recording videos were created by participants in the Design workshop. A Professional Design Group of myself and the two participating designers reviewed visual materials then created two new animated

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[18] In early planning stage, the names of these workshops were given as Decoding Workshop, the 1st Design Workshop, the 2nd Design Workshop, and the 3rd Design Workshop. After reviewing the content of these workshops, I reflected that these four workshops had different values so I gave them 'official names' to clearly present how they are different.

expressive behaviour in gif format. To refine these two creations, I arranged the Design Review workshop to obtain the participants' feedback. In addition, the approach of video self-recording used in the co-design framework (Figure 30) was evaluated in this workshop. Based on the participants' feedback in the Design Review workshop, three new animations with expressive behaviour were refined by the Professional Design Group. The aim of the Evaluation workshop was to evaluate the usefulness of all creations (five animated expressive behaviour) for online interaction.

4.3   The Workshop Setting

The workshop study consisted of a series of four co-design workshops, each involving designers and users (Table 8). Because of participants' schedules, some participants did not attend all workshops (Table 9). The designers have at least two years of professional experience as a designer including animation as well as 3-4 years of professional education in design. In particular, two of the designers (Yu-Liu and Kingin) have experience of creating avatar's expressive behaviour in specific design projects. As for the users, the each watches at least two movies or TV dramas in a week. Besides, the each users have at least four years experience of using avatar-based environments such as online games and instant message systems.

Table 8 The participants in Workshop Study 1 (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

	Code	Alias Name	Age	Gender	Nationality
	S-D1	Peter Taylor	24	Male	UK
Designer	S-D2	Yu-Liu Huang	31	Female	Taiwan
	S-D3	Kingin Cheng	30	Female	China
	S-U1	Huiyu Cheng	26	Male	China
	S-U2	Dennis van Grunsven	26	Male	Holland
Users					
	S-U3	Mai Inthawong	31	Female	Thailand
	S-U4	Suraya Kharuddin	34	Female	Malaysia

[100]

Table 9 The overview of participants' attendance in workshops

Participant \ Workshop		Orientation workshop	Design workshop	Design Review workshop	Evaluation Workshop
Designers	S-D1		✓	✓	✓
	S-D2	✓	✓	✓	✓
	S-D3	✓			
Users	S-U1	✓	✓	✓	✓
	S-U2	✓			
	S-U3	✓	✓	✓	✓
	S-U4		✓		

These workshops were hold at a typical university meeting room at Sheffield Hallam University. In this meeting room (Figure 42), a desktop computer, a projector and a projection screen were ready for playing film clips. One long table for six people and six chairs were placed in the middle. As shown as Table 9, the number of participants was different in these workshops and I arranged different sittings in these workshops as described below (4.4.1, 4.5.1, 4.6.1, and 4.7.1).

Each workshop in this workshop study had different aims (Table 7). To enable the designers understand the goal of the workshop study, I arranged informal discussions with the designers in one-to-one approach to present my own pilot study before the Orientation workshop. I also arranged follow-up discussions with the designers after the first two workshops. These follow-up discussions were aimed at obtaining their viewpoints and evaluations on the process of each workshop. These follow-up discussions were useful because designers provided their feedback for the following workshop. The process of these workshops and discussions is shown as Figure 45.

Figure 45 The process of workshops and discussions

4.3.1 Participants

In this workshop study, two groups of avatar users were recruited: one group to complete the film clip suggestion questionnaire (3.3.6) and a more selective group (3.3.7.1) to participate in the subsequent co-design workshops. Here I will explain how I recruited these two groups.

The purpose of the film clip suggestion questionnaire was to obtain respondents' ideas for the selection of stimulus film clips from movies and TV dramas (3.3.5.1). Therefore, I needed to recruit avatar users who have an interest in movies and TV dramas. To help focus this selection process, potential avatar users were asked questions about their frequency of watching movies and TV dramas. Avatar users who watched at least two movies or TV dramas in a week were invited to complete the questionnaire (3.3.7.1).

As described in 3.3.5.1 and 3.3.7.1, I adopted a snowball approach as follows: 1. I asked acquaintances to identify and recommend their acquaintances who used online environments and watched at least two movies or TV dramas in a week; 2. I also asked

[102]

the identified avarar users to identify and recommend others. From this recruiting

process, fifteen people (Table 10) were invited to complete the film clip suggestion

question (3.3.6). These people were students at Sheffield Hallam University and

University of Sheffield from several countries.

Table 10 The detail of respondents (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Study Specialism	Nationality
Chia-Li Hung	25	Female	Marketing	Taiwan
Huiyu Cheng	26	Male	Computing	China
Yuhan Lin	25	Female	Business	China
Linlin Yu	25	Female	Marketing	China
Meichug Chen	24	Female	Graphic Design	China
David Brook	43	Male	Engineering	UK
Steve Baker	39	Male	Computing	UK
Mary Smith	23	Female	Fine Art	UK
Dennis van Grunsven	26	Male	Bio-Engineering	Holland
Ismail Mustapha	35	Male	Engineering	Malaysia
Suraya Kharuddin	34	Female	Engineering	Malaysia
Mai Inthawong	31	Female	Health and Wellbeing	Thailand
Gau Be Nguyen	28	Male	Engineering	Vietnam
Bich Ngoc Quang	26	Female	Marketing	Vietnam
Ali al-Assad	38	Male	Computing	Libya

As well as respondents for the film clip suggestion questionnaire, these volunteers

were potential participants in my workshops (3.3.7.1). Initially, they had not been seen

as potential participants in the workshop stage of this research. However, some showed

a good level of engagement with the issues of the project. For example some

respondents played DVDs to show their suggested scenes when I collected complete

questionnaires which led me to believe that that these respondents could be potential

participants in my workshops.

From my review of participatory design (2.4.1) I believed that participants in

workshops should be willing to share their opinions and knowledge to other participants.

Therefore, I needed an approach to identify such individuals from the questionnaire

respondents.

The content of response to questionnaires was not helpful because richness of answers might depend on respondents' time management. To ascertain respondents' willingness to share opinions and ideas in discussion, brief follow-up discussions were used to review their answers in the questionnaires and observed their reactions. After I collected and reviewed the completed questionnaires I met each respondent for an individual discussion. In these discussions, I asked individual questions depending on the responses. Then I enquired about their experience of online interaction in avatar-based environments.

I observed respondents' reactions and noted their responses. As discussed in 3.3.7.1, respondents who showed their willingness and ability to propose their own questions in these individual discussions were potential workshop participants. I identified seven respondents (Table 11) who appeared to be suitable to take part in the workshops and, taking account of their availability, I selected four of them for the actual workshops.

Table 11 The list of suitable non-design participants (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Nationality	Availability
Huiyu Cheng	26	Male	China	Yes
Steve Baker	39	Male	UK	No
Mary Smith	23	Female	UK	No
Dennis van Grunsven	26	Male	Holland	Yes
Suraya Kharuddin	34	Female	Malaysia	Yes
Mai Inthawong	31	Female	Thailand	Yes
Ali al-Assad	38	Male	Libya	No

I also invited three designers (Table 12) who were interested in this workshop study through my personal contacts. The designers have at least two year of professional experience as a designer including animation. In particular, two of the designers have experience of creating avatar's expressive behaviour in specific design projects (Yu-Liu and Kingin). Therefore, the designers understand how to use their design skills and discuss with other people well. Seven participants for the workshop study consisted of

three designers and four users (Table 8).

Table 12 The designers invited in Workshop Study 1 (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Nationality	Professional Experience
Peter Taylor	24	Male	UK	2 Years
Yu-Liu Huang	31	Female	Taiwan	4 Years
Kingin Cheng	30	Female	China	6 Years

4.3.2   Stimulus Film Clips

Through the film clips suggestion questionnaire (3.3.6, also Appendix I), 33 scenes from 20 movies and 2 TV dramas were suggested by respondents. Some of respondents indicated actors' expressive behaviours via playing DVD on laptop when collecting questionnaires. As discussed in 3.3.5.1, some of the scenes they suggested as examples of interpersonal performance did not appear suitable, for example fight scenes. In addition, respondents did not consider the framing of sequence shots and the visibility of acting expressive behaviour. To select suitable film clips used in this workshop study, I needed to study these suggested scenes.

In 3.3.5.1, I indicated that framing in 'medium' shot is appropriate for observation of expressive behaviour because the actor's facial expression and body movements such as gestures and postures can be observed. In addition this research focused on interpersonal performances with expressive behaviour. So when I studied these suggested scenes, I looked for sequence shots that presented interpersonal performances with expressive behaviours, in particular facial expression and gestures, framed in a medium shot. From this process I selected 14 film clips that contained different expressive behaviours with a variety of emotional messages (Table 13).Each film clip was about 10-25 seconds.

Table 13 Fourteen film clips used in Workshop Study 1

Code	Image of film clip	Brief

SF1		From movie 'He's just not that into you', 2009. Alex and Anna's reaction after playing a video game. (Film clip link: http://tinyurl.com/ck8pssh)
SF2		From movie 'He's just not that into you', 2009. Alex is describing his feelings to Gigi. (Film clip link: http://tinyurl.com/d5gbv6o)
SF3		From movie 'Mr. Bean's Holiday', 2007. The interaction between Mr. Bean and Carson Clay after they notice everyone is standing up to applaud. (Film clip link: http://tinyurl.com/bnggnop)
SF4		From movie 'Licence to Wed', 2007. Ben Murphy and Sadie Jones are disputing about the meaning of love. (Film clip link: http://tinyurl.com/bmdfnd9)
SF5		From movie 'My Best Friend's Wedding' 1997. Julianne Potter describes her feelings to Michael O'Neal (Film clip link: http://tinyurl.com/7k58fkv)
SF6		From TV drama 'The Office', 2001. The staff's reactions when David Brent announces the staff will lose their jobs. (Film clip link: http://tinyurl.com/d9sp3gc)

SF7		From TV drama 'The Office', 2001. Tim Canterbury and Rachel's reactions when they are getting the warning from Gareth Keenan. (Film clip link: http://tinyurl.com/c78tk2s)
SF8		From movie 'Jurassic Park', 1993. Lex Murphy and Tim Murphy want to close the door via the computer. (Film clip link: http://tinyurl.com/cklwsj6)
SF9		From movie 'Jerry Maguire', 1996. Dorothy Boyd's reaction when she knows Jerry Maguire broke up his fiancée. (Film clip link: http://tinyurl.com/cne9gu2)
SF10		From movie 'Jurassic Park', 1993. Dr. Alan Grant and Dr. Ellie Sattler's reactions to being told that there are real dinosaurs in the park. (Film clip link: http://tinyurl.com/crdy7om)
SF11		From movie 'Forrest Gump', 1994. Jenny Curran is trying to stop Forrest Gump's beating. (Film clip link: http://tinyurl.com/cxl5rbu)

SF12		From movie 'Mr. Bean's Holiday', 2007. Mr. Bean wants to elude a ticket inspector. (Film clip link: http://tinyurl.com/bldrz88)
SF13		From movie 'Kiss Kiss Bang Bang', 2005. Harmony Faith Lane answers Harry Lockhart with growl. (Film clip link: http://tinyurl.com/d8yu976)
SF14		From TV drama 'The Office', 2001. Tim Canterbury's reaction after leaving David Brent's office. (Film clip link: http://tinyurl.com/c53pp3y)

4.4   The Orientation Workshop

This co-design workshop was the first workshop in this series of design activities. It enabled me and the designers to identify potential issues occurring in the interaction between participants.

4.4.1 The Setting
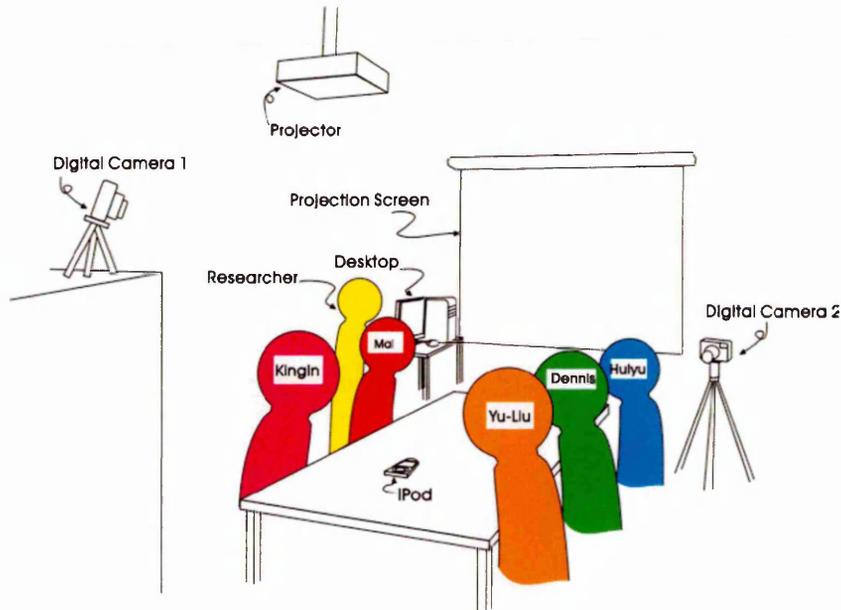
Figure 46 The setting of the Orientation workshop

The setting of this workshop is shown as Figure 46. One sound recording device (iPod Classic) and two Video recording devices (digital cameras with tripods) were arranged. My role was the moderator in this workshop. Five participants consisted of two designers and three users (Table 14). Their seats were arranged for this group discussion. Twenty sketch papers and five pens were provided for design activity in this workshop.

Table 14 The detail of participants in the Orientation workshop (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

	Code	Alias Name	Age	Gender	Nationality
Designer	S-D2	Yu-Liu Huang	31	Female	Taiwan
	S-D3	Kingin Cheng	30	Female	China
User	S-U1	Huiyu Cheng	26	Male	China
	S-U2	Dennis van Grunsven	26	Male	Holland
	S-U3	Mai Inthawong	31	Female	Thailand

4.4.2 The Procedure

Before starting this workshop, I arranged around twenty minutes to explain the process of this workshop and confirm participants' understanding (Appendix III). As discussed in 2.5, a co-design framework (Figure 30) that consists of decoding stage and encoding stage is proposed for creating avatar's expressive behaviour. Therefore, there were two stages in this co-design workshop: the decoding stage was interpreting actors' expressive behaviours in stimulus film clips; the encoding stage was sketching expressive behaviours. The procedure of this workshop is shown as Figure 47.

The decoding stage: analysing and discussing 12 film clips	70 min.
Break time	15 min.
The encoding stage: creating and discussing expressive behaviour	30min.
Reviewing and discussing with the participating designers	60 min.

Figure 47 The procedure of the Orientation workshop

Fourteen film clips were ready for this practical work but I played twelve film clips (film clip SF1 – SF12) in the decoding stage. These film clips were played on the projection screen through Realone Player[19] software. The sound was off to focus on actors' expressive behaviour. In this workshop, my strategy was to discuss each clip immediately after playing it. During the discussions, every participant was allowed to control the frame and the time of the clip when they found specific postures, gestures, or facial expression (Figure 48). Each film clip was discussed for around 5-8 minutes. Then all participants were asked to select three of these film clips that they were interested in for further discussion.

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[19] Realone Player is compatible with numerous formats within the multimedia realm. This software was the only media player installed in the desktop of the meeting room so I used it in this workshop study.

Figure 48 Participants observed and discussed on actors' performances (Left: taken from Camera 1; Right: taken from Camera 2)

Participants considered that most actors' behaviours were understandable but several actors' actions and reactions were not easy to interpret. Therefore, they selected SF5, SF6 and SF9 for further discussion. During the discussion, participants focused on the interaction between actors and discussed the story in each film clips. Then they were asked to make an agreement on the meaning of actors' expressive behaviours for each film clip. These three agreements became the topics for the encoding stage.

Participants were given pens and papers before starting the encoding stage. Then they were asked to create their personal style of expressive behaviours based on the topic created in the first stage via pen-based sketching. After the workshop, I captured all design protocols such as audios, videos, and sketches that were produced within the workshop. Then I used the technique of event logs (3.4.1) to sort out these design protocols via a computer. Each digital file was logged in a digital diary of the project with a brief description of events including dialogues and actions.

After the co-design workshop, the two participating designers were invited to review and evaluate the process of the co-design workshop. When interviewing designers, I used a sound recording device (classic iPod with microphone).

[111]

4.4.3   Observations

4.4.3.1   The Decoding Stage

Jordan (1991) provided a definition for empathy:

> *"Empathy is the affective-cognitive experience of understanding another*
> *person. Intersubjectivity carries with it some notion of motivation to*
> *understand another's meaning system from his/her frame of reference and*
> *ongoing and sustained interest in the inner world of the other.*
> *Intersubjectivity could be thought of as a relational frame of reference*
> *within which empathy is most likely to occur. It is a 'holding' of the other's*
> *subjectivity as central to the interaction with that individual (p.82)."*

Empathy helps us to deal with a wide spectrum of emotional issues, especially in

interpersonal communication. Ickes (1997) stated that empathy as a complicated form of

psychological assumption integrates observation, memory, knowledge, and reasoning to

yield insights into the thoughts and feelings of others.

When observing actors' expressive behaviour, participants seemed to use their

ability to empathise situations and dialogues in film clips. Because of empathy,

participants interpreted actors' feelings and discussed them with others. The discussion

of film clip SF4 is an example.

> Yu-Liu: *This girl, I think the guy keeps mentioning something in his*
> *way and the girl looks like... 'Why do you think in this*
> *way?' That's what I guess.*
> Mai: *Uh, I think she is disappointed on this man. Maybe, he is her*
> *boyfriend or husband. The situation is like 'Why don't you*
> *understand me?'*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.1 t0.15]

In the discussion, participants sometimes made interesting narratives for the film

clips. One user made his narrative for film clip SF5:

> Mai: *The story looks like... this man has some troubles... uh... she*
> *says 'ok, I know you are in trouble'... and the man says 'oh, I*
> *can't control...I am going to be crazy and never think about it's*
> *happened.' Then she tries to give him some ideas and the man*

[112]

> *is going more...crazy and nervous to the woman. She's like...*
> *'I'm trying to give you some ideas to fix it.' But she is worried*
> *about this man.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.1 t0.28]

In the process of interpretation, participants used their ability to empathise actors'

subtle body movements.

In addition to situations, dialogues and narratives, participants indicated actors'

specific postures, gestures, or facial expression in film clips. This discussion of film clip

SF6 is an example:

> Yu-Liu: *For me, this guy is a team leader and he brings a bad news*
> *to other people. He really doesn't want to tell them because*
> *it's really bad news. He uses his fingers to touch his face*
> *like this... and when he says this news, everybody is*
> *shocked and some people touch their faces, and some*
> *people cover mouths to complain, and some*
> *people...uh...like...uh...they don't believe it.*
> Huiyu: *They don't believe it?*
> Yu-Liu: *Some people look like... 'wow' surprised and some people*
> *look like...what's the situation and how to fix it*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.1 t0.36]

Through indicating specific physical movements, participants explained how they

interpreted actors' feelings, emotions and status.

When one participant stated their opinion, it sometimes caused another participant

to hold back from saying what they had thought. Therefore, some ideas might be kept

out of the discussion. The discussion on film clip SF5 is an example.

> Dennis: *It's hard to tell .He puts his hands on the face and hair...he*
> *looks like 'I don't want to listen it anymore' and she puts*
> *her hands...so I think she is angry with him and he did*
> *some stupid things...*
> Huiyu: *I don't think so. I don't think the woman shows her anger. It*
> *looks like this man gets trouble and she is trying to think*
> *idea.*
> Dennis: *Hmm... yeah... probably.*
> Mai: *I think... hmm...*
> Dennis: *Huh?*
> Mai: *Well, I thought another scenario but... I agree with Huiyu.*
> Dennis: *Yeah? Hmm...*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.1 t0.25]

[113]

As shown as the conversation, Dennis and Huiyu had different opinions on film clip SF5. Mai seemed to have another opinion but she did not present her idea. It shows that Dennis and Huiyu's opinions caused Mai to keep her (Mai's) initial viewpoint out of the discussion.

After analysing these twelve film clips, participants were asked to select three interesting film clips from the twelve film clips for further discussion. Participants considered that many actors' expressive behaviour in film clips were understandable. However, they discussed that actors' expressive behaviour in SF5, SF6 and SF9 were not easy to interpret. They were interested in the actors' expressive behaviour in these three film clips so the three film clips were selected to discuss for further.

Participants focused on the interaction between actors and intended to reason the situation in the three film clips. They discussed the story for each film clip and made three agreements on these three stories[20]: SF5 presented a story about 'helpless', SF6 presented a story about 'confounded', and SF9 showed a story about 'astonished'. These three agreements became the topics for the next stage – the encoding stage.

Overall, participants showed their willingness to discuss actors' performances and indicate key movements in this stage. Participants seemed to present their ability of empathy to interpret the situation, dialogues and narratives for film clips.

4.4.3.2 The Encoding Stage

At the end of the decoding stage, three topics ('helpless', 'confounded' and 'astonished') were created for the encoding stage. I expected all participants would undertake the activity of pen-based sketching in this stage. However, users seemed to have difficulty with drawing. This situation had prevented me from getting a result from

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[20] The process of making agreements in the Orientation workshop was different from in the Design workshop (4.5.3.1).

[114]

the workshop and led me to change practice (4.5.1.1) for later workshops.

In the break time, the users told me their concerns about their drawing skills. I did not record the conversation with any device but I jotted the situation down in my notebook as below:

> *"Dennis van Grunsven said he is not good at drawing so don't ask him to sketch"*
> *"Mai Inthawong had the same problem"*
> *"Huiyu Cheng can sketch but he can't promise we could understand his sketch"*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1 Note]

I tried to encourage them to take the activity of pen-based sketching. Also, one designer tried to encourage these users in the beginning of this part:

> Kingin: *Are you sure you don't want to take the pen and paper?*
> Dennis: *Hmm, I am sure.*
> Kingin: *Oh, come on. Drawing something will give you a lot of fun.*
> Dennis: *Well... I believe that but sketching is very difficult for me.*
> Mai: *Yes, it is very difficult.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.2 t0.02]

These users presented their reluctance to sketch so only the designers took the activity of pen-based sketching.

When designers drew body movements on paper, the users did not seem to be involved in the encoding stage. As shown in Figure 49, one female user discussed with one designer when the designer sketched the expressive behaviour. However, another two male users seemed to feel bored. In particular, these two male users left their seats for a while (Figure 50). Besides, the discussion only focused on the designers' sketches because the users did not take the activity of pen-based sketching (Figure 51). The designers did not acquire the users' ideas on the creation of expressive behaviour in the end.

[115]

Figure 49 The designers sketched expressive behaviours (Left: taken from Camera 1; Right: taken from Camera 2)

Figure 50 Two users left the space when designers sketched (Left: taken from Camera 1; Right: taken from Camera 2)

Figure 51 The designers presented the sketch of body movements (Left) and discussed with users (Right)

4.4.4 Discussion

As discussed in 4.4.3.1, participants seemed to use their ability to empathise the situation, dialogues, and narratives for film clips in the decoding stage. In addition, some specific physical movements presented by actors in film clips were indicated by participants. The process of the decoding stage seems to show that the use of film clips

[116]

in group discussion was productive for obtaining participants' perspectives on expressive behaviours. When reviewing the process of the workshop with the participating designers, the two designers gave their comments on the use of film clips as below:

> Yu-Liu: *I had the experience to create animation before and I knew it is uneasy to create meaningful expressive behaviour. I observed and analysed people's action but I was not sure my interpretation was correct or incorrect. These film clips, however, I think they were useful to engage our participants to discuss so I could recognise their perspectives on these actors' performances.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.3 t0.06]

> Kingin: *These selected clips from films present the reliable expressive behaviour because these actors' are professional and famous. When watching and interpreting these actors' performances, I felt these materials absolutely encouraged participants to discuss expressive behaviour.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.3 t0.11]

The designers seemed to confirm that actors' expressive behaviours in film clips are useful materials for the co-design workshops. However, two potential problems in the workshop were identified from the interaction among participants.

One problem identified in the decoding stage was participants being over-influenced by others' opinions. As presented in 4.4.3.1, one participant seemed to be over-influenced by another participant and might not provide her initial reaction. This situation was also of concern to the designers because they mentioned that their views were influenced by others' words sometimes. The designer – Yu-Liu also reported that she did not provide her initial reactions when she was influenced by others' words. In the workshop, participants' perspectives might not be provided fully in the group discussion because of this reason. To deal with this problem, written exercises with tasks would be considered as a useful approach to record participants' initial ideas and obtain more personal opinions. Therefore, the video experience note (see Appendix III) was created for the decoding stage.

Another problem was users' concerns about their drawing skills in the encoding stage. Users did not participate in this stage as I had hoped, losing interest in the process. As discussed in 4.4.3.2, users did not seem to be as involved in the encoding stage. When two designers reviewed this part, they gave their comments as below:

> Yu-Liu: *I even did not know other people's real ideas since I felt I did not interact with them during the creation work. I need them to sketch their ideas.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.3 t0.29]

> Kingin: *Designers absolutely have the sketch skill but I believe every person has the ability to draw their ideas...We should ask these three participants to sketch.*
>
> Sheffield Workshop 1 19.3.11 [event log SHF1.3 t0.37]

Designers seemed to be unsatisfied with the process of the encoding stage. In particular, this research focused on the notion of co-creation so all participants should be involved in the activity of sketching to present their ideas in the co-design workshop.

To address this situation, the approach of video-recording seemed to be productive for users to 'sketch' their ideas. The initial idea for video sketching was that participants should perform expressive behaviours and film each other in the workshop. In my own pilot study (3.3.2), I conducted one role-play game and invited a group of non-actors to film their expressive behaviours. Specific postures could be observed but participants seemed to feel uncomfortable when I filmed them. The piloting experience gave me more understanding of recording people's expressive behaviours via camera. However, the idea was changed when considering the participants' backgrounds. These participants were not professional actors. They might feel uncomfortable in front of the video camera when they were aware that they were filmed. To deal with the situation, therefore, the approach of self-recording by participants was considered and developed (4.5.1.1).

In the decoding stage of this workshop, the twelve film clips (SF1 – SF12) were played and discussed alternately. Each film clip was discussed for around 5-8 minutes.

The participating designers reported that they were tired after discussing these twelve film clips because the group discussion in this stage was around 70 minutes. This strategy (5-8 minutes for one film clip discussion) also seemed to have the problem to discuss actors' expressive behaviour in detail if the group discussion took written exercises with tasks. Because of this, I decided to use only two film clips (SF13 and SF14) and rearranged my strategy for the Design workshop (4.5.2).

4.5 The Design Workshop

Through my own observation as well as the participating designers' feedback on the Orientation workshop, two problems and the actions for dealing with were identified (Table 15). To respond the actions, the video experience note and the video self-recording device as the generative tools were developed and planned to test in this co-design workshop (4.5.1.1). This co-design workshop was aimed at creating ideas and images for two animated expressive behaviour.

Table 15 Two problems and the actions were identified after the Orientation workshop

The stage of	The Problem	The Action
Decoding	Participants may be over-influenced by others' opinions and may not provide their initial reactions.	Written exercises with tasks
Encoding	Users may have difficulty with drawing and may lose interest in the process.	Video self-recording

4.5.1 The Setting

The setting of this workshop is shown as Figure 52. Two participants (Yu-Liu and Dennis) in the Orientation workshop could not attend this one so I invited two substitutes (Peter and Suraya). To experience the two generative tools used in the activity of co-creation, I took the role of designer to engage in interpreting and creating

expressive behaviour in this workshop. This workshop had six participants that consisted of three designers and three users (see Table 16). I took part in the participants' activities as well as operating the workshop so I had to change the place of my seat sometimes. To undertake my work smoothly, the locations of two cameras were not the same as the Orientation workshop (Figure 46). In this workshop, one camera was placed on the computer case and another was placed behind participants to face the projection screen (Figure 52). Twenty sketch papers and six pens were provided for design activity in this workshop. Besides, one classic iPod with microphone was arranged for sound recording.
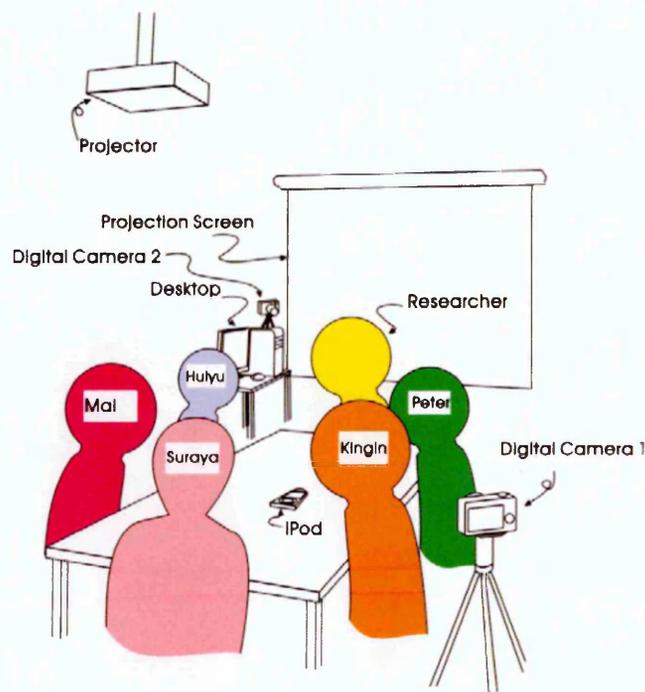
Figure 52 The setting of the Design workshop

Table 16 The detail of participants in the Design workshop (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

	Code	Alias Name	Age	Gender	Nationality
	S-D1	Peter Taylor	24	Male	UK
Designer	S-D3	Kingin Cheng	30	Female	China
	Researcher	Yen-Fu Chen	32	Male	Taiwan
User	S-U1	Huiyu Cheng	26	Male	China
	S-U3	Mai Inthawong	31	Female	Thailand

4.5.1.1   The Video Experience Note & The Video Self-recording Device

The video experience note and the video self-recording device were developed and adopted to deal with problems that occurred in the Orientation workshop. The aim of the video experience note (Figure 53) was to enable participants to record their initial reactions as a reference point for discussion. This was a response to the problem of participants being over-influenced by others' opinions. Two tasks were prepared on the video experience note. In the first task, participants were asked to describe actors' emotions and status. Then, participants needed to indicate actors' expressive behaviours in the second task. Because of time management in this workshop, participants were suggested to complete these tasks with keywords.

Figure 53 The video experience note

The aim of the video self-recording device (Figure 54) was to enable users to produce visual materials for the creation of visual expressive behaviour. This was a possible solution to deal with users' concerns about the creation of expressive behaviour via pen-based sketching. Two designers who had participated in the Orientation workshop suggested the approach of video-recording could be provided to users to

'sketch' their ideas.

Figure 54 The video self-recording device (iPad 2 with iMovie software)

As discussed in 4.4.4, these participants were not professional actors. They might feel uncomfortable in front of the video camera when they were aware that they were filmed. I supposed that participants might be comfortable if they could record their performances by themselves through a video self-recording device with immediate feedback. In addition, I expected this device could offer a suitable size display screen for a small group. In this workshop, iPad 2 with iMovie software was used as a video self-recording device (Figure 55) because it offered the front camera for video self-recording with easy controls and 9.7 inches display screen appropriate for group discussion.

Figure 55 The iPad 2 with iMovie was used for discussing participants' expressive behaviour

4.5.2 The Procedure

Before starting this workshop, I arranged around twenty minutes to explain the process of this workshop and confirm participants' understanding (Appendix III). This co-design workshop was conducted based on the co-design framework (Figure 30) so there were two stages in this workshop: the decoding stage (discussing actors' expressive behaviours) and the encoding stage (sketching expressive behaviour). The procedure of this workshop is shown as Figure 56.

The decoding stage: analysing and discussing film clip SF13	15 min.
The encoding stage: creating and discussing expressive behaviour	25 min
Break time	15 min.
The decoding stage: analysing and discussing film clip SF14	15 min.
The encoding stage: creating and discussing expressive behaviour	25 min.
Reviewing and discussing with the participating designers	50 min.

Figure 56 The procedure of the Design workshop

As explained in 4.4.4, I used two film clips (SF13 and SF14) for this co-design workshop. These two film clips were played on the projection screen through Realone Player software and the sound was off to focus on actors' performances[21].

Before playing the first film clip (film clip SF13), participants were given the video experience note. Then they were asked to record their initial ideas on the note while watching the film clip (Figure 57). I gave participants 5 minutes to observe actors' expressive behaviour and record their initial reactions.

My strategy was to discuss the film clip immediately after participants completed their video experience notes (Figure 58). During the discussion, participants were

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[21] This is the same as the Orientation workshop.

allowed to control the frame and time of the film clip when they mentioned specific

body movements in the film clip (Figure 59). In the end of the decoding stage, all

participants made an agreement on the meaning of actors' expressive behaviours

including emotions and status. This agreed meaning of actors' expressive behaviours as

the topic was ready for the activity of the encoding stage.

Figure 57 Participants took notes while watching the film clip (Left: taken from Camera 1; Right: taken from Camera 2)
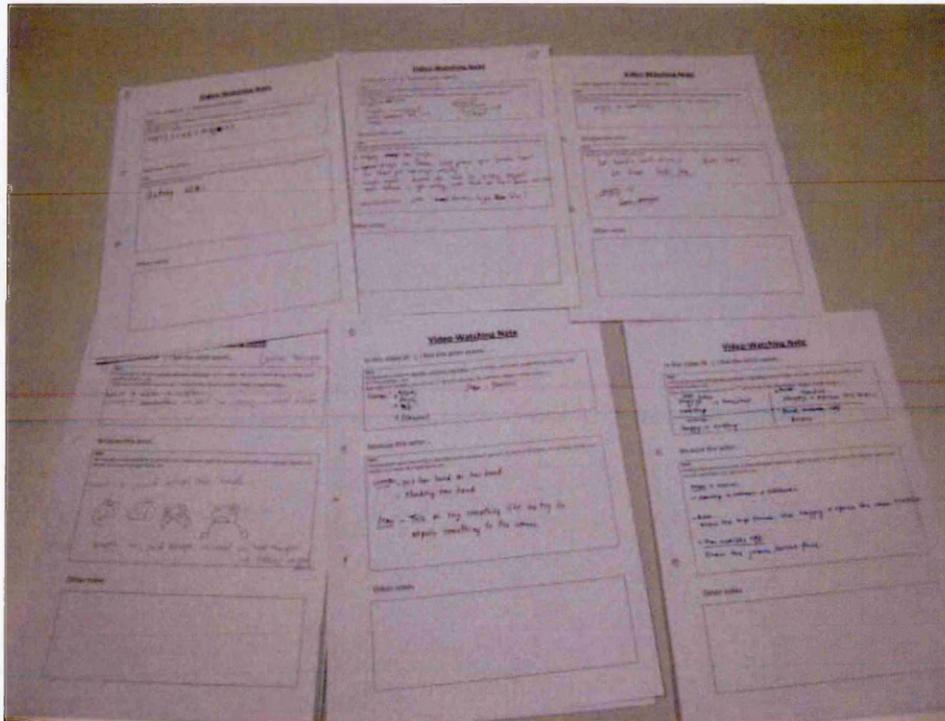
Figure 58 Participants' initial ideas on the video experience notes

Figure 59 Participants discussed their observation and indicated specific body movements (Left: taken from Camera 1; Right: taken from Camera 2)

The encoding stage was to create and discuss participants' expressive behaviours through the activity of sketching. In this stage, participants were asked to sketch possible expressive behaviours for the topic created in the decoding stage. Then these sketches of expressive behaviours were presented and discussed.

Before starting the encoding stage, all participants were informed that they could use the video self-recording device if they were unwilling to draw expressive behaviours (Figure 60). Then all participants presented their creation on the paper or the video self-recording device for further discussion.

Figure 60 some participants used the video self-recording device (Left: taken from Camera 1; Right: taken from Camera 2)

The procedure of discussion on the second film clip (film clip SF14) was the same as the procedure of discussion on the first film clip (film clip SF13). After this workshop, two participating designers were invited to review and evaluate the process of the Design workshop.

4.5.3 Observations

4.5.3.1 The Decoding Stage

Participants were given the video experience note to record their initial reactions in
the beginning of the decoding stage. As discussed in 4.5.1.1, two tasks were prepared on
the video experience note (Figure 53, Appendix IV). In this stage, participants seemed
to focus on two tasks (Figure 57). When observing actors' expressive behaviours,
participants jotted their initial ideas down on the note.

Hint:
Using words to describe feelings, emotions, and status, such as happy, sad, angry, embarrassing, exciting, tired,
worried, anxious... etc.
If you feel it is complex, you can use "+" (plus) to describe, for example: happy + embarrassing + ...

Woman : + Worry   Man : Serious
        + Angry
        + Sad
        + Nervous

Hint:
Writing down some keywords to describe actor's behaviour, gesture, posture, and motion, for example, hands cover
mouth, turn head, rise right hand...etc.

Woman — put her hand on her head
— shaking her hand

Man — Talk or say something like he try to
explain something to the women.

Hint:
Using words to describe feelings, emotions, and status, such as happy, sad, angry, embarrassing, exciting, tired,
worried, anxious... etc.
If you feel it is complex, you can use "+" (plus) to describe, for example: happy + embarrassing + ...

irritated → angry
annoyed → frustrated.

Hint:
Writing down some keywords to describe actor's behaviour, gesture, posture, and motion, for example, hands cover
mouth, turn head, rise right hand...etc.

no hand on forehead — realisation of what is happening.
two hands on head
shaking body / arms apart waving wildly — anger
at person   hands outstretched.

Figure 61 Two participants' records on the note when analysing film clip SF13

As shown as Figure 61, participants seemed to provide a wide range of information
on their notes (also see Appendix V). The words recorded on the note seemed to be
useful to remind participants in the discussion. Each participant was observed to check

[126]

the notes at least ten times when they discussed their analysis of actors' expressive

behaviours. A discussion on film clip SF13 as an example is presented as below:

> Peter: *Uh…Annoyed… that's what I think…uhh…the face becomes worried and angrier… and something is like urgent and want to sort out.*
> Yen-Fu: O*kay… how about you?*
> Mai: *Let me check my note. Hmm, I think…for the woman, she is worried and angry.*
> Yen-Fu: *Hmm…*
> Mai: *And nervous.*
> Huiyu: *Nervous? Hmm?*
> Mai: *Yeah… The man wants to put something on her… and she is shaking. But for this man, he is so calm, maybe he is serious and talking to the woman and he wants to explain to this woman. I am not sure… does he make her angry or worried? Hehe.*

<div align="center">Sheffield Workshop 2 16.4.11 [event log SHF2.1 t0.06]</div>

Although Mai presented her opinion after three participants (Huiyu, Suraya and

Peter), she used the video experience note as the reminder to recall her initial reaction.

Sometimes, participants indicated and presented actors' specific movements based on

their notes (Figure 62).

Figure 62 One participant read his note and presented specific movements

After analysing each film clip, participants were asked to make an agreement on

the meaning of actors' expressive behaviours for each film clip. Because of participants'

initial ideas on the video experience note, the strategy was to focus on the actor who

presented the strong emotion and attractive expressive behaviour in the film clip[22]. For

example, participants considered that Harmony Faith Lane's body movements in film

clip SF13 showed strong emotion such as anger, sad, and indignation. Therefore,

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[22] The process of making agreements in this workshop was different form in the Orientation workshop (4.4.3.1)

participants made an agreement on the meaning of Harmony Faith Lane's body movements. In film clip SF14, participants indicated that they were interested in Tim Canterbury's body movements so the focus of film clip SF14 was Tim Canterbury's status and emotions. Through discussion on these two actors' body movements, two topics – 'lose temper' and 'relief' were created for film clip SF13 and SF14 respectively.

4.5.3.2   The Encoding Stage

In the encoding stage, participants were asked to create expressive behaviours for two topics – 'lose temper' and 'relief' by using pen-based sketching and the video self-recording device. The video self-recording device seemed to be useful in the encoding stage as can be seen in the observations below.

When creating expressive behaviours for the topic of 'lose temper', the users showed their interest in using the video self-recording device for their creations from the start. One discussion on the video self-recording device for the creations among participants is provided as below:

> Kingin: *Let's sketch our body language. Hehe.*
> Mai: *You can sketch and... Huh, can I use this (iPad 2)?*
> Suraya: *Ok, I give up to sketch and also want to use that one (iPad 2). Haha.*
> Kingin: *Hmm, of course you can use iPad 2 but I think you should try to sketch something on the paper firstly. You don't need to draw the detail because we don't need high quality drawings. Just draw your ideas.*
> Suraya: *Hmm, I think the topic is all right for me.*
> Mai: *Huh, ok... I will try.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.1 t0.13]

Two users (Mai and Suraya) wanted to use the video self-recording device initially. However, they changed their minds when one designer encouraged them. Then participants were asked to show their sketches when participants finished their sketches.

[128]

Although the users drew their expressive behaviours on the paper (Figure 63), they seemed to feel uncomfortable to present their sketches in the group discussion. One discussion on one user's sketch as an example is shown as below:

Mai: *Huh, is it my turn?*
Kingin: *Yes.*
Mai: *Oh, no... I don't want to show it.*
Kingin: *Huh, why not?*
Mai: *I am sure my sketch is rubbish so... I really don't want to show it.*
Kingin: *Don't worry about the quality but we need to know what your sketch is.*
Mai: *Hmm, ok. It is my sketch. (silent for around 10 seconds.)*
Kingin: *Huh, could you tell us more?*
Mai: *It is 'lose temper'. Haha*
Peter: *Haha, Kingin wants you to tell us something about the body.*
Mai: *Oh... You can see her face... she is crying. Uh... That's all.*

Sheffield Workshop 2 16.4.11 [event log SHF2.1 t0.27]

Users seemed to feel uncomfortable to present their ideas via pen-based sketching. In addition, users appeared to explain their sketches passively when showing their sketches to other participants.
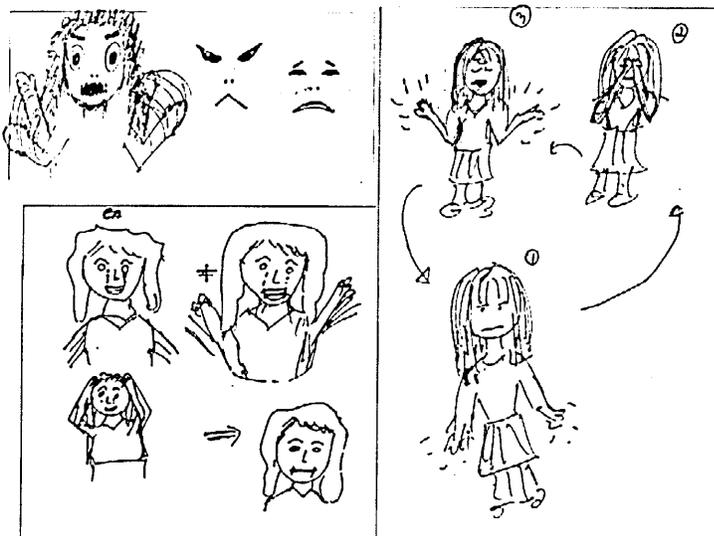
Figure 63 The three users' sketches for the topic of 'lose temper'.

When creating expressive behaviours for the topic of 'relief', two users seemed to have difficulty in drawing their ideas on paper. The discussion on the creation of this topic in the beginning is shown as below:

Kingin: *We still can draw this topic.*
Suraya: *Huh, I think I will use iPad 2 to record, it's*

> *easy for me.*
> Mai: *For me, I think the topic is difficult to*
> *draw...Haha*
> Suraya: *Yeah, yeah. I agree with you. Maybe my*
> *background is not art and design.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.2 t0.17]

Users (Mai and Suraya) used the video self-recording device for their creations (Figure 64).

Figure 64 One user used iPad 2 to record her expressive behaviour

When discussing participants' creations, two users who used the video self-recording device seemed very willing to discuss their recording videos (Figure 65). On the one hand, they described the scenarios that were from their experiences to support their video sketches. On the other hand, they seemed to indicate their body movements in as much detail as possible. One discussion as an example is provided as bellow:

> Suraya: *It's my video. Huh, can you see the movement of my hand?*
> Peter: *Yes.*
> Huiyu: *Hmm*
> Suraya: *When I recorded this gesture, I was thinking when I felt*
> *relief... then the first thing in my mind was to finish my*
> *experiments... Haha*
> Mai: *Haha, I can imagine that because I have similar experience.*
> Kingin: *Me too.*
> Suraya: *Ok, I do this. In the beginning, my hand was...huh...like a*
> *fist because I was nervous.*
> Kingin: *Yeah. I will do that.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.2 t0.29]

The scenario based on participants' experience seemed to enable other participants to reflect if they have had a similar experience. Because of the similar experience, the interaction among participants seemed to be enhanced.

[130]

Figure 65 Two users' video-sketches for the topic of 'relief'

4.5.4   The Creations

The aim of the Design workshop was to create ideas and images for two animated expressive behaviour in gif format. Visual materials including sketches (Figure 63) and self-recording videos (Figure 65) were created in the encoding stage. I expected that two animated expressive behaviour could be created from these visual materials. Therefore, my strategy for these two creations was to review these materials with the two participating designers (Peter and Kingin). Then the technique of storyboarding[23] was adopted to create the two animated expressive behaviour.

When reviewing the visual materials of 'lose temper'(Figure 66) , we observed that participants drew several noticeable face and body movements: 1. arms waving; 2. head scratching; 3. covering face with hands; 4. eyebrows up; 5. eyebrows down; 6. eyes glare; 7. pulling down of lip corners, and 8. narrowing of the lips. Two participants also drew tears on the face.

---

[23]   Storyboards are a communication tool in the form of images presented in sequence for pre-visualizing the concept of a film, animation, and relevant media areas. They are easy to convey the concept of story and characters while creating the complete story. In this creation work, I and the two designers used this technique to create two animations with expressive behaviour.

[131]
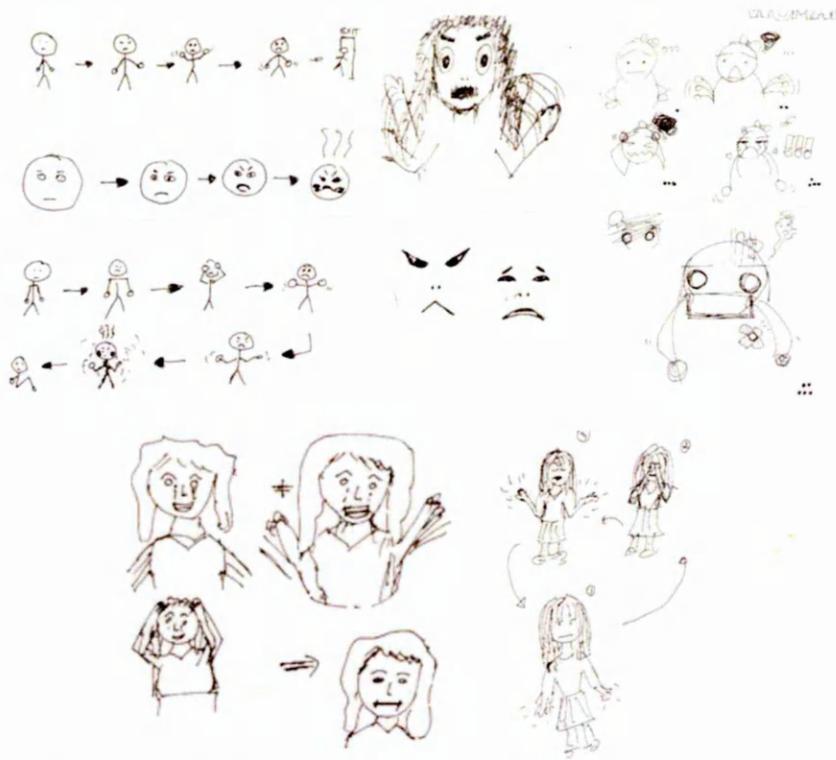
Figure 66 Participants' sketches for the topic of 'lose temper'

These visual materials presented that one person loses temper because of anger, sadness or both. The two designers suggested that the animation of 'lose temper' could consist of 'anger' and 'sadness'. Then a scenario was created as below: a person argues with someone and feels aggrieved. Based on participants' visual materials, fifteen frames with the face and body movements (Figure 67) were created for the animation 'lose temper 1'.

Figure 67 The frames of the first animation – 'lose temper 1' (http://b54.in/98nb)

When reviewing the visual materials of 'relief' (Figure 68), we noted that participants drew several important face and body movements: 1. clasping palms; 2. lifting both hands; 3.high-five; 4. eyebrows up; 5. pushed up cheeks; 5. mouth open; 6. squinting eyes, and 7. eyes close.

Figure 68 Participants' sketches and videos for the topic of 'relief'

In the encoding stage of film clip SF14, participants indicated a sense of relief

[133]

when achieving a task. In this creation work, therefore, the two designers suggested the situation of relief might be waiting the result in tense situations such as result announcement and the football match. The scenario of the animation for relief was created as below: one person is waiting for the result and obtaining the positive result finally. Face and body movements such as clasping palms, lifting both hands, eyebrows up, mouth open, squinting eyes, and eyes close were selected to present the scenario. Thirteen frames with the face and body movements (Figure 69) were created for the animation 'relief 1'.
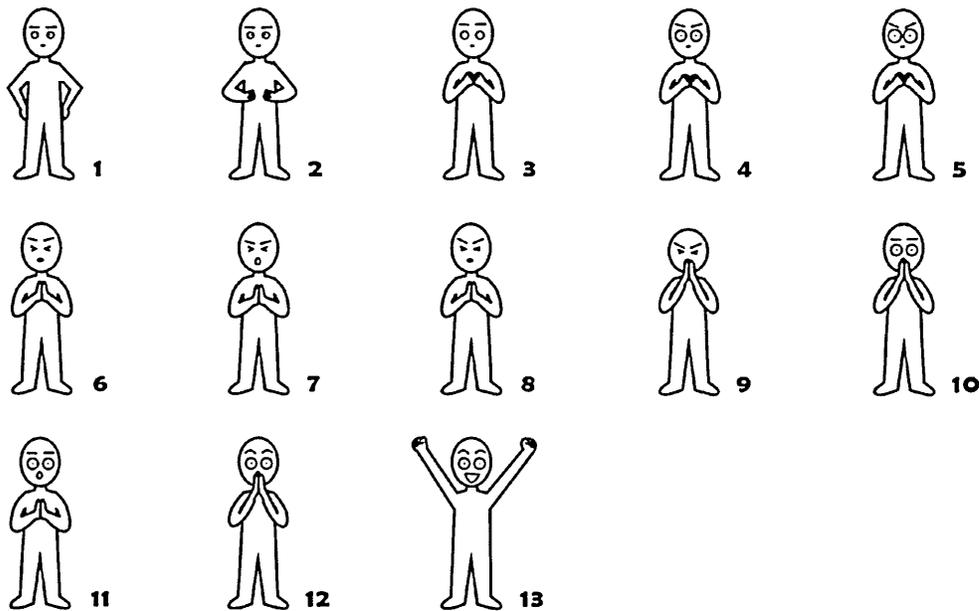
Figure 69 The frames of the second animation – 'relief 1' (http://b54.in/98nf)

4.5.5   Discussion

As discussed in 4.5.2, the workshop had a decoding stage and an encoding stage. The decoding stage was to analyse actors' expressive behaviours in stimulus film clips. The encoding stage was to create expressive behaviours via pen-based sketching and video sketching.

In the decoding stage, the video experience note was used to record participants' initial reactions as a reference point for discussion. As discussed in 4.5.1.1, two tasks

[134]

were arranged on this video experience note: 1. the description of actors' emotions and status; 2. the indication of actors' expressive behaviours. As detailed in 4.5.3.1, participants seemed to provide a wide range of information on their notes. Two participating designers considered this note was useful to obtain more personal opinions when they reviewed the process of this workshop. As one designer gave the comment as below:

> Peter: ...*these two questions on this paper are tasks and useful to achieve your aim. Participants needed to focus on actor's expressive behaviour and think the reason.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.3 t0.07]

When participants jotted their initial ideas down on the note, they did not talk to each other but focused on the actors' expressive behaviours.

The video experience note was also useful to remind participants what they observed in the stimulus film clips. As discussed in 4.5.3.1, each participant was observed to check the notes at least ten times when they discussed their analysis of actors' expressive behaviours. Designer Kingin who attended in the Orientation workshop and the Design workshop gave her comment as below:

> Kingin: ...*I think the discussion on clips in this workshop was better than previous workshop because of these notes. The note reminded me what my answers were so I could remember my ideas...I think other participants really presented their personal ideas through their notes as well.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.3 t0.18]

Comparing the two workshops (the Orientation workshop and the Design workshop), it appeared that the video experience note had a strong effect in encouraging participants to give more personal opinions.

Besides, the video experience note was used to support participants to focus on specific actors' expressive behaviour when making topics for film clips. As described in 4.4.3.1 & 4.5.3.1, participants used different strategies to make topics in the decoding stage. Participants focused on stories and the interaction between actors in the

[135]

Orientation workshop. However, they focused on the specific actor's body movements when the video experience note was provided.

In the encoding stage, all participants were asked to sketch expressive behaviours according to two created topics. To encourage users to contribute their sketches for discussion, the video self-recording device was arranged to record their expressive behaviours by themselves. This device enabled two users to contribute their video sketches in the group discussion when they felt it difficult to sketch their expressive behaviours on the paper.

As detailed in 4.5.3.2, users appeared to prefer to use the video self-recording device for the creation of expressive behaviour. When creating expressive behaviours for the topic of 'lose temper' via pen-based sketching, users seemed to present their sketches unwillingly. In addition, they seemed to discuss the creation of expressive behaviour on paper passively. However, users showed their willingness to present the video sketches for further discussion when they used the video self-recording device for their creations. When reviewing the process of the encoding stage with two participating designers, designers gave their comments on the video self-recording device as below:

> Peter: *...I was surprised to see these people's reaction. I mean... they preferred to use iPad and record their actions. Huh, they had no problem to record... It's like a mirror and I feel it was very useful to help people see how they perform their behaviour.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.3 t0.33]
>
> Kingin: *...I don't think they felt uncomfortable to record their body movements. Maybe... they really thought it's a mirror and they did some actions in the front of a mirror.*
>
> Sheffield Workshop 2 16.4.11 [event log SHF2.3 t0.35]

This video self-recording device provided a front camera and a suitable size display screen. Designers considered this device was like a mirror to reflect people's body movements when recording (Figure 70). Because of the immediate feedback, users might feel confident in presenting the right position of body movements then showed

[136]

their willingness for further discussion.

Figure 70 The video self-recording device as a mirror used for video sketching

As presented in 4.5.3.2, users narrated their experience actively when they showed their videos to others. The experience seemed to recall other participants' similar experiences and might confirm the detail of expressive behaviour. Therefore, users were observed that they had interest in the process and the interaction among participants appeared to be enhanced. As described in 4.5.4, users' experiences and videos influenced the two designers' ideas for the creation of 'relief 1'.

4.6   The Design Review Workshop

Two animated expressive behaviours (Figure 67 and Figure 69) in gif format were created after the Design workshop. To refine these two creations, I arranged the Design Review workshop to obtain non-design participants' feedback. I also planned to obtain non-design participants' perspectives on the approach of video self-recording in the encoding stage of such co-design workshops.

4.6.1 The Setting
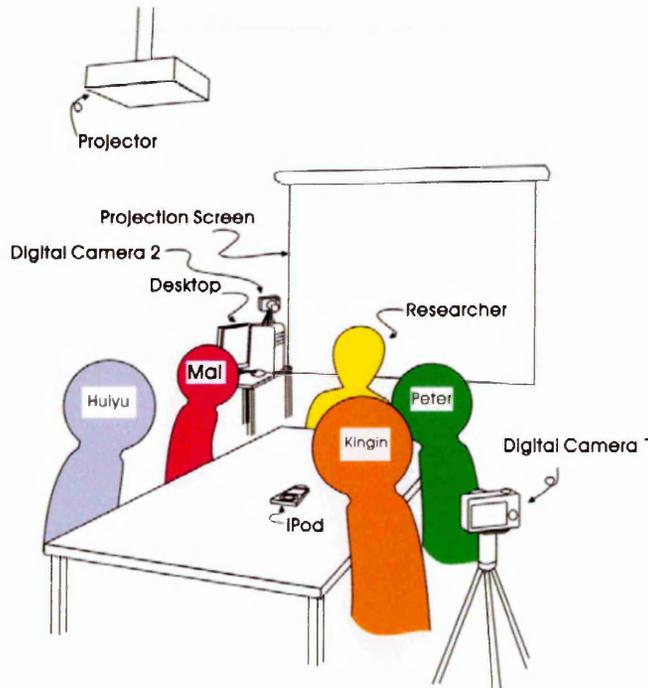
Figure 71 The setting of the Design Review workshop

The setting of this workshop is shown as Figure 71. One iPod for sound recording and two cameras for video recording were applied to record the process. The setting of these recording devices was the same as the Design workshop. My role was the moderator in this workshop. One participant (Suraya) in the Design workshop could not attend this one. Therefore, four participants were invited to attend in this workshop (Table 17).

Table 17 The detail of participants in the Design Review workshop (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

	Code	Alias Name	Age	Gender	Nationality
Designer	S-D1	Peter Taylor	24	Male	UK
	S-D3	Kingin Cheng	30	Female	China
User	S-U1	Huiyu Cheng	26	Male	China
	S-U3	Mai Inthawong	31	Female	Thailand

4.6.2 The Procedure

There were two stages in this workshop (Figure 72): the animation stage was to evaluate the two animated expressive behaviour (Figure 67 and Figure 69); the video recording stage was to evaluate the approach of video self-recording.

The animation stage: evaluating the two animated expressive behavior in gif format	30 min.
Break time	5 min.
The video recording stage: evaluating the approach of video self-recording	40 min.

Figure 72 The procedure of the Design Review workshop

In the animation stage, the two animated expressive behaviour in gif format were played on the projection screen. Each animation was discussed immediately after playing it. During the discussion, I also displayed the frames of animations to enable participants to observe animated body movements in detail. All participants were allowed to control the play of animations and frames. Each animated expressive behaviour (animation and frames) was discussed for 10-15 minutes.
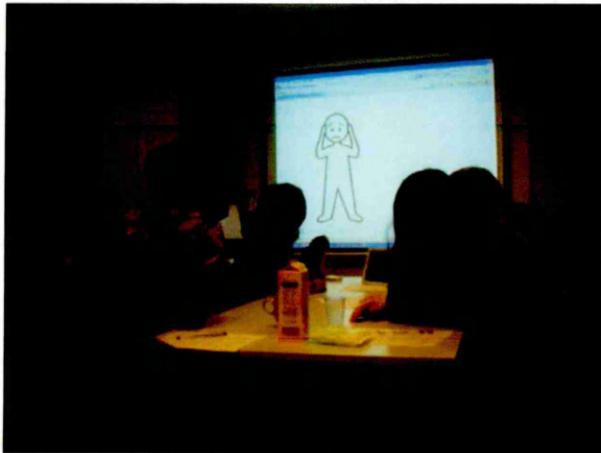
Figure 73 The 'lose temper' animation was played on the on the projection screen

In the video recording stage, all participants were involved in the activity of body movements recording to evaluate the use of video recording device. Two different video recording devices were used: one was a video self-recording device (iPad 2) and another

was a digital camera (Sony Nex-3). Besides, two topics 'relief' and 'lose temper' were applied in this activity. In the topic of 'relief', participants used the video self-recording device to record their bodily expression by themselves (Figure 74). In the topic of 'lose temper', one designer and one user as a group (Peter and Mai; Kingin and Huiyu) were asked to record each other through the digital camera (Figure 75). Then participants were asked to review all videos and provide their opinions on the use of these two different video recording devices.

Figure 74 The participant recording her body movements by herself

Figure 75 Participant used the camera to film their partners

4.6.3   Observations and Discussion

4.6.3.1   The Evaluation of Animations

Two animated expressive behaviours in gif format and the frames were presented

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in the animation stage. Non-design participants considered that two animations were interesting and presented the status of 'lose temper' and 'relief' definitely. For online interaction, the body movements in the two animations were rich so participants suggested that these two creations could be simplified. A discussion on the animation of 'lose temper' as an example is presented as below:

Huiyu: *I think the content is too rich.*
Kinglin: *Too rich?*
Huiyu: *Hmm...too rich.*
Peter: *Because there are a lot of things and...*
Huiyu: *Actually you want to use...like Microsoft message, online game...just show one emotion.*
Mai: *Hmm*
Peter: *There are a lot of emotions and you just pick up one emotion to show... this one can be simplified... I just guess.*

Sheffield Workshop 3 14.5.11 [event log SHF3.1 t0.16]

When reviewing the animation 'lose temper 1', participants considered that the frames of this animation could be divided into two different animations: 1. the character feels remorse; 2. the character argues with someone. Therefore, 'lose temper 2' animation (Figure 76) and 'lose temper 3' animation (Figure 77) were created after the workshop.

Figure 76 The frames of 'lose temper 2' (http://b54.in/98ni)
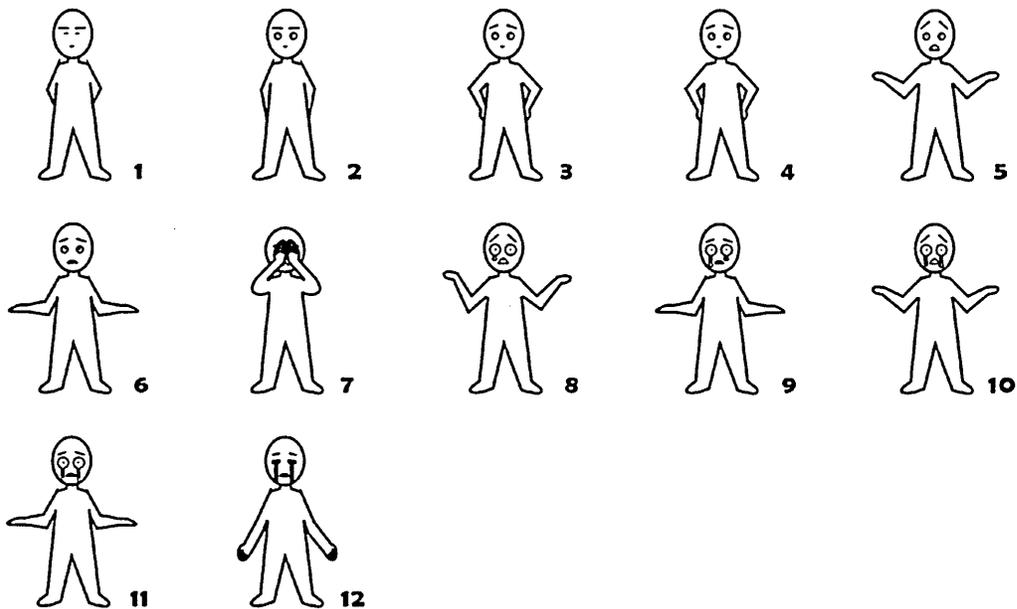
Figure 77 The frames of 'lose temper 3' (http://b54.in/98nj)

As for the animation 'relief 1', the body movements showed 'praying' because of a tense situation. Participants suggested that the movement of praying was unnecessary and could be taken out. The simplified animation – 'relief 2' that was created after the workshop is shown as Figure 78.
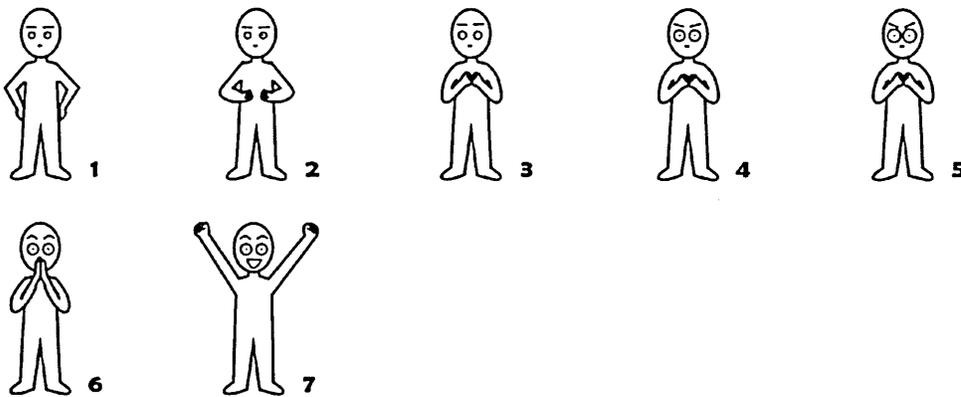
Figure 78 The frames of 'relief 2' (http://b54.in/98nk)

4.6.3.2 The Evaluation of Video Recording Devices

I conducted the activity of body movements recording to evaluate the use of video recording device in the video recording stage. All participants were asked to record their body movements for the topic of 'lose temper' and 'relief' through two different

[142]

approaches: self-recording (iPad 2) and recording by another participant (Sony Nex-3). When reviewing these videos, participants provided their opinions on these two approaches.

In these videos, participants did not present body movements for the topic 'lose temper' naturally because they were smile (Figure 79 and Figure 80). However, they presented body movements for the topic 'relief' very well. Designer Kingin intended to explain the reason as below

> Kingin: *... everyone was comfortable to present how they feel relief but not comfortable to present the topic 'lose temper'. The topic 'lose temper' is asked us to present a negative behaviour... and I don't think we want to present the bad thing to others, in particular the public space. Besides, we could hurt other people or damage things such as the table and chairs if we really presented we lose temper.*

Sheffield Workshop 3 14.5.11 [event log SHF3.2 t0.26]
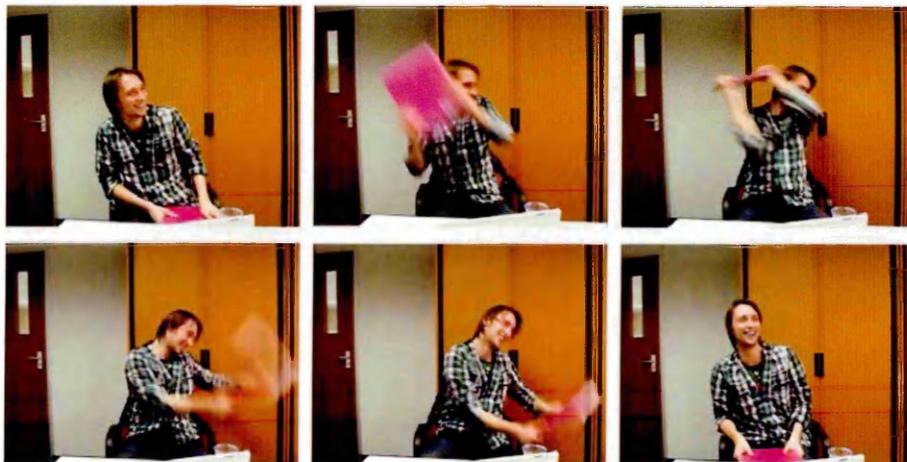
Figure 79 Peter presented his expressive behaviour when he really lost temper

Figure 80 Mai showed her expressive behaviour when she felt anger

[143]

This video self-recording device provided a front camera and a suitable size display screen. Participants considered this device was like a mirror to reflect their body movements. Participant Mai provided her feedback as below

> Mai: S*elf-recording, it's like to see a mirror. When I did the performance…I felt confident because I could see myself and make sure my body movements.*
>
> Sheffield Workshop 3 14.5.11 [event log SHF3.2 t0.32]

Because of immediate feedback, participants felt confident to present right position of body movements. Participants also indicated that they preferred to use the video self-recording device when asking the question about the preferences of video recording approach for recording body movements.

4.7 The Evaluation Workshop

Following the Design Review workshop, three new animations were refined from these two creations. The aim of the Evaluation workshop was to evaluate all animations if participants used them in online interaction.

4.7.1 The Setting
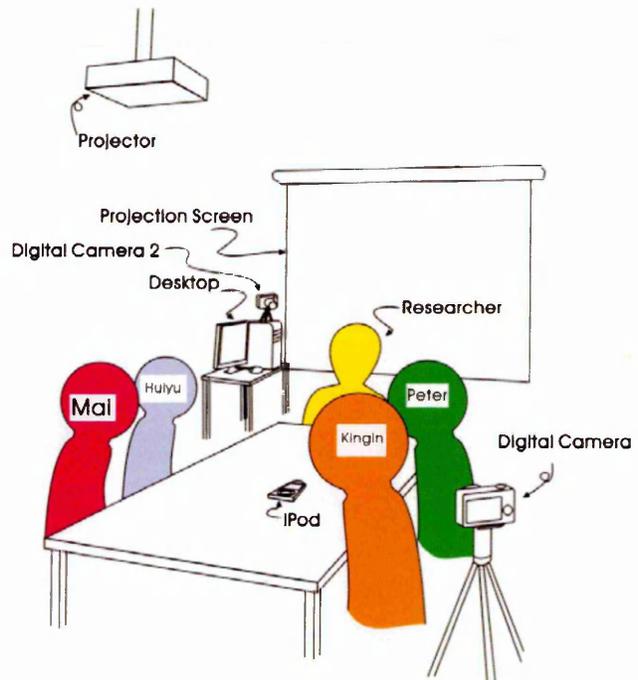
Figure 81 The setting of the Evaluation workshop

The setting of this workshop is shown as Figure 81. My role was the moderator in this workshop. Four participants were the same as the Design Review workshop (Table 17). The participants' locations for this workshop were expected to be the same as the Design Review workshop. However, Huiyu and Mai's locations had been changed because Mai was late to attend the workshop. One iPod for sound recording and two cameras for video recording were applied to record the process.

4.7.2 The Procedure

I arranged about ten minutes to inform participants of the process of this workshop in the beginning. Then five animated expressive behaviour in gif format (Table 18) were played on the projection screen (Figure 82). All participants were asked to provide their opinions if they would use the five animations in online interaction.

[145]

Figure 82 One animation was played on the projection screen

Table 18 Five animated expressive behaviour in gif format

Topics	Animations	Created for
Lose temper	Lose temper 1 (Figure 67)	The Design Review workshop & The Evaluation workshop
	Lose temper 2 (Figure 76)	The Evaluation workshop
	Lose temper 3 (Figure 77)	The Evaluation workshop
Relief	Relief 1 (Figure 69)	The Design Review workshop & The Evaluation workshop
	Relief 2 (Figure 78)	The Evaluation workshop

4.7.3 Discussion

Participants indicated that the two animations – 'lose temper 1' (Figure 67) and 'relief 1' (Figure 69) presented rich expressive behaviour. The two animations could tell more information to the receiver but the receiver may need time to watch for response. A discussion on the animation 'lose temper 1' as an example is presented as below:

> Huiyu: *From my personal opinion, these two animations are like to present stories. For example, this one (the animation 'lose temper 1') is showing how to lose temper. That is very interesting and I will use this one to my friends for online interactions. But...uhhh... they will need to take time to see how the process is going and respond it.*
>
> Mai: *Hmm... it (the animation 'lose temper 1') is very funny and I can see a lot of information how this guy loses his temper. Hehe.*

Sheffield Workshop 4 11.6.11 [event log SHF4.1 t0.05]

[146]

On the other hand, participants considered that the three animations – 'lose temper 2' (Figure 76), 'lose temper 3' (Figure 77) and 'relief 2' (Figure 78) showed the intention in a direct way. The receiver could recognize the sender's status or mood immediately. As user Mai provided her feedback

> Mai: *The first one (the animation 'lose temper 2') shows I am very angry. I don't need to say any word in online interaction.*
>
> Sheffield Workshop 4 11.6.11 [event log SHF4.1 t0.09]

Designer Peter also provided his opinion

> Peter: *...you get me to understand the angry with that one, the first one (the animation 'lose temper 2'). The second one (the animation 'lose temper 3') is more distress. Something easy to get the emotion and...err they are different things but everyone can understand 'lose temper'...*
>
> Sheffield Workshop 4 11.6.11 [event log SHF4.1 t0.10]

These five animations presented rich expressive behaviour and simplified expressive behaviour. Participants suggested that these animated expressive behaviour could be adopted in different online interaction.

Three simplified animations ('lose temper 2', 'lose temper 3' and 'relief 2') were refined from the two animations ('lose temper 1' and 'relief 1'). Participants indicated that these animations could be viewed as stimulus for the new creation of expressive behaviour by avatar. The discussion is presented as below:

> Huiyu: *Well, I think we can create more animations from these three (simplified animations).*
> Mai: *I agree. The second one (the animation 'lose temper 3') is complicated and not for one emotion. If you give the second one to the designer, you will get wide animations from designers.*
> Peter: *Designers? Kingin and I?*
> Mai: *Yes! Haha.*
> Peter: *Of course, we can make five or six different new animations from these created animations. Hehe.*
> Kingin: *Uhh...these animations are basic but I am thinking if I use them to design relevant body movements in the game, I believe these body movements will be more attractive.*
>
> Sheffield Workshop 4 11.6.11 [event log SHF4.1 t0.21]

These animations were considered as the positive aid to the work – in creating

[147]

more diverse behaviours.

4.8 Summary and Conclusions

In this workshop study, four co-design workshops were arranged to look into and refine the co-design methods in working with designers and users. These workshops were the Orientation workshop, the Design workshop, the Design Review workshop, and the Evaluation workshop. The process of the Orientation workshop and the Design workshop were according to the co-design framework (Figure 30).

In the Orientation workshop, two problems were identified from my own observation and designers' feedback (4.4.3 and 4.4.4). The first problem was how to obtain more participants' personal opinions on actors' performances in discussion. The second problem was how to enable users to contribute their concepts in creating expressive behaviour. Having identified problems in the co-design process, the video experience note and the video self-recording device were developed and adopted to facilitate information exchange between participants in the Design workshop.

The video experience note was used to record participants' initial reactions as reference points in discussion. The video self-recording device provided users another approach to contribute their concepts in the creation of expressive behaviour. These supportive tools generated a more wide-ranging discussion of the movie clips, with a wider variety of opinions expressed, and the participants were able to produce a substantial amount of video material themselves.

After the Design workshop, two animations 'lose temper 1' and 'relief 1' were created with the two participating designers (4.5.4). I then arranged the Design Review workshop to refine these two creations. From participants' observations and feedback, these two creations were suggested to be simplified. Therefore, three new animations 'lose temper 2', 'lose temper 3' and 'relief 2' were created from the two creations –

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'lose temper 1' and 'relief 1'.

In the Evaluation workshop, the participants were invited to review all creations. These participants (in particular users) indicated that they would use these creations for online interactions. Also, these creations were suggested to be viewed as the stimulus for creating more diverse behaviours.

This practical work of four workshops is the Workshop Study 1 for this PhD research. The evidences emerged from this practical work provided me the confidence to construct the design methods for creating expressive behaviour by avatars by using the co-design framework (Figure 30). The video experience note and the video self-recording device as new generative tools were developed in this workshop study. To focus on evaluating these tools used in such co-design workshops, I then arranged Workshop Study 2 that was conducted in Taipei and will be described in chapter 5.

5 Workshop Study 2: Evaluating Generative Tools

5.1 Introduction

Workshop Study 1 in chapter 4 indicated that I had identified and refined useful strategies with two potentially useful generative tools for co-creating expressive behaviour by avatars. More reliable evaluation of the effectiveness of the generative tools was still needed. Therefore, the main aim of Workshop Study 2 in this chapter is to evaluate the generative tools in use with professional collaborators. To achieve this main aim, two co-design workshops were conducted in Taipei, Taiwan. The main features of the co-design workshops in this chapter are the same as the previous workshop study in chapter 4 (Table 19)

Table 19 The list of the main features of the workshop study

The setup	The selection of participants
	The selection of stimulus film clips
The workshop	The decoding stage (analysis session)
	The encoding stage (creation session)
Tools / Methods	The film clips suggestion questionnaire
	Selected film clips
	The video experience note
	The video self-recording device
Recording	Sound recorder
	Digital cameras with tripods

The interaction among participants in this workshop study was quantified through Bales' Interaction Process Analysis (IPA) (3.4.2) and results verified with the Chi-square goodness-of-fit test. The result shows: 1. the frequency of users' task-oriented acts were increased significantly when using the video experience note to analyse actors' expressive behaviours in film clips; 2. the frequency of users' task-oriented acts were raised when using the video self-recording device to create and

discuss expressive behaviours; 3. the frequency of participants' social-emotional acts were increased significantly when using the video self-recording device to create and discuss expressive behaviours.

5.2 Workshop Study Aims

The overall aim of Workshop Study 2 was to evaluate the effectiveness of the identified generative tools in creating productive interaction between designers and users. The video experience note was used to assist participants in analysing actors' expressive behaviours in stimulus film clips. The video self-recording device was applied to support the activity of sketching. To achieve the aim, Bales' IPA was applied to quantify the manner in which tool modes affect group communication process for analysing and creating expressive behaviours.

5.3 The Setting of the Workshop Study

Table 20 The background of participants in Workshop Study 2 (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

	Code	Alias Name	Age	Gender	Nationality
Designer	T-D1	Yi-Ching Wu	32	Male	Taiwan
	T-D2	Tze-Yin Huang	27	Female	Taiwan
User	T-U1	Wen-Cheng Lou	33	Male	Taiwan
	T-U2	Sheng-Yi Wang	29	Male	Taiwan

Two co-design workshops were arranged in this workshop study. The co-design team comprised two designers and two users (Table 20). Designer Yi-Ching who is a game designer in a successful game design company with a large design team in Taiwan has 6 years professional experience on characters design including characters' expressive behaviours. Another designer Tze-Yin is an animator/effect artist in an

[151]

animation company in Taipei. She has 3 years professional experience on animation creation including expressive behaviours. As for the two users, Wen-Cheng has 10 years experience of using avatar-based environments and Sheng-Yi has 8 years experience. These four participants did not know each other before the workshops. All participants attended both workshops.

The workshop setting was planned to give the best opportunity to evaluate the two generative tools. The two workshops in this workshop study were both conducted at a meeting room of MyDesy design studio in Taipei (Figure 83).In this space, a laptop computer, a projector and a projection screen were ready for playing film clips. A table and four chairs were placed in the front of projection screen.

Figure 83 The space and equipment for workshops
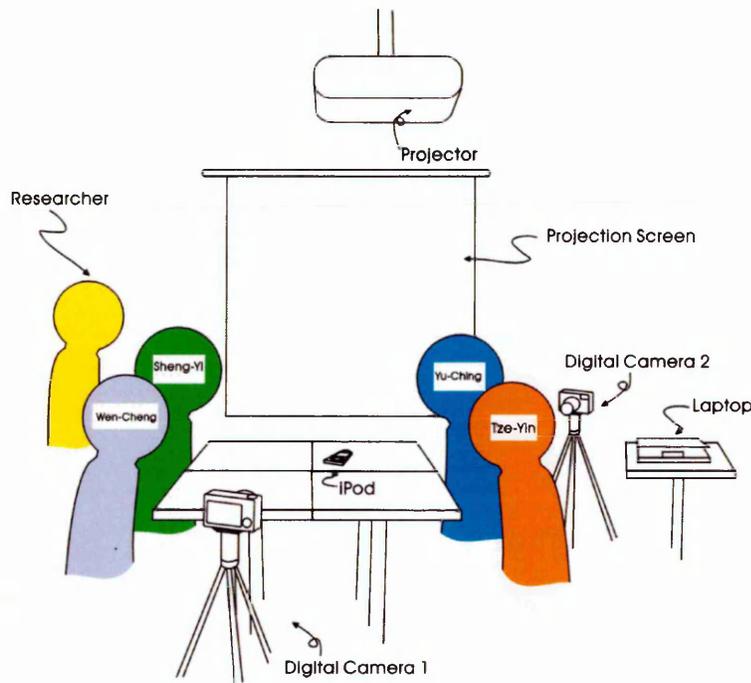
Figure 84 The setting of Workshop Study 2

The setting of this workshop study is shown as Figure 84. Two designers and two users were arranged to sit side by side separately for this group discussion. A sound recorder (iPod Classic with microphone) and two digital cameras with tripods were arranged different places for recording the interaction among participants. Sketch paper and pens were provided for design activity. The four video experience notes and four video self-recording devices (iPad2) were prepared. The projector was set up to allow display of material from the video self-recording devices as well as the laptop computer.

As in the previous workshops (4.5.2), these two workshops in this study consisted of the decoding stage and the encoding stage. To evaluate the effectiveness of the video experience note and the video self-recording device used in the co-design workshops, my strategy is shown in Table 21. In each of the two workshops the participants undertook similar tasks both with and without the two tools being evaluated. The detail of each workshop will be described in 5.4 and 5.5.

Table 21 The overview of this workshop study

Workshop	Film clip	Session	Stage of	Tool
The 1st	TF1	Control	Decoding	None
			Encoding	Pens and sketch paper
	TF2	Tool-use	Decoding	The video experience note
			Encoding	iPad 2 (The video self-recording device)
The 2nd	TF3	Control	Decoding	None
			Encoding	Pens and sketch paper
	TF4	Tool-use	Decoding	The video experience note
			Encoding	iPad 2 (The video self-recording device)

5.3.1 Participants

The recruitment process is the same as that used in the Workshop Study 1 (4.3.1). I asked acquaintances to identify and recommend their acquaintances who use avatars and appeared to have an interest in movies and TV dramas, in particular watching at least two movies or TV dramas in a week. I also asked the identified avarar users to identify and recommend others. From the recruiting process, I made sure that these volunteers were likely to be able to respond to the film clips suggestion questionnaire. After that, eight volunteers were invited to suggest potential film clips (Table 22). The questionnaire includes open questions that were difficult to answer in detail in a short time so I gave all respondents one week to respond.

Table 22 The detail of respondents (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Background	Occupation
Wen-Cheng Lou	33	Male	Mathematics	Research Assistant
Sheng-Yi Wang	29	Male	Electrical Engineering	Electrical Engineer
Yu-Chan Hung	28	Female	Business	Cashier
Mei-Hui Lin	27	Male	Computing	Computing Engineer
Yen-Cheng Tu	30	Female	Law	Administrative Assistant
Chi-Ya Hung	26	Female	Marketing	Sales Assistant

| Tzu-De Wang | 28 | Male | Marketing | Waiter |
| Yu-Ming Chen | 31 | Male | Computing | Computing Engineer |

Individual discussions with respondents were arranged after I collected and reviewed completed questionnaires. The process is the same as my previous process in 4.3.1. In these discussions, I asked individual questions depending on the responses and enquired about their experience of online interaction in avatar-based environments. As in the previous workshops I expected, to identify suitable workshop participants via these individual discussions. As explained at the end of 3.3.7.1, I observed the respondents who really showed: 1. greater willingness to discuss additional questions in detail; also 2. ability to propose their own questions in the discussion. Then I invited them to attend the co-design workshops. I identified five respondents (Table 23) who appeared to be suitable to take part in the workshops and, taking account of their availability, I selected two of them for the actual workshops.

Table 23 The list of suitable non-design participants (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Nationality	Availability
Wen-Cheng Lou	33	Male	Taiwan	Yes
Sheng-Yi Wang	29	Male	Taiwan	Yes
Yu-Chan Hung	28	Female	Taiwan	No
Yen-Cheng Tu	30	Female	Taiwan	No
Tzu-De Wang	28	Male	Taiwan	No

I also invited two professional designers (Table 24) who were interested in this workshop study through my personal contacts. Yu-Ching has 6 years of professional experience as designer in game design including characters design and Tze-Yin has 3 years of professional experience as animator/effect artist in animation. The designers understand how to use their design skills and discuss with other people well. Four participants for the workshop study consisted of two designers and two users (Table 20).

Table 24 The designers invited in Workshop Study 2 (As explained in 3.3.3, to preserve the anonymity of participants, aliases have been used instead of their real names.)

Alias Name	Age	Gender	Nationality	Professional Experience
Yi-Ching Wu	32	Male	Taiwan	6 Years

5.3.2   Stimulus Film Clips

17 movies and 5 TV dramas were suggested by the questionnaire respondents (Table 22) for this workshop study. 26 scenes with actors' expressive behaviours that impressed respondents were also provided. To evaluate the video experience note in such co-design workshop is one aim in this study. One or two nonverbal signals in the film clip seemed to be insufficient to evaluate the video experience note. Therefore, each clip that contained more nonverbal signals was rimmed about 1 minute. Following the process described for previous workshops (4.3.2), two considerations for further selections were concerned: 1. the content of actors' expressive behaviours involved two or more emotions; 2. the length of a film clip was in approximate 1 minute (around 50 seconds to 60 seconds). Finally, 4 film clips were selected for using in the workshops (Table 25).

Table 25 Four film clips used in Workshop Study 2

Code	Image of film clip	Description
TF1		From movie 'Sex and the City: The Movie', 2008. Carrie, Miranda and Charlotte are angry with Mr. Big (in particular Carrie) because Mr. Big changes his mind in the wedding. (Film clip link: http://tinyurl.com/oxp7yvx)
TF2		From movie 'Coach Carter', 2005. The basketball players and the audience's show their reactions when one team gets the last points in the last second. (Film clip link: http://tinyurl.com/nzhu9l2)

TF3		From movie 'Jerry Maguire', 1996. Jerry, Rod's family and friends, and the audience worry about Rod's condition on the field of American football. (Film clip link: http://tinyurl.com/ok8eefp)
TF4		From movie 'The Curious Case of Benjamin Button', 2008. Queenie and Tizzy find the baby at the nursing home and Queenie decides to care for the baby as her own. (Film clip link: http://tinyurl.com/o4np3oh)

5.3.3   The Generative Tools

In chapter 4, I described the development of two novel tools that might be used to enhance the generative phase of co-creating avatar's expressive behaviours. These were the video experience note and the video self-recording device. As explained in 4.5.1.1, the video experience note was used to record participants' initial reactions as a reference point for discussion on actors' expressive behaviours. This video experience note consisted of two tasks: 1. the description of actors' emotions and status; 2. the indication of actors' expressive behaviours. The video self- recording device was used to record users' expressive behaviours as visual materials for the creation of visual expressive behaviours. A tablet computer with front camera (iPad2 with iMovie software) enabled participants to record their actions by themselves easily.

5.3.4   Analysis Methods

The data analysis in this study focused on the interaction among participants. Bales' Interaction Process Analysis (IPA) was used to quantify the manner in which the tool

modes affect the group communication process for analysing and creating expressive behaviours. All nonverbal behaviours and verbal communications in these two workshops were recorded (Figure 84) and transcribed for coding. My role was a researcher and observer in this workshop study. I did not take part in the activity of discussion and creation. I only provided help when participants needed further information on tasks and tools. Most participants' nonverbal behaviour was accompanied by verbal communications. To avoid repeating coding the same acts, the coding work was based on the transcript of verbal communications. Also the communication and interaction between participants and I were taken out the coding work.

I used independent coders to avoid bias in the course of coding work. I intended to recruit the coders at my university – Tatung University (TTU) in the beginning but Bales' IPA was the new data analysis technique for my colleagues. To recruit the suitable encoders, I had to go outside my university for the expertise. A great help for the coding work was obtained from Department of Information Management at National Taiwan University (NTU). The two coders were postgraduate students (TTU and NTU) who had been trained for six weeks in accordance with the IPA coding scheme developed by Bales (Appendix VII).

The kappa statistic that was introduced by Jacob Cohen in 1960 was used to assess interrater reliability[24] between the two coders in this study. Kappa values can range from -1 to 1, where 1 is perfect agreement, 0 is exactly what would be expected by chance, and negative values indicate agreement less than chance (Viera and Garrett, 2005). Table 26 shows interpretation of Kappa values. After the coding work, totally 794 verbal acts occurred in the interaction between designers and users were identified. The intercoder reliability was calculated and reliability between coders was satisfactory

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[24] McHugh (2012) explained that reliability across multiple data collectors is 'interrater reliability' and reliability of a single data collector is 'intrarater reliability'.

(kappa = 0.7598) (see Appendix VIII).

Table 26 Interpretation of Kappa

Kappa	Agreement
< 0	Less than chance agreement
0.01–0.20	Slight agreement
0.21– 0.40	Fair agreement
0.41–0.60	Moderate agreement
0.61–0.80	Substantial agreement
0.81–0.99	Almost perfect agreement

When categorical data produces nonnumerical data that are frequency counts of categories from one or more variables, the Chi-square test is applied to examine whether there is a significant association between data (Black, 2012). As Black (ibid) explained,

> *"The chi-square goodness-of-fit test is used to compare a theoretical or expected distribution of measurements for several categories of a variable with the actual or observed distribution of measurements* (p.680)."

In this study, two categories were sessions ('control' and 'tool-use') from a single co-design team ('designers' and 'users'). To assess the effects of tools on designers' and users' communication acts in a group discussion, the Chi-square goodness-of-fit test was applied to analyse designers and users' social-emotional acts and task-oriented acts (5.4.3.1, 5.4.3.2, 5.5.3.1 and 5.5.3.2).

5.4 The 1st Workshop

5.4.1 The Setting

As described in 5.3, four participants (two designers and two users) were arranged to sit side by side separately for this group discussion. To record the interaction among participants, one sound recorder (iPod Classic with microphone) and two digital cameras with tripods were arranged different places as shown in Figure 84. Sketch paper and pens were provided for design activity. The four video experience notes and

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four video self-recording devices (iPad2) were prepared. The projector was set up to allow display of material from the video self-recording devices as well as the laptop computer.

5.4.2   The Procedure

Before starting this workshop, I arranged around fifteen minutes to explain the process of this workshop and confirm participants' understanding. Two stimulus film clips (film clip TF1 and TF2) were ready for the decoding stage of this workshop and played on the projection screen through Windows Media Player software. The film clips were played without sound. The workshops followed the same pattern as previous workshops, shown below in Figure 85.

Control session	The decoding stage: analysing and discussing the film clip TF1 without the video experience note	15 min.
	The encoding stage: creating and discussing expressive behaviour with pens and sketch paper	15 min.
	Break time	10 min.
Tool-use session	The decoding stage: analysing and discussing the film clip TF2 with the video experience note	15 min.
	The encoding stage: creating and discussing expressive behaviour with the video self-recording	15 min.

Figure 85 The procedure of the first workshop

The workshop consisted of 'control' session (film clip TF1) and 'tool-use' session (film clip TF2). The process is the same for each session: 1. analysing and discussing a film clip in the decoding stage (Figure 86); 2. creating and discussing expressive behaviour in the encoding stage.

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Figure 86 Participants observed and discussed on actors' performances (Left: taken from Camera 1; Right: taken from Camera 2)

In the decoding stage of 'control' session, the topic – 'indignation' was created for the film clip TF1. This topic was used for the activity in the encoding stage creating and discussing participants' expressive behaviours through the activity of sketching. Participants were asked to sketch possible expressive behaviours (Figure 87). These sketches of expressive behaviours were presented in the group discussion.

Figure 87 Two users' sketches for the topic of 'indignation'

In the decoding stage of 'tool-use' session, the topic – 'can't believe it' was created with using the video experience note for the film clip TF2. The encoding stage was to create and discuss participants' expressive behaviours for this topic. Pens and sketch paper were not provided in this session. Instead, four tablet computers (iPad 2) as the self-video recording deceives were provided. All participants were asked to record their expressive behaviours by themselves via the device (Figure 88). The recording videos as video sketches (Figure 89) contained participants' expressive behaviours were

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presented on the projector screen for discussing (Figure 90).

Figure 88 One user used the video self-recording device for video sketching

Figure 89 One user's video sketch for expressive behaviour of 'can't believe it '

Figure 90 Participants discussed one user's video sketch

5.4.3   Result

In this workshop, 386 communication acts were identified in the interaction among participants.

5.4.3.1   The Decoding Stage of the 1st Workshop

In this analysis I will compare the coding results for the 'control' and 'tool-use'

sessions to establish whether using the tools results in a significant enhancement of users participation. Table 27 shows observed frequencies of participants' communication acts during 'decoding' in the 'control' session (Video Experience Note not used) while Table 28 shows observed frequencies of participants' communication acts during 'decoding' in the 'tool-use' session (Video Experience Note used). The video experience note was used in this session. Note that users' 'attempted answers' acts were 33 in the 'tool-use' session copmpared to 17 in the 'control' session. The other data appears to show no significant change between the two sessions.

Table 27 'Decoding' in the 'control' session (Workshop TF1)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	11	2	31	9
Users	8	5	17	8

Table 28 'Decoding' in the 'tool-use' session (Workshop TF2)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	12	1	30	6
Users	10	2	33	8

As explained at the end of 5.3.4, designers and users' social-emotional acts and task-oriented acts were analysed with a Chi-square goodness-of-fit test to access the group discussion in different sessions ('control' and 'tool-use'). Table 29 shows observed frequencies of participants' communication acts for 'deciding' in the 'control' session and the 'tool-use' session. According to the Chi-square distribution table (Montgomery et al, 1998), the value of $\chi^2_{(0.05, 1)}$ is 3.84. When a chi-square value is bigger than 3.84, there is a statistically significant difference in the data.

Chi-square test testing observed frequencies of users' task-oriented acts between two sessions achieved significance, $\chi^2 = 3.879 > 3.84$. The result indicates that the

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frequency of users' task-oriented acts was influenced significantly when using the video experience note.

Table 29 'Deciding' in the 'control' session and the 'tool-use' session (Workshop TF1 and TF2)

	Sessions		χ^2 (1)
	Control	Tool-use	
Designers' social-emotional acts	13	13	0
Users' social-emotional acts	13	12	0.04
Designers' task-oriented acts	40	36	0.211
Users' task-oriented acts	**25**	**41**	**3.879***

* means 'achieved significance'

5.4.3.2 The Encoding Stage of the 1st Workshop

Table 30 shows observed frequencies of participants' communication acts during 'encoding' in the 'control' session. Pens and paper waer used to sketch expressive behaviours in this session. Table 31 shows observed frequencies of participants' communication acts during 'encoding' in the 'tool-use' session. The video self-recording device was applied to sketch expressive behaviours in this session. Note that designers' 'postive social-emotional' acts were 24 in the 'tool-use' session copmpared to 2 in the 'control' session. Users' 'postive social-emotional' acts were 32 in the 'tool-use' session copmpared to 4 in the 'control' session. Users' 'attempted answers' acts were 25 in the 'tool-use' session copmpared to 14 in the 'control' session. Users' 'questions' acts were 11 in the 'tool-use' session copmpared to 3 in the 'control' session. The other data appears to show no significant change between the two sessions.

Table 30 'Encoding' in the 'control' session (Workshop TF1)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	2	2	25	5
Users	4	5	14	3

Table 31 'Encoding' in the 'tool-use' session (Workshop TF2)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	24	5	24	7
Users	32	5	25	11

Designers and users' social-emotional acts and task-oriented acts were analysed with a Chi-square goodness-of-fit test to to access the group discussion in different sessions ('control' and 'tool-use'). Table 32 shows observed frequencies of participants' communication acts for 'deciding' in the 'control' session and the 'tool-use' session. Chi-square test testing observed frequencies of designers' social-emotional acts, users' social-emotional acts, and users' task-oriented acts between two sessions achieved significance, χ^2 (1) > 3.84. The result indicates that the frequencies of designers' social-emotional acts, users' social-emotional acts and designers' task-oriented acts were influenced significantly when using the video self-recording device.

Table 32 'Encoding' in the 'control' session and the 'tool-use' session (Workshop TF1 and TF2)

	Sessions		χ^2 (1)
	Control	Tool-use	
Designers' social-emotional acts	13	29	6.095*
Users' social-emotional acts	13	37	11.52*
Designers' task-oriented acts	30	31	0.016
Users' social-emotional acts	17	36	6.811*

* means 'achieved significance'

It can be seen that the results for the second workshop were very similar to those for the first workshop reinforcing the conclusion that the generative tools signficantly enhanced participants' engagement in the co-design process, particularely users' engagement.

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5.4.4 Discussion

In the 'decoding' stage of the 'control' session, participants did not use the video experience note. As shown as Table 29, the frequencies of designers' and users' social-emotional acts were the same. However, designers produced more task-oriented acts than users. In the 'decoding' stage of the 'tool-use' session, the video experience note was applied in the group discussion. The frequencies of designers' and users' social-emotional acts were similar. The frequencies of designers' and users' task-oriented acts were also similar (Table 29).

Using Chi-square goodness-of-fit test to examine 'decoding' in the 'control' session and the 'tool-use' session (shown as Table 29), it can be seen that the frequency of users' task-oriented acts between two sessions was increased significantly. It shows that the use of the video experience note enhanced users' task-oriented acts. The video experience note appeared to be useful for engaging users in the decoding stage of the co-design workshop.

In the 'encoding' stage of the 'control' session, participants sketched and discussed expressive behaviours by pens and sketch paper. As shown as Table 32, the frequencies of designers' and users' social-emotional acts were the same. However, designers produced more task-oriented acts than users. In the 'encoding' stage of the 'control' session, participants recorded and discussed expressive behaviours by the video self-recording device. The frequencies of designers' and users' social-emotional acts were similar (Table 32). The frequencies of designers' and users' task-oriented acts were also similar.

Using Chi-square goodness-of-fit test to examine 'encoding' in the 'control' session and the 'tool-use' session (shown as Table 32), it can be seen that the frequencies of designers' and users' social-emotional acts, in particular positive

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social-emotional acts, were increased significantly. In addition, the frequency of users'

task-oriented acts was increased significantly. The use of the video self-recording device

enhanced participants' engagement in the encoding stage of the co-design workshop.

5.5 The 2nd Workshop

5.5.1 The Setting

In this workshop, I used the same setting of the first workshop (see 5.4.1). The

participants sat in the same places with same equipments.

5.5.2 The Procedure

Control session	The decoding stage: analysing and discussing the film clip TF3 without the video experience note	15 min.
	The encoding stage: creating and discussing expressive behaviour with pens and sketch paper	15 min.
Break time		10 min.
Tool-use session	The decoding stage: analysing and discussing the film clip TF4 with the video experience note	15 min.
	The encoding stage: creating and discussing expressive behaviour with the video self-recording	15 min.

Figure 91 The procedure of the second workshop

The procedure of this workshop was the same as the first workshop (see 5.4.2).

Figure 91 shows the procedure of this workshop. In the decoding stage of 'control'

session, the topic – 'pleasant surprise' was created for the film clip TF3. This topic was

used for the activity in the encoding stage creating and discussing participants'

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expressive behaviours through the activity of sketching. Participants were asked to sketch possible expressive behaviours (Figure 92). These sketches of expressive behaviours were shown in the group discussion.
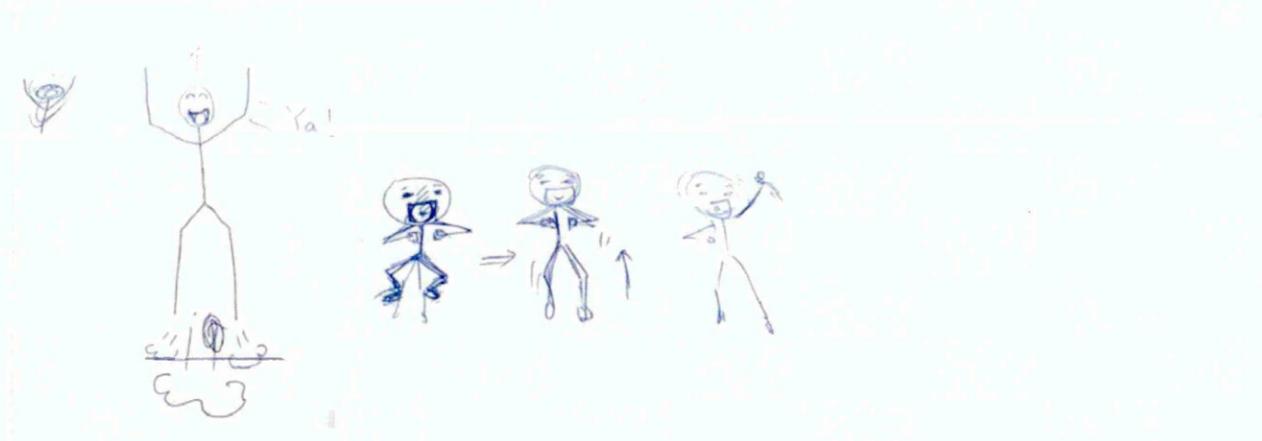
Figure 92 Two users' sketches for the topic of 'pleasant surprise'

In the decoding stage of 'tool-use' session, the topic – 'shock' was created with using the video experience note for the film clip TF4. The encoding stage was to create and discuss participants' expressive behaviours for this topic. Pens and sketch paper were not provided in this session. Instead, four tablet computers (iPad 2) as the self-video recording deceives were provided. Participants were asked to record their expressive behaviours by themselves via the device (Figure 93). The recording videos as video sketches (Figure 94) contained participants' expressive behaviours were presented on the projector screen for discussing (Figure 95).

Figure 93 One user used the video self-recording device for video sketching

Figure 94 One user's video sketch for expressive behaviour of 'shock'

Figure 95 Participants discussed one designer's video sketch

5.5.3   Result

In this workshop, 408 communication acts were identified in the interaction among participants.

5.5.3.1   The Decoding Stage of the 2nd Workshop

In the decoding stage, the results for the second workshop were very similar to those of the first workshop as can be seen from the tables below.

Table 33 'Decoding' in the 'control' session (Workshop TF3)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	10	1	35	6
Users	9	2	**18**	7

Table 34 'Decoding' in the 'tool-use' session (Workshop TF4)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	12	3	32	5
Users	12	4	**34**	7

Table 35 'Deciding' in the 'control' session and the 'tool-use' session (Workshop TF3 and TF4)

	Sessions		χ^2 (1)
	Control	Tool-use	
Designers' social-emotional acts	11	15	0.615
Users' social-emotional acts	11	16	0.926
Designers' task-oriented acts	41	37	0.205
Users' social-emotional acts	**25**	**41**	**3.879***

* means 'achieved significance'

5.5.3.2 The Encoding Stage of the 2nd Workshop

In the encoding stage, the results for the second workshop were very similar to those of the first workshop as can be seen from the tables below.

Table 36 'Encoding' in the 'control' session (Workshop TF3)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	**5**	2	28	6
Users	**8**	3	**15**	4

Table 37 'Encoding' in the 'tool-use' session(Workshop TF4)

	Social-emotional Acts		Task-oriented Acts	
	Positive	Negative	Attempted Answers	Questions
Designers	**24**	6	27	8
Users	**32**	9	**26**	8

Table 38 'Encoding' in the 'control' session and the 'tool-use' session (Workshop TF3 and TF4)

	Sessions		$\chi2\ (1)$
	Control	Tool-use	
Designers' social-emotional acts	**7**	**30**	**14.297***
Users' social-emotional acts	**11**	**41**	**17.308***
Designers' task-oriented acts	34	35	0.014
Users' social-emotional acts	**19**	**34**	**4.245***

* means 'achieved significance'

5.5.4 Discussion

The results in the second workshop followed the same pattern as the first workshop (5.4.3.1 and 5.4.3.2) and reinforced the finding that the two generative tools significantly enhanced participants, particularly users', engagement in in the co-design processes.

5.6 The Designers' Feedback

After the two workshops, the two designers (Yi-Ching and Tze-Yin) were invited to attend in a 40 minutes interview and provide their perspectives on: 1. the process of the co-design workshops; 2. the generative tools. Also, they were asked whether they will use the co-design methods and the tools for their professional work. One sound recoder (iPod classic with microphone) was used to record the interview.

As described in 5.3, Yi-Ching and Tze-Yin have professional experience on creations of expressive behaviour in game design and animation. The two designers indicated that the co-design process enable them to consider a wide range of expressive behaviour for characters design in games and animations, in particular the encoding stage in 'tool-use' session. As Yi-Ching and Tze-Yin provided their feedback as below:

Yi-Ching: *...the encoding stage in these two workshops was very*

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*impressive because of non-desigers' experience (in
'tool-use' session). Their ideas for the expressive
behaviour might be not good for the creation. However,
their experience enabled me to reflect relevant situations
and body movements from my experience... we shared
and discussed these experiences and body movements. I
believe we could discuss a lot (of situations and body
movements). The information is very useful for designing
characters and the body movements in game and
animation.*

Taipei Interview 26.1.13 [event log TPE3.1 t0.09]

The video experience note and the video self-recording device were applied in

the 'tool-use' session. The two designers considered that the video experience note was

useful to focus on the analysis of actors' expressive behaviour because of the tasks

(4.5.1.1). Also, this tool was indicated as a reminder for participants providing more

information in the group discussion. The discussion on the use of the video experience

note is shown as below:

Yen-Fu: *How do you think the video experience note?*
Yi-Ching: *From my personal view, it's really helpful. The two tasks
tell us that we need to observe interesting body
movements in film clips and think the status and
emotions.*
Tze-Yin: *Hmmm, I agree.*
Yi-Ching: *Also, it reminded me what I focused on in the film clip
sometimes. Yes, it is like a reminder...by the way, I
noticed Wen-Cheng and Sheng-Yi (the two users)
provided more opinions in discussing when we used the
video experience note. Did you notice that?*
Tze-Yin: *Hmmm.*
Tze-Yin: *I think...this tool is the reason to enable them to provide
more information.*

Taipei Interview 26.1.13 [event log TPE3.1 t0.22]

As for the video self-recording device, the two designers considered that this tool

is productive to create expressive behaviour, in particular for users. They also pointed

out that users are not educated in design so the approach of video sketching would be

the best.

In the end of the interview, the two designers suggested that the co-design methods

and the generative tools (especially the video self-recording device) applied in the

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workshops were productive for the creation of expressive behaviour by avatar (or character in animation) in the generative phase. Therefore, the two designers stated that they will use the co-design methods and tools for their professional work.

5.7 Summary and Conclusions

In this workshop study, two workshops were arranged to evaluate the video experience note and the video self-recording device used for the generative phase of creating avatar's expressive behaviours. Two stages arranged in these workshops were analysing actors' expressive behaviours in the film clips and creating expressive behaviours through sketching. Four different stimulus film clips (TF1, TF2, TF3 and TF4) were used in these two workshops. The video experience note and the video self-recording device were not used in the 'control' session (Workshop TF1 and TF3). However, these tools were applied in the 'tool-use' sessions (Workshop TF2 and TF4). The interaction among participants was quantified by Bales' IPA and analysed by Chi-square goodness-of-fit test

In the decoding stage of the first workshop, the frequency of users' ask-oriented acts was increased significantly when the video experience note was used. In the encoding stage of the first workshop, the frequencies of designers' and users' social-emotional acts and users' task-oriented acts were increased significantly when the video self-recording device was applied.

The result of the second workshop matched closely that of the first workshop. The two workshops indicated that the generative tools influenced participants' communication acts:

1. the use of the video experience note increased users' task-oriented acts;

2. the use of the video self-recording device improved users' task-oriented acts;

3. the use of the video self-recording device enhanced designers' and users'

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social-emotional acts.

From this result, the interaction among participants in particular users'

communication acts were affected by the engagement of the video experience note and

the video self-recording device and the professional designers who took part expressed

belief that this was a useful process which they would use in future.

6 Discussion

6.1 Introduction

The aims of this research included understanding the problems of Avatar Design (2.2 and 2.5), understanding Participatory Design (2.4.1), particularly Co-Design (2.4.1.1), identifying useful tools (4.4 and 4.5) and evaluating those tools (5.4 and 5.5) in a practical setting. The overarching goal of the two workshop studies presented in this thesis was to develop and evaluate generative tools which support the creation of avatar's expressive behaviour in the generative phase of co-design process. Chapter 4 and 5 presented research findings from two workshop studies identifying and evaluating two novel generative tools: 1. the video experience note used to analyse actors' expressive behaviours in the stimulus film clips; 2. the video self-recording device used to create participants' expressive behaviours. This chapter will discuss the co-design framework that was proposed for co-creating avatar's expressive behaviours. Then I will summarise and discuss the findings from the workshop studies.

6.2 A Framework for Co-creating Expressive Behaviour

As described in 2.3.2, Argyle's (1990) encoding-decoding paradigm of nonverbal communication (NVC) was adopted to explain how a nonverbal signal works between the sender and the receiver. A nonverbal signal is encoded by the sender then this signal may be decoded by the receiver. The sender and the receiver may communicate with a shared code. On the other hand, the receiver may incorrectly decode the signal because the poor ability of the sender or the receiver, or both.

In 2.2.3, I explained that avatar designers' creative methods for addressing the

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issue of behavioural realism in virtual worlds are mainly supported from animators' techniques. Avatar designers tend to use their own experience and standard tools (2.2.4.1 and 2.2.4.2) to design expressive behaviour, rather than using a co-design approach. Because expression may vary from person to person and context to context, the interpretation and creation of expressive behaviour given by individual designers appears to be limited and insufficient. From this, I argued for adopting co-design in 2.5 (also 2.4.3). I suggested that avatar designers may use a participatory design approach to consider different notions of expressive behaviours from different non-design participants.

In 2.5, I introduced a paradigm of decoding-encoding-decoding (Figure 30) that was adopted from Argyle's encoding-decoding paradigm of NVC (Figure 22) to propose. The decoding-encoding-decoding paradigm consists of four stages:

1. the designer and the user decode exist nonverbal communication;

2. the designer and the user encode new nonverbal communication;

3. the designer reflects on the process of co-creation and encode nonverbal communication in new avatar behaviours;

4. the new avatar behaviour is decoded by the end-users.

In this scheme, designers decoding with users is intended to help designers to reflect on what they will encode in new designs for users.

In 3.3.2, the procedure of co-design framework was tested and evaluated in the pilot study. The result of the pilot study gave me the confidence to use the co-design framework in the two workshop studies in this research.

[176]
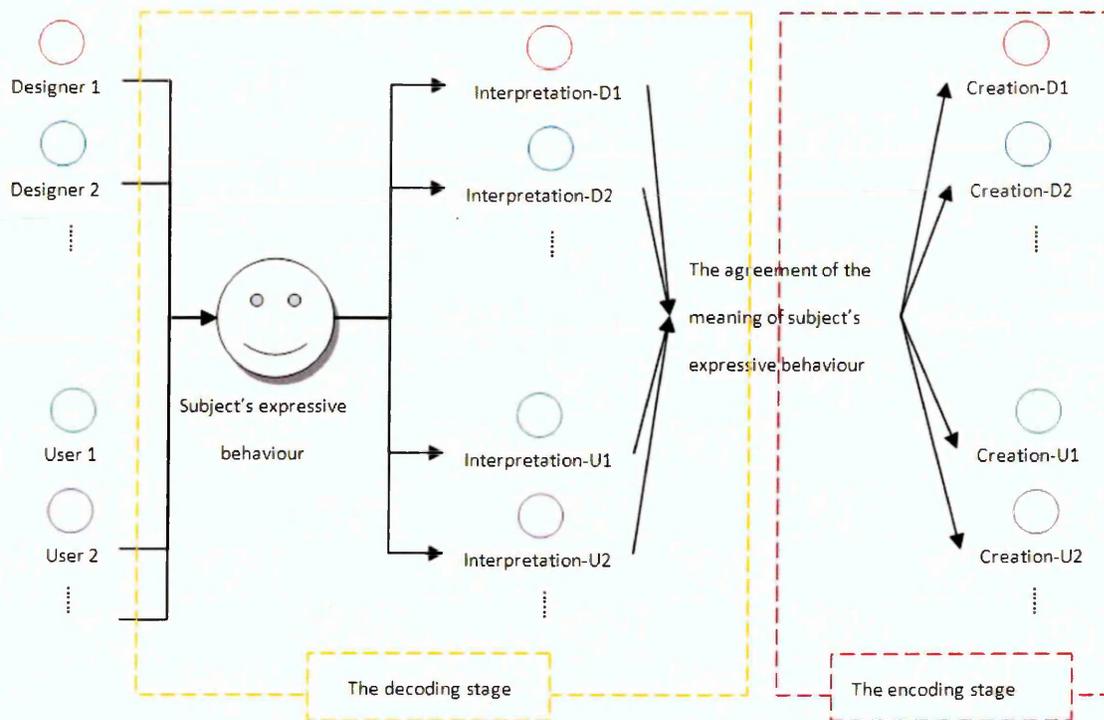
Figure 96 The co-design workshop process of expressive behaviours by avatars

As shown as Figure 96, there are two stages in this co-design workshop process, matching the first two stages of the decoding-encoding-decoding paradigm above.

The first stage is for avatar designers and avatar users to observe and decode examples of expressive behaviours and the second stage is for the same group to encode new expressive behaviours.

Participants share their knowledge and discuss the meaning of expressive behaviour that consists of emotions, status, and attitudes. Different avatar users may perform different nonverbal behaviours to express the same meaning of expressive behaviour – the same emotion, status, and attitude. Therefore, the second stage allows users to show and discuss their creations of expressive behaviour.

The interpretation, negotiation and expression of expressive behaviours in this co-design framework are intended to lead the group of participants to create, evaluate and refine the value of expressive behaviours by avatars.

6.2.1 Selecting Stimulus Film Clips

As described in 3.3.5, films are dynamic and provide a high degree of what Gross and Levenson (1995) describe as 'ecological validity'. Compared to other techniques such as role play and scenario-based design they provide a very rich context for the interaction between actors. Some researchers such as McHugo et al (1982), Philippot (1993), Gross and Levenson (1995) used film segments from commercial films to analyse actors' expressive behaviours in emotion studies. The idea of stimulus films was adopted to observe the subject's expressive behaviour for the co-design framework in this research (3.3.2).

The pilot study (3.3.2) indicated that it would be productive to ask avatar users who have an interest in movies and TV dramas to suggest suitable film clips and having developed a questionnaire process for this (3.3.6) it became evident (3.3.7.1) that the questionnaires were also valuable for selecting participants who would play an active role in the workshops.

The film clip questionnaire was developed (3.3.6) with three pairs of questions, a specific closed question being followed by an open question to encourage self-expression.

Potential participants should also be asked about their frequency of watching movies and TV dramas to ascertain if they were the target respondents to the designed questionnaire. Because of the open-end questions in this questionnaire, and the advantage of allowing respondents to do some research into the material they suggest, respondents should be allowed to complete it in their own time (3.3.6).

Although a lot of engaging scenes and performances with insights were provided by these respondents, some suggested film clips with scenes of actors' interpersonal performances that may be unsuitable for the co-design workshop, for example fight

scenes. In addition, respondents may not consider the framing of sequence shots and the visibility of acting expressive behaviour. To address this situation those leading codesign workshops should study the participants' suggestions and make the final selection of the stimulus film clips by themselves when receiving the completed questionnaires. In 3.3.5.1, I suggested that the actor's body in the medium shot seems to be appropriate for observation of expressive behaviour because it not only presents the actor's gesture and posture but also provides the quality of facial expression. Besides, the content of the stimulus film clips should present actors' interpersonal performances with expressive behaviour.

6.2.2   Selecting Users to Participate

As explained in 2.5, the co-design framework for creating avatar's expressive behaviours involves the participation of avatar users who have insight into nonverbal communication. These avatar users are expected to have willingness to share their perspectives and ideas on the analysis and creation of expressive behaviours in the group discussion (4.5.3.1 and 4.5.3.2). Therefore, how to select suitable avatar users invited in the co-design workshop is very important.

A questionnaire process was developed (3.3.6) to select suitable avatar users to be participants as described in 3.3.7.1. I sought avatar users with an interest in movies and TV dramas to suggest potential film clips therefore I recuited avatar users who watched at least two movies or TV dramas in a week (3.3.5.1). Because of the open-end questions, these respondents might take few days to complete the questionnaire. As described in 4.3.1, the content of response to questionnaires was not helpful to identify suitable avatar users invited in the co-design workshop because these respondents provided rich or poor answers depending on their time management.

To ascertain respondents' willingness to share their opinions and ideas in

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discussion, I suggested that brief follow-up interviews with added questions to review answers to the questionnaires could be adopted (4.3.1). Observing respondents' reactions in these follow-up interviews was found to be a useful approach to identifying suitable participants (4.3.1). In general, respondents would answer these added questions. Some respondents present their willingness and ability to propose their questions in the discussion. Therefore, I suggested these respondents could be participants invited to the co-design workshop.

6.3 Developing the Generative Tools

Pilot research referred to in Chapter 3 indicated potentially fruitful methods for co-design in this field. Then the Workshop Study 1, described in Chapter 4, was set up to explore and refine these methods and identify possible tools for the process. To achieve the aim of the workshop study, four co-design workshops were conducted in Sheffield, UK. The procedure of the first two co-design workshops (the Orientation workshop described in 4.4 and the Design workshop described in 4.5) was according to the theoretical framework that was discussed in 6.2.

Two problems were recognized from the interaction between designers and users in the Orientation workshop (4.4): 1. participants' perspectives appeared to be over-influenced by others in the course of the decoding stage; 2. users were nhibited by concerns about their sketching skills in the course of the encoding stage. In the Design workshop (4.5), therefore, the video experience note and the video self-recording device were used to deal with these situations.

6.3.1 Developing the Video Experience Note

In 4.4.4 I reviewed the process of the co-design workshop with two participating

designers. When reviewing the decoding stage of the workshop, the designers

mentioned that their views were influenced by others' stated opinions leading them to

hold back their own viewpoints sometimes. Also, they were concerned that other

participants' perspectives might not be provided fully in the group discussion. As

Barbour (2007) stated

> "...An alternative avenue for exploring this issue involves the judicious use
> of complementary written exercises within the one focus group session,
> which can also provide access to individuals' views and concerns.
> Furthermore, such an approach has added value in that it affords a ready
> comparison between private comments and shared discourse on a specific
> occasion (p.85)."

To avoid participants being over-influenced by others in group discussion,

therefore, written tasks were developed.

The video experience note was a designed note with two tasks employed to analyse

expressive behaviours in film clips in the decoding stage (Appendix IV). The aim of the

video experience note was to enable participants to record their initial reactions as a

reference point for discussion. The first task was to describe actors' status and emotions.

The second task was to indicate actors' expressive behaviours. Participants were asked

to provide keywords rather than full answers on their notes.

When comparing the decoding stage in the two workshops (4.4.3.1 and 4.5.3.1),

participants seemed to provide more information for discussion in the second workshop

when they were using the video experience note (4.5.3.1). Participants' keywords on the

video experience notes were observed to act as reminders enabled participants to

remember their original ideas as the discussion progressed (4.5.3.1 and 4.5.5).

6.3.2 Developing the Video Self-recording Device

As Tversky (2002) noted

> "Sketches are a way of externalizing ideas, of turning internal thoughts

public, of making fleeting thoughts more permanent… Sketches can also convey abstract ideas metaphorically, using elements and spatial relations on paper to express abstract elements and relations (p.148)."

In the initial plans for the codesign sessions, the activity of pen-based sketching was intended to create expressive behaviours in the encoding stage of the co-design workshop. These sketches could be used as visual materials to discuss further the creation of avatar's expressive behaviours.

Originally, as described in 4.4.3.2, I expected all participants would take part in sketching in the encoding stage of the co-design workshop. However the users showed their reluctance to use sketching. To address this situation, the designers suggested that video-recording could be used to allow users to 'sketch' their ideas. From my experience in the pilot study (3.3.2), participants seemed to be uncomfortable 'performing' in front of a video camera.

Having explored some of the capabilities of (then) novel tablet computers I considered (4.5.1.1) that participants may feel more comfortable if they could record their performances by themselves through a video self-recording device with immediate feedback. This appeared to be possible with a touch screen tablet computer fitted with a front-facing camera and simple video recording/viewing software (iPad tablet with iMovie software).

I also suggested the video self-recording device should offer a suitable size display screen to allow group review after the recording.

As explained in 4.5.3.2, users seemed to be happy to use the video self-recording device for video sketching in the Design workshop. In my personal observations (4.5.3.2), users were interested in the activity of video sketching. They presented their expressive behaviours on self-recording videos actively and with confidence.

6.3.3 Summary of the Development of the Generative Tools

In the Orientation workshop (4.4), two problems were recognized from the interaction among participants: 1. participants were over-influenced by others in the course of the decoding stage; 2. users were concerned about and inhibited by their sketching skills during the encoding stage. To deal with these problems, two new generative tools, the video experience note and the video self-recording were developed and tested in the Design workshop (4.5). The purpose of the video experience note was to enable participants to record their perspectives of actors' performances in film clips before discussion. The purpose of the video self-recording device was to enable users to produce visual materials for group discussion. In the Design workshop the use of these tools appeared to enhance the interaction among participants. The Workshop Study 2 (Chapter 5) was intended to evaluate how effective these tools were in enhancing this interaction.

6.4 Evaluating the New Generative Tools

Workshop Study 2 set out to quantify the interaction between designers and users with Bales' Interpersonal Process Analysis (IPA), presented in chapter 5, in order to evaluate the validity of these two tools in a reliable way. To do this, two co-design workshops were conducted in Taipei, Taiwan. The procedure of these two co-design workshops was according to the theoretical framework that was discussed in 6.2. The workshops followed the same general procedure as those in Workshop Study 2, including sessions with and without the two generative tools to allow comparison.

6.4.1 Evaluating the Video Experience Note

As explained in 6.3.1, some participants' perspectives appeared to be over-influenced by others and they might not provide their perspectives fully in the group discussion. Therefore, the purpose of the video experience note was to enable participants to record their initial reactions as a reference point for discussion.

Without the video experience note (Table 29 and Table 35), designers provided more task-oriented acts than users. With the video experience note (Table 29 and Table 35), the frequencies of users' task-oriented acts, revealed by the Bales' Interaction Process Analysis (IPA) (5.3.4) were increased and the Chi-square goodness-of-fit test showed this was a significant change (Table 29 and Table 35). However, the frequencies of designers' task-oriented acts were not changed significantly.

As described in 2.4, the purpose of participatory design approach is to enable designers obtain users' knowledge and feedback in the design process. Generative tools (2.4.5) are used to facilitate exchange between the people who experience products, interfaces, systems and spaces and the people who design for experiencing. Comparing 'control' sessions and 'tool-use' sessions in the decoding stage, the result showed that the video experience note was useful to elicit users' task-oriented communications in the group discussion.

6.4.2 The Encoding Stage with/without the Video Self-recording Device

As explained in 6.3.2, users were inhibited about using drawing skills in group discussion. The use of the video self-recording device seemed to be useful to resolve users' concerns.

Without the video self-recording device (Table 32 and Table 38), designers

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provided more task-oriented acts than users. When the video self-recording device was provided to participants (Table 32 and Table 38), the frequencies of users' task-oriented acts, revealed by the Bales' IPA (5.3.4) were increased and the Chi-square goodness-of-fit test showed this was a significant change (Table 32 and Table 38). However, the frequencies of designers' task-oriented acts were not changed significantly.

The purpose of participatory design approach (2.4.1) is to enable designers to obtain users' knowledge and feedback in the design process. Generative tools (2.4.5) are used to facilitate exchange between the people who experience products, interfaces, systems and spaces and the people who design for experiencing. Comparing 'control' session and 'tool-use'session in the encoding stage, the result showed that the video self-recording device was useful to elicit users' task-oriented communications in the group discussion.

6.4.3   Summary Discussion for the Evaluation of Generative Tools

Two workshops were conducted to evaluate the validity of the video experience note and the video self-recording device used in the generative phase of co-creating avatar's expressive behaviours. Participants were observed in sessions working both with and without the tools. The interaction among participants in this workshop study was quantified by Bales' IPA.

Three findings emerged from the workshop study:

1.   the frequency of users' task-oriented acts were increased significantly when using the video experience note to analyse actors' expressive behaviours in film clips;

2.   the frequency of users' task-oriented acts were raised when using the video self-recording device to create and discuss expressive behaviours;

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3. the frequency of all participants' social-emotional acts were increased significantly when using the video self-recording device to create and discuss expressive behaviours.

The findings indicated that the video experience note and the video self-recording device used in the co-design workshop could enrich the interaction among participants.

6.5 The Review Sessions with Designers

As reported in 4.4.4, 4.5.5 and 5.6, I invited participating designers to review the process of co-design workshops to evaluate co-design methods and tools. Their feedback on these co-design workshops indicates that the co-design process appeared to be helpful and suitable for designers of avatar behaviours. Also, participating designers indicated that they may use these techniques oin their own professional work in future.

6.6 Chapter Summary

This chapter discussed the co-design framework that was proposed for co-creating avatar's expressive behaviours. Also, it discussed the findings from the two workshop studies presented in chapter 4 and 5. The co-design framework involves designers and users to co-create avatar's expressive behaviours. This co-design framework influenced by Argyle's NVC paradigm contains a decoding stage and an encoding stage. In decoding, participants analyse expressive behaviours in the stimulus film clips. In encoding, participants create expressive behaviours through the activity of sketching. The interpretation, negotiation and expression of expressive behaviours in this co-design framework lead the group of participants to create, evaluate and refine the value of expressive behaviours by avatar.

In summary, the two workshop studies presented in this thesis investigated the

form and the validity of the generative tools for co-creating avatar's expressive behaviours in such a co-design framework. The result suggested that the video experience note and the video self-recording device will provide useful generative tools for a co-design workshop in this field. The video experience note used in the decoding stage may enable participants to record and retain their perspectives on actors' performances in film clips for discussion, despite the social influence of others' opinions. The video self-recording device used in the encoding stage of the co-design framework may enable users to produce visual materials for group discussion, providing designers with access to experience and insight beyond their own experience and the normal conventions of animation design. The analysis also showed that these generative tools could enhance the interaction among participants. The following chapter will summarise the overall contributions of this research and suggest directions for future research.

7 Conclusion

In this chapter, I summarise my work presented in this thesis. Then I describe the contributions this research makes to knowledge for co-creating avatar's expressive behaviours. Finally, I discuss the limitations of the research and outline my plans for future research.

7.1 Summary of this Research

This research investigated methods to support co-creation or 'co-design' by designers and users in the generative phase of the creation of expressive behaviours for avatars. The practical work presented in this thesis aimed to develop and evaluate generative tools that would enable such a co-design process.

Avatars are human-like images with either 2D or 3D graphics and have been widely used to represent avatar users in avatar-based environments. Avatar users can show their emotions, status, and attitudes through the humanoid avatars' expressive behaviours. As described in 2.2.4 and 2.3.2, avatar designers use universal methods that are mainly supported by animators' techniques, long established in cinema, to create avatar's expressive behaviours. Normally, avatar designers interpret peoples' expressive behaviours and give the value of expressive behaviour based on their knowledge and experience. They then create expressive behaviour applied to interpersonal interactions of virtual worlds.

As argued in 2.5, one key barrier to the creation of expressive behaviour in current avatar-based environments is the paucity of different interpretations and perspectives from diverse people. On the one hand, the interpretation of expressive behaviour given by individual designers appears to be limited and insufficient because expression may

vary from person to person and context to context. On the other hand, designers may be not aware of potential expressive behaviours that the users want to realize in the future.

To deal with the situation, described in 2.5 and 6.2, I moved from Argyle's concepts of encoding and decoding (Figure 22) to a decoding-encoding-decoding paradigm for co-design (Figure 30). There are four stages in this decoding-encoding-decoding paradigm:

1. the designer and the user decode exist nonverbal communication;

2. the designer and the user encode new nonverbal communication;

3. the designer reflects on the process of co-creation and encode nonverbal communication in new avatar behaviours;

4. the new avatar behaviour is decoded by the user.

The first stage of decoding is the activity where designers learn about users needs and experience in the codesign workshop. Therefore, this decoding-encoding-decoding paradigm would be an interesting topic for investigation in other design settings, for example product design.

From this decoding-encoding-decoding paradigm, a co-design workshop process for co-creating expressive behaviour was developed (Figure 96). This co-design workshop process involves the decoding stage and the encoding stage. In the decoding stage, participants are asked to observe and analyse expressive behaviours in stimulus film clips. In the encoding stage, participants are engaged in creating and discussing expressive behaviours through the activity of sketching.

As discussed in 2.4.5, the process of co-design requires generative tools that are designed for designers and users to use. This research concentrated primarily on developing and evaluating generative tools efficient in creating avatar's expressive behaviour in the generative phase of co-design process. Two workshop studies were conducted investigating two key aspects of the generative tools: the form and the

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validity.

Workshop Study 1 investigating the interaction among participants, reported in chapter 4, and sought to identify the form of generative tools used for the co-creation of expressive behaviours by avatars. Four co-design workshops were conducted in Sheffield, UK. The procedure of the first two co-design workshops was according to the co-design framework explained in 2.5 and 6.2. As detailed in 4.4.3.1, 4.4.3.2, and 4.4.4, two problems were recognized in the Orientation workshop:

1. participants' perspectives appeared to be over-influenced by others in the course of decoding part;

2. users were concerned about their pen-based sketching skills in the course of the encoding part.

To address the situations, the video experience note and the video self-recording device were developed and tested in the Design workshop. (The use and evaluation of these two tools then became the principal focus of the research).

As shown as Figure 53 (p.121), the video experience note was a practical exercise requiring two tasks of expressive behaviour analysis (also see Appendix IV):

- participants were asked to describe actors' emotions and status;

- participants were asked to indicate actors' expressive behaviours.

The purpose of the video experience note was to enable participants to record their perspectives on actors' performances in film clips before discussion.

The video self-recording device was the tablet computer with a front camera (see Figure 54, p. 122). The purpose of the video self-recording device was to enable users to produce visual materials through video sketching for group discussion. Observations in the second workshop indicated that the use of the video experience note and the video self-recording device appeared to be productive in stimulating open discussion on expressive behaviours, and the video sketches were valuable for designers in gaining an

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insight into users' ideas about expression.

Workshop study 2 quantifying the interaction among participants with Bales' Interaction Process Analysis (IPA), reported in chapter 5, sought to evaluate the validity of the video experience note and the video self-recording device used in the co-creation process. Two co-design workshops were conducted in Taipei, Taiwan to achieve the aim of this workshop study. Participants in the workshops undertook co-design activity without the two generative tools to provide a base for evaluation, and with the tools to discover their effect.

Analysing with the Chi-squire test, three findings emerged from the workshop study:

- the frequency of users' task-oriented acts increased significantly when using the video experience note to analyse actors' expressive behaviours in film clips;

- the frequency of users' task-oriented acts raised when using the video self-recording device to create and discuss expressive behaviours;

- the frequency of all participants' social-emotional acts increased significantly when using the video self-recording device to create and discuss expressive behaviours.

The result of this workshop study was that the video experience note and the video self-recording device when used in the co-design workshop could enrich interaction among participants.

7.2 The Co-design methods and the Generative Tools

In 1.5, I proposed a research question concerning the generative tools used for the creation of expressive behaviour by avatars in the co-design workshop. The question is presented as follows:

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What methods and tools might be used to enable successful co-design collaborations between designers and users in creating useful new expressive behaviours for online avatars?

Two workshop studies reported in chapter 4 and 5 were conducted to answer the question. After the two workshop studies, the contributions in this thesis to knowledge are:

- a co-design framework for the creation of expressive behaviours by avatars, supported by

- methods for the selection of stimulus film clips and non-design participants;

- two novel generative tools for the co-creative work;

- a quantified evaluation of the generative tools in action.

7.2.1 The Co-design Framework for the Creation of Expressive Behaviour

As discussed in 2.5 and 6.2, a co-design framework engaging avatar designers and avatar users in co-creating expressive behaviours by avatars was proposed based on Argyle's (1990) encoding-decoding paradigm of NVC. In 3.3.2, I described that the procedure of this framework was tested and evaluated in the pilot study. Then I applied the framework into the two workshop studies reported in chapter 4 and 5. These practical co-design works proved that the framework was working for co-creating expressive behaviours in the generative phase of the design process.

As shown as Figure 96 (p.177), a co-design workshop process for creating expressive behaviour by avatars involves two stages: the first stage is to decode expressive behaviours and the second stage is to encode expressive behaviours. Actors' expressive behaviours in stimulus film clips are observed and analysed by designers and users in the first stage. When observing actors' expressive behaviours, the sound of film

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clips should be off to enable participants to focus on actors' body movements.

Through group discussion, participants share their knowledge and perspectives of actors' expressive behaviours including emotions, status, and attitudes. Avatar users may perform different expressive behaviours to express the same emotion, status, and attitude. In the second part, therefore, users have the chance to show their creations of expressive behaviour and discuss with the group of people through the activity of sketching. It also provides designers with an opportunity to take account of users' latent needs in future online interaction.

The interpretation, negotiation and expression of expressive behaviours in this co-design workshop process are expected to lead the group of participants to create, evaluate and refine the value of expressive behaviours by avatars.

7.2.2 The Method for the Selection of Stimulus Film Clips

As described in 3.3.5, films are dynamic and provide a high degree of what Gross and Levenson (1995) describe as 'ecological validity'. Compared to other techniques such as role play and scenario-based design they provide a very rich context for the interaction between actors. The co-design framework developed in this research calls for suitable stimulus film clips. As explained in 3.3.5.1 and 6.2.1, the list of film clips used in the co-design framework could be recommended by avatar users who are interested in movies and TV dramas. A flim clip suggestion questionnaire with open-end questions and closed-end questions as described in 3.3.6 was an effective tool to obtain suitable film clip recommendations from avatar users who have an interst in movies and TV dramas.

A group of avatar users with the interest in watching movies and TV dramas should be recruited in the beginning (3.3.5.1 and 3.3.7.1). To ascertain if these avatar users (3.3.5.1 and 3.3.7.1) were suitable participants the questionnaire should include the

question about the frequency of watching movies and TV dramas. Because the questionnaire contains open-end questions, respondents may be allowed to take few days to complete it (3.3.6).

Some suggested film clips may be unsuitable for the co-design workshop, for example fight scenes (3.3.5.1). In addition, respondents may not consider the framing of sequence shots (3.3.5.1) and the visibility of the expressive behaviour. For this reason it is necessary for the workshop organiser to make the final selection of clips.

As suggested in 3.3.5.1and 6.2.1, the actor's body in the medium shot seems to be appropriate for observation of expressive behaviour because it not only presents the actor's gesture and posture but also provides the quality of facial expression. Judgement will be needed to decide which clips contain expressive behaviour suitable for the proposed workshop.

7.2.3   The Method for the Selection of Participants

The co-design framework (Figure 30) developed in this research involves the designe who has at least two year of professional experience including animation, in particular the creation of expressive behaviour by humanoid characters (4.3.1and 5.3.1). The co-design framework also involves the participation of avatar users who have insight into nonverbal communication. These avatar users are expected to have a willingness to share their perspectives and ideas on the creation of expressive behaviours in the group discussion. As explained in 3.3.7.1 and 6.2.2, suitable avatar users invited to the co-design workshops could be selected through the questionnaire that is described in3.3.6.

As explained in 3.3.5.1, 6.2.1 and 7.2.2, the questionnaire respondents are avatar users who have an interest in watching movies and TV dramas. These respondents may take a few days to complete the questionnaire because of the open-end questions. These

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respondents provided rich or poor answers depending on their time management. Therefore, the content of response to questionnaires is not sufficient to identify suitable avatar users for the co-design workshop.

As suggested in 3.3.7.1 and 6.2.2, the brief follow-up interviews with added questions to review their answers in the questionnaires will help to ascertain respondents' willingness to share opinions and ideas in discussion. Normally, respondents would answer these added questions but some respondents showed greater willingness and ability to propose their own questions in the discussion. These respondents seem to be more active in discussing the topic so they were invited to be participants in the co-design workshop.

7.2.4   The Use of the Generative Tools

The decoding-encoding-decoding paradigm (Figure 30) engaging designers and users in co-creating expressive behaviours by avatars requires the generative tools as follows: the video experience note used in the decoding stage and the video self-recording device used in the encoding stage.

The video experience note is a designed note with two tasks employed to analyse expressive behaviours in film clips in the co-design workshop (Sample in Appendix IV). As discussed in 6.3.1, the aim of the video experience note is to enable participants to record their initial reactions as a reference point for discussion. Two tasks are ready for participants to analyse actors' expressive behaviours in the film clips on the video experience note. The first task is to ask participants to answer what actors' status and emotions are. The second task is to indicate actors' expressive behaviours.

The video experience note is given to participants before playing the stimulus film clips in the decoding stage of the co-design workshop. Participants record their initial opinions while watching the film clip. In 6.3.1, I suggested that participants use

keywords to complete these tasks due to time management in the workshop. Then participants can share their analysis based on the keywords recorded on the note.

The video self-recording device is the tablet computer with a front camera and a suitable screen used in the creation stage of the co-design workshop. As discussed in 6.3.2, the purpose of the video self-recording device is to enable users to produce visual materials for group discussion. A front camera and a suitable size display screen are offered so participants can obtain immediate feedback when recording performance.

The video self-recording device is provided to participants before taking part in the activity of sketching in the encoding stage of the co-design workshop. Participants record their expressive behaviours by themselves. In 6.3.2, I suggested that the device should offer a suitable size display screen for small group so participants can present their recorded performances and discuss with others.

7.3   Limitations and Future Work

As described in 5.3, the two designers (Yi-Ching and Tze-Yin)[25] were invited in Workshop Study 2. Yi-Ching is a game designer in Softstar Entertainment (http://www.softstar.com.tw/) that is a successful game design company with a large design team in Taiwan. This game design company makes and sells diverse games including PC games and mobile games (on iOS and Android) to consumers in Taiwan, China, and Hong Kong. After the workshop study, Yi-Ching explained my practical work to his colleagues and friends who are game designers and animators in game industry in Taiwan and China. I am already aware of others who know my work taking account of the co-design framework and the methods used in their design work. I expect the knowledge of the research used for the generative phase of co-creating expressive

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[25] As explained previously (3.3.3), to preserve the anonymity of participants, aliases have been used instead of their real names.

behaviours can be used more widely.

This thesis has used the notion of co-creation for selected users participating in the generative phase of the creation of expressive behaviour by avatars. It provides avatar designers a co-creation aspect to explore as-yet unknown, undefined, and unanticipated expressive behaviours. The co-design framework and the generative tools appear to provide the opportunity to create a wider variety of avatar behaviours based on the participants' experience and personal styles of expression. These personal expressive behaviours may support users' online identity to build and enhance their interpersonal relationships in online social networking.

As reported in chapter 5, Bales' IPA was adopted to quantify the interaction among participants in Workshop Study 2. It enabled me to evaluate participants' communicative acts with and without the new generative tools. However, the frequencies of the interaction among participants could not be observed by Bales' IPA. To understand the generative tools used in the co-design workshop thoroughly, further research into the social aspect of co-creating expressive behaviours would be of value.

Another direction for future research concerns the technique of video self-recording. In this research, I used a tablet computer as the video self-recording device to record participants' expressive behaviours. Because participants placed the tablet on the table and sat for the activity of video sketching in the workshops, the framing of video sketching was limited. I noticed this limitation in Workshop Study 2 but there was no time during the research to address it. The technique of video self-recording should be investigated in more detail in future.

Reference

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004).
User-centered design. In W. S. Bainbridge (Ed.), *Berkshire Encyclopedia of Human-Computer Interaction* (pp. 445-456) Great Barrington, MA: Berkshire Publishing Geoup.

Archer, B. (1995). The nature of research. *Co-Design, Interdisciplinary Journal of Design,* 6-13.

Argyle, M., & Cook, M. (1976). Gaze and mutual gaze. Cambridge, England: Cambridge. University Press.

Argyle, M. (1990). *Bodily communication* (2nd ed.) UK: Routledge.

Argyle, M. (1994). *The Psychology of Interpersonal Behaviour* (5th ed.). UK: Penguin.

Bailenson, J. N., & Blascovich, J. (2004). Avatars. In W. S. Bainbridge (Ed.), *Encyclopedia of human-computer interaction* (pp. 64-68). Great Barrington, MA: Berkshire Publishing Group.

Bales, R. F. (1950). A set of categories for the analysis of small group interaction. *American Sociological Review, 15*(2), 257-263.

Bales, R. F. (1970). *Personality and interpersonal behavior.* New York: Holt, Rinehart & Winston.

Barbour, R. (2007). *Doing focus groups.* London: Sage Publications.

Bartlett, M. S. (1998). *Face image analysis by unsupervised learning and redundancy reduction.* (PhD Thesis, University of California, San Diego).

Becker, B., & Mark, G. (2002). Social conventions in computermediated communication: A comparison of three online shared virtual environments. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 19-39), London: Springer-Verlag.

Benford, S., Bowers, J., Fahlén, L. E., Greenhalgh, C., & Snowdon, D. (1995). User embodiment in collaborative virtual environments. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* pp. 242-249.

[198]

Bernal, G., Bonilla, J., & Bellido, C. (1995). Ecological validity and cultural sensitivity for outcome research: Issues for the cultural adaptation and development of psychosocial treatments with Hispanics. *Journal of Abnormal Child Psychology, 23*(1), 67-82.

Black, K. (2012). *Business statistics: For contemporacy decision making (7th edtioion)*. Wiley.

Blascovich, J. (2002). Social influence within immersive virtual environments. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 127-145), London: Springer-Verlag.

Boberg, M., Piippo, P., & Ollila, E. (2008). Designing avatars. In *Proceedings of the 3rd International Conference on Digital Interactive Media in Entertainment and Arts,* pp. 232-239.

Brace, I. (2004). *Questionnaire design: How to plan, structure, and write survey material for effective market research.* London; Sterling, VA: Kogan Page.

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist, 32,* 513-531.

Bull, P. (1983). *Body movement and interpersonal communication.* Chichester, Sussex, UK: John Wiley & Sons.

Chaudhuri, A. (2006). *Emotion and reason in consumer behavior.* Oxford: Butterworth-Heinemann.

Chen, Y., & Rust, C. (2009). Animated emoticons for men's conversation. In *Proceedings of IASDR 2009,* Coex, Seoul, KOREA.

Clough, P., & Nutbrown, C. (2002). *A student's guide to methodology : Justifying enquiry.* London: SAGE.

Cole, P. M., Jenkins, P. A., & Shott, C. T. (1989). Spontaneous expressive control in blind and sighted children. *Child Development, 60*(3), 683-688.

Craig, D. V. (2009). *Action research essentials.* San Francisco, Calif.: Jossey-Bass.

Darwin, C. (1998). *The expression of the emotions in man and animals* (3rd ed). New York: Oxford University Press. (Original work published 1872)

De Silva, P. R., & Bianchi-Berthouze, N. (2004). Modeling human affective postures: An information theoretic characterization of posture features. *Computer Animation and Virtual Worlds, 15*(3-4), 269-276.

DeWalt, K. M., & DeWalt, B. R. (2002). *Participant observation: A guide for fieldworkers*. Walnut Creek, Calif.; Oxford: AltaMira Press.

Dorst, K. (1995). Analysing design activity: New directions in protocol analysis. *Design Studies, 16*(2), 139-142.

Dorst, K., & Dijkhuis, J. (1995). Comparing paradigms for describing design activity. *Design Studies, 16*(2), 261-274.

Ehn, P., & Kyng, M. (1987). The collective resource approach to systems design. In G. Bjerknes, P. Ehn and M. Kyng (Eds.), *Computers and Democracy - a Scandinavian Challenge* (pp. 17-57), UK: Gower Publishing Company Ltd.

Ehn, P., & Kyng, M. (1991). Cardboard computers: Mocking-it-up or hands-on the future. In J. Greenbaum, & M. Kyng (Eds.), *Design at work: Cooperative design of computer systems* (pp. 169-195). Hillsdale, N.J: Lawrence Erlbaum Associates.

Ekman, P. (1999). Basic emotions. In T. Dalgleish, & M. J. Power (Eds.), *Handbook of cognition and emotion* (pp. 45-60). Chichester: Wiley.

Ekmam, P., & Friesen, W. V. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica, 1*(1), 49-98.

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: A technique for the measurement of facial movement*. Palo Alto: Consulting Psychologists Press.

Ekman, P., & Friesen, W. V. (1981). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. In A. Kendon (Ed.), *Nonverbal Communication, Interaction, and Gesture* (pp. 57-106), The Hague: Mouton.

Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual Review of Psychology, 30*(1), 527-554.

Ekman, P., Friesen, W. V., & Ellsworth, P. (1972). *Emotion in the human face: Guidelines for research and an integration of findings*. New York: Pergamon Press.

[200]

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data* (2nd ed.). Boston: MIT press.

Fabri, M., & Moore, D. J. (2002). Expressive agents: Non-verbal communication in collaborative virtual environments. Paper presented at the *Autonomous Agents and Multi-Agent System,* Bologna, Italy.

Fabri, M., & Moore, D. J. (2004). Designing emotionally expressive avatars for virtual meetings. Paper presented at the *Workshop on Designing and Evaluating Virtual Reality Systems,* Nottingham University.

Fabri, M., & Moore, D. J. (2005). The use of emotionally expressive avatars in collaborative virtual environments. Paper presented at the *Symposium on Empathic Interaction with Synthetic Characters, Artificial Intelligence and Social Behaviour Convention 2005 (AISB 2005),* University of Hertfordshire.

Fast, J. (1970). *Body language.* New York: M. Evans and Company Inc.

Fields, T., & Cotton, B. (2011). *Social game design: Monetization methods and mechanics.* US: Taylor & Francis.

Foddy, W. (1994). *Constructing questions for interviews and questionnaires: Theory and practice in social research.* Cambridge, UK: Cambridge University Press.

Frayling, C. (1993). *Research in art and design.* London: Royal Coll. of Art.

Friesen, W. V. (1972). *Cultural differences in facial expressions in a social situation: An experimental test on the concept of display rules.* (Unpublished doctoral dissertation, University of California, San Francisco).

Galati, D., Miceli, R., & Sini, B. (2001). Judging and coding facial expression of emotions in congenitally blind children. *International Journal of Behavioral Development, 25*(3), 268-278.

Garau, M. (2003). *The impact of avatar fidelity on social interaction in virtual environments.* (PhD Thesis, University College London).

Gerhard, M. (2003). *A hybrid avatar/agent model for educational CVEs.* (PhD Thesis, Leeds Metropolitan University).

Gero, J. S., & McNeill, T. (1998). An approach to the analysis of design protocols. *Design Studies, 19*(1), 21-61.

Gillham, B. (2007). *Developing a questionnaire* (2nd ed.). London: Continuum.

Gillies, M., Crabtree, I. B., & Ballin, D. (2004). Customisation and context for expressive behaviour in the broadband world. *BT Technology Journal, 22*(2), 7-17.

Greenbaum, T. L. (1998). *The handbook for focus group research* (2nd ed.). Sage.

Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition & Emotion, 9*(1), 87-108.

Gulliksen, J., Lantz, A., & Boivie, I. (1999). User centered design in practice-problems and possibilities. *SIGCHI Bulletin, 31*(2). 25–35.

Guye-Vuillème, A., Capin, T. K., Pandzic, S., Thalmann, N. M., & Thalmann, D. (1999). Nonverbal communication interface for collaborative virtual environments. *Virtual Reality, 4*(1), 49-59.

Hooks, E. (2003). Acting for animators: A complete guide to performance animation. USA: Portsmouth, N.H.: Heinemann, 2003.

Hubert, W., & de Jong-Meyer, R. (1990). Psychophysiological response patterns to positive and negative film stimuli. *Biological Psychology, 31*, 73-93.

Ickes, W. (1997). *Empathic accuracy*. New York: The Guilford Press.

Izard, C. E. (1977). *Human emotions*. New York: Plenum Press.

Jordan, J. V. (1991). The meaning of mutuality. In J. V. Jordon, A. G. Kaplan, J. B. Miller, I. P. Stiver, & J. L. Surrey (Eds.), *Women's growth in connection* (pp.81–96). New York: Guilford Press.

Katz, S. D. (1991). *Film directing shot by shot: Visualizing from concept to screen*. USA: Michael Wiese Productions.

Kendon, A. (1967). Some functions of gaze-direction in social interaction. *Acta Psychologica, 26*, 22-63.

Kendon, A. (2004). *Gesture: Visible action as utterance*. Cambridge: Cambridge University Press.

[202]

Keyton, J. (1997). Coding communication in decision-making groups. In L. R. Frey & J. K. Barge (Eds), *Managing group life: Communicating in decision-making groups* (pp. 236-269). Boston: Houghton Mifflin.

Kim, H., & Que, E. (2007). Presentation desire of digital identity in virtual community. In D. Schuler, *Online communities and social computing: Second International Conference, OCSC 2007, Held as Part of HCI International 2007, Beijing, China, July 22-27, 2007. Proceedings* (pp. 96-105), Springer Berlin Heidelberg.

Klineberg, O. (1938). Emotional expression in Chinese literature. *The Journal of Abnormal and Social Psychology, 33*(4), 517-520.

Klineberg, O. (1940). *Social psychology.* New York: Holt.

Knapp, M. L., & Hall, J. A. (2010). *Nonverbal communication in human interaction* (7th , International ed.). Boston, MA: Wadsworth, Cengage Learning.

LaBarre, W. (1947). The cultural basis of emotions and gestures. *Journal of Personality, 16*(1), 49-68.

Lamb, W., & Watson, E. (1979). *Body code: The meaning in movement.* Routledge and Kegan Paul.

Lasseter, J. (1987). Principles of traditional animation applied to 3D computer animation. *Computer Graphics, 21*(4), 35-44.

Lazar, J., Feng, J. H., & Hochheiser, H. (2010). *Research methods in human-computer interaction.* Chichester: John Wiley.

Lazarus, R. S., Speisman, J. C., Mordkoff, A. M., & Davison, L. A. (1962). A laboratory study of psychological stress produced by a motion picture film. *Psychological Monographs, 76* (whole number 553).

Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues, 2*(4), 34-46.

Litosseliti, L. (2003). *Using focus groups in research.* London: Continuum.

Liverman, M. (2004). *The animator's motion capture guide : Organizing, managing, and editing.* Hingham, Mass: Charles River Media.

Lloyd, P., Lawson, B., & Scott, P. (1995). Can concurrent verbalization reveal design cognition? *Design Studies, 16*(2), 237-259.

Lupton, D. (1998). *The emotional self: A sociocultural exploration*. London: Sage Publications.

Machado, I., & Paiva, A. (2000). The child behind the character. *Proc.Socially Intelligent Agents-the Human in the Loop, AAAI, 31*, 102-106.

MacKay, D. M. (1972). Formal analysis of communicative processes. In R. A. Hinde (Ed.), *Non-verbal communication* (pp. 3-26), Cambridge University Press.

McDonough, J. P. (1999). Designer selves: Construction of technologically mediated identity within graphical, multiuser virtual environments. *Journal of the American Society for Information Science, 50*(10), 855-869.

McHugh, M. L. (2012). Interrater reliability: the kappa statistic. *Biochemia Medica*, 22(3), 276-282.

McHugo, G. J., Smith, C. A., & Lanzetta, J. T. (1982). The structure of self-reports of emotional responses to film segments. *Motivation and Emotion, 6*(4), 365-385.

Meeren, H. K., van Heijnsbergen, C. C., & de Gelder, B. (2005). Rapid perceptual integration of facial expression and emotional body language. Paper presented at the *National Academy of Sciences of the United States of America, 102*, pp. 16518-16523.

Mewborn, C. R., & Rogers, R. W. (1979). Effects of threatening and reassuring components of fear appeals on physiological and verbal measures of emotion and attitudes. *Journal of Experimental Social Psychology, 15*(3), 242-253.

Millenson, J. R. (1967). *Principles of behavioural analysis*. New York: Macmillan.

Montgomery, D. C., Runger, G. C., & Hubele, N. F. (1998). *Engineering statistics*. Wiley.

Morgan, D. L. (1992). *Focus groups as qualitative research* (2nd ed.). Sage.

Norman, D. A. (1988). *The psychology of everyday things.* Basic books.

Norman, D. A., & Draper, S. W. (1986). *User centered system design; new perspectives on human-computer interaction.* L. Erlbaum Associates Inc.

Notarius, C. I., & Levenson, R. W. (1979). Expressive tendencies and physiological response to stress. *Journal of Personality and Social Psychology, 37*(7), 1204.

Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement.* London: Continuum.

Ortony, A., & Turner, T. J. (1990). What's basic about basic emotions? *Psychological Review, 97*(3), 315-331.

O'Shaughnessy, J., & O'Shaughnessy, N. J. (2003). *The marketing power of emotion.* Oxford; New York: Oxford University Press.

Panksepp, J. (1982). Toward a general psychobiological theory of emotions. *Behavioral and Brain Sciences, 5*(3), 407-467.

Pearce, C. (2002). Emergent authorship: The next interactive revolution. *Computers & Graphics, 26*(1), 21-29.

Pease, A. (1984). *Body language: How to read others' thoughts by their gestures.* Sheldon.

Pedgley, O. (2007). Capturing and analysing own design activity. *Design Studies,* 28(5), 463-483.

Pedgley, O. & Wormald, P. (2007). Integration of design projects within a PhD. *Design Issues,* 23(3), 70–85.

Philippot, P. (1993). Inducing and assessing differentiated emotion-feeling states in the laboratory. *Cognition & Emotion, 7*(2), 171-193.

Picard, R. W. (1997). *Affective computing.* MIT press.

Pink, S. (2007). *Doing visual ethnography: Images, media, and representation in research* (2nd ed.). London: Sage Publications.

Plutchik, R. (1980). A general psychoevolutionary theory of emotion. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, Research, and Experience, 1*(3), 3-31.

Plutchik, R. (2001). The nature of emotions: Human emotions have deep evolutionary roots, a fact that may explain their

complexity and provide tools for clinical practice. *American Scientist, 89*(4), 344-350.

Polanyi, M. (1966). *The tacit dimension.* Garden City, New York: Doubleday & Company, Inc.

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing, 18*(3), 5-14.

Rubin, J. (1994). *Handbook of usability testing: How to plan, design and conduct effective tests.* New York: John Wiley & Sons.

Russell, J. A., & Fernández-Dols, J. M. (1997). What does a facial expression mean? In J. A. Russell & J. M. Fernández-Dols (Eds.), *The Psychology of Facial Expression* (pp. 3-30). New York: Cambridge University.

Rust, C. (2004). Design enquiry: Tacit knowledge & invention in science. *Design Issues, 20*(4), 76-85.

Rust, C., Mottram, J., & Till, J. (2007). *AHRC review of practice-led research in art design & architecture.* UK: AHRC.

Salem, B., & Earle, N. (2000). Designing a nonverbal language for expressive avatars. Paper presented at the *The Third International Conference on Collaborative Virtual Environments,* San Francisco, California, USA. pp. 93-101.

Sanders, E. B. –N. (1992). Converging perspectives: Product development research for the 1990s. *Design Management Journal, 3*(4), 49-54.

Sanders, E. B. –N. (1999). Postdesign and participatory culture. In *Proceedings of the International Conference 'Useful and Critical'-the Position of Research in Design.* University of Art and Design, Tuusala, Finland, pp. 87-92.

Sanders, E. B. -N. (2000). Generative tools for co-designing. In B. A. W. Scrivener (Ed.), *Collaborative Design: Proceedings of CoDesigning 2000* (pp. 3-12). London: Springer-Verlag.

Sanders, E. B. -N. (2002). "From User-Centred to Participatory Design Approaches," in *Design and the Social Sciences,* J Frascara, ed. Taylor & Francis

Sanders, E. B. –N. (2006). Design research in 2006. *Design Research Quarterly,* 1(1), 1-8.

Sanders, E. B. –N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-Design: International Journal of CoCreation in Design and the Arts, 4*(1), 5-18.

Scheflen, A. (1973). *Communicational structure*. Bloomington: Indiana University Press

Schell, J. (2008). *The art of game design: A book of lenses*. Taylor & Francis US.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic books.

Schroeder, R. (1996). *Possible worlds: The social dynamic of virtual reality technology*. Westview Press, Inc.

Schuler, D. (2008). *Liberating voices: A pattern language for communication revolution.* The MIT Press.

Shaver, P., Schwartz, J., Kirson, D., & O'connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology, 52*(6), 1061-1086.

Simon, H. A. (1969). *The sciences of the artificial*. Cambridge, MA: MIT Press.

Simpson, M., & Tuson, J. (1995). *Using observation in small-scale research: A beginner's guide*. Glasgow: The Scottish Council for Research in Education.

Sleeswijk Visser, F., Stappers, P. J., van der Lugt, R., & Sanders, E. B. –N. (2005) Contextmapping: Experiences from Practice. *CoDesign, 1*(2), 119-149.

Spinuzzi, C. (2005). The methodology of participatory design. *Technical Communication, 52*(2), 163-174.

Spitzberg, B. H. (2006). Preliminary Development of a Model and Measure of Computer-Mediated Communication (CMC) Competence. *Journal of Computer-Mediated Communication, 11*, 629-666.

Stringer, E. T. (1999) *Action Research* (2nd ed.). Sage.

Strongman, K. T. (1995). *The psychology of emotion: Theories of emotion in perspective*. John Wiley & Sons.

Strongman, K. T. (2003). *The psychology of emotion: From everyday life to theory* (5th ed.). Chichester: Wiley.

Suwa, M., & Tversky, B. (1997). What do architects and students perceive in their design sketches? A protocol analysis. *Design Studies, 18*(4), 385-403.

Swinth, K., & Blascovich, J. (2002). Perceiving and responding to others: Human-human and human-computer social interaction in collaborative virtual environments. *Paper presented at the 5th Annual International Workshop on PRESENCE,* Porto, Portugal. , *392.* pp. 310-340.

Tang, H. H., Lee, Y.Y., & Gero, J.S. (2011). Comparing collaborative co-located and distributed design processes in digital and traditional sketching environments: A protocol study using the function–behaviour–structure coding scheme. *Design Studies, 32*(1), 1-29.

Taylor, T. L. (2003). Intentional bodies: Virtual environments and the designers who shape them. *International Journal of Engineering Education, 19*(1), 25-34.

Terzopoulous, D., & Waters, K. (1993). Analysis and synthesis of facial image sequences using physical and anatomical models. *IEEE Transactions on Pattern Analysis and Machine Intelligence, 15*(6), 569-579.

Thalmann, D. (2001). The role of virtual humans in virtual environment technology and interfaces. In R. Earnshaw, R. Guedj, A. Van Dam & J. Vince (Eds.), *Frontiers of human-centred computing, online communities and virtual environments* (pp. 22-39). London: Springer.

Thomas, F., & Johnston, O. (1984). *The illusion of life : Disney animation.* New York: Hyperion.

Thompson, L. A., & Massaro, D. W. (1986). Evaluation and integration of speech and pointing gestures during referential understanding. *Journal of Experimental Child Psychology, 42*(1), 144-168.

Todorović, D. (2006). Geometrical basis of perception of gaze direction. *Vision Research, 46*(21), 3549-3562.

Tomkins, S. S. (1962). *Affect, imagery, consciousness: Vol. 1. The positive affects.* New York: Springer.

Tomkins, S. S. (1963). *Affect, imagery, consciousness: Vol. 2. The negative affects*. New York: Springer.

Tomkins, S. S. (1984). Affect theory. In K. R. Scherer & P. Ekman (Eds.), *Approaches to Emotion* (pp.163-195). Hillsdale, NJ: Erlbaum.

Tomkins, S. S., & McCarter, R. (1964). What and where are the primary affects? some evidence for a theory. *Perceptual and Motor Skills, 18*(1), 119-158.

Tromp, J., Bullock, A., Steed, A., Sadagic, A., Slater, M., & Frécon, E. (1998). Small group behaviour experiments in the coven project. *Computer Graphics and Applications, IEEE, 18*(6), 53-63.

Tversky, B. (2002). What do sketches say about thinking. *2002 AAAI Spring Symposium, Sketch Understanding Workshop, Stanford University, AAAI Technical Report SS-02-08,* 148-151.

Vanden Abeele, V. A., & Van Rompaey, V. (2006). Introducing human-centered research to game design: Designing game concepts for and with senior citizens. *CHI'06 Extended Abstracts on Human Factors in Computing Systems,* 1469-1474.

Vaughan, L. (2003). Statical Methods for the Information Professional: A Practical, Painless Approach to Understanding, Using, and Interpreting Statistics (Asist Monograph Series). Canda: Thomas H. Hogam, Sr.

Viera, A. J. & Garrett J. M. (2005). Understanding Interobserver Agreement: the Kappa Statistic. *Family Medicine,* 37(5), 360-363.

Walther, J., & D'Addario, K. (2001). The Impacts of Emoticons on Message Interpretation in Computer-Mediated Communication. *Social Science Computer Review, 19*(3), 324-347

Webster, C. (2005). *Animation: The mechanics of motion.* Taylor & Francis.

Wood, N. (2006). *Transmitting craft knowledge: Designing interactive media to support tacit skills learning.* (PhD Thesis, Sheffield Hallam University).

Wood, N., Rust, C., & Horne, G. (2009). A tacit understanding: The designer's role in capturing and passing on the skilled

knowledge of master craftsmen. *International Journal of Design,* *3*(3), 65-78.

Bibliography

Akin, Ö., & Lin, C. (1995). Design protocol data and novel design decisions. *Design Study, 16*(2), 211-236.

Allen, W. R., Comerford, R. A., & Ruhe, J. A. (1989). Factor analytic study of bales' interaction process analysis. *Educational and Psychological Measurement, 49*(3), 701-707.

Argyle, M. (1972). Non-verbal communication in human social interaction. In R. A. Hinde (Ed.), *Non-verbal communication* (pp. 243-269), Cambridge University Press.

Argyle, M. (2001). *The Psychology of Happiness* (2nd ed.), Sussex: Routledge.

Armstrong, D. F., Stokoe, W. C., & Wilcox, S. E. (1995). *Gesture and the nature of language.* Cambridge University Press.

Arnold, M. B. (1960). *Emotion and personality.* New York: Columbia University Press.

Badler, N. I., Chi, D. M., & Chopra, S. (1999). Virtual human animation based on movement observation and cognitive behavior models. In *Proceedings of Computer Animation Conference,* pp. 128-137.

Badler, N. I., Palmer, M. S., & Bindiganavale, R. (1999). Animation control for real-time virtual humans. *Communications of the ACM, 42*(8), 64-73.

Baek, E., Cagiltay, K., Boling, E., & Frick, T. (2008). User-centered design and development. In J. M. Spector, M. D. Merrill, J. J. van Merrienboner & M. F. Driscoll (Eds.) *Handbook of Research on Educational Communications and Technology* (3rd ed., pp. 659-670) London, UK: Routledge.

Bailenson, J. N., & Beall, A. C. (2006). Transformed social interaction: Exploring the digital plasticity of avatars In R. Schroeder and A.-S. Axelsson (Eds.), A*vatars at work and play: Collaboration and interaction in shared virtual environments* (pp. 1-16). London: Springer.

Bales, R. F. (1953). The equilibrium problem in small groups. In T. Parsons, R. F. Bales, & E. A. Shils (Eds.), *Working papers int the theory of action* (pp. 111-161). Glencoe: The Free Press.

Bales, R. F. (1956). Task status and likability as a function of taking and listening in decision-making groups. In L. D. White (Ed.). *The state of the social sciences* (pp. 148-161). Chicago: University of Chicago Press.

Bales, R. F. (1999), *Social interaction system. Theory and measurement.* New Brunswick: Transaction.

Bales, R. F., & Slater, P. E. (1995). Role differentiation in small decision-making groups. In T. Parsons & R. F. Bales (Eds.), *Family, socialization and interavtion process* (pp. 259-306). Glencoe: The Free Press.

Bardzell, J., Pace, T., & Terrell, J. (2010). Virtual fashion and avatar design: A survey of consumers and designers. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries,* pp. 599-602.

Bartneck, C., Takahashi, T., & Katagiri, Y. (2004) Cross-cultural study of expressive avatars. Paper presented at the *International Workshop on Social Intelligence Design,* 2004.

Bazeley, P. (2007). *Qualitative data analysis with Nvivo.* London: SAGE.

Beyer, H. and Holtzblatt, K. (1998). *Contextual design: defining customer-centered systems.* San Francisco: Morgan Kaufman.

Bødker, S. (1996). Creating conditions for participation: Conflicts and resources in systems development. *Human-computer interaction, 11,* 215-236.

Bødker, S., Ehn, P., Kammersgaard, J., Kyng, M., & Sundblad, Y. (1987). A Utopian experience. In G. Bjerknes, P. Ehn and M. Kyng (Eds.), *Computers and Democracy – a Scandinavian Challenge* (pp. 251-278), UK: Gower Publishing Company Ltd.

Bødker, S., Grønbæk, K., & Kyng, M. (1993). Cooperative Design: Techniques andexperiences from the Scandinavian Scene. In A. Namioka & D. Schuler (Eds.), *Participatory Design* (pp. 157-175). Hillsdale, NJ.: Lawrence Erlbaum Associates.

Bowen, S. (2009). *A critical artefact methodology: Using Provocative Conceptual Designs to Foster Human-centred Innovation.* (PhD Thesis, Sheffield Hallam University).

Brandt, E. (2006). Designing exploratory design games: A framework for participation in participatory design? In

Proceedings of the Ninth Participatory Design Conference 2006, Trento, Italy.

Breazeal, C. L. (2002) *Designing Sociable Robots.* USA:The MIT Press.

Brewer, J. D. (2000). *Ethnography.* UK: Open University Press.

Burns, C., Dishman, E., Verplank, W., & Lassiter, B. Actors, hairdos & videotape - informance design. In *Proceedings of CHI '94 Conference Companion on Human Factors in Computing Systems ,* pp. 119-120.

Carroll, J. M., Chin, G., Rosson, M. B., & Neale, D. C. (2000). The development of cooperation: Five years of participatory design in the virtual school. In *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques,* pp. 239-251.

Cassell, J., Nakano, Y. I., Bickmore, T. W., Sidner, C. L., & Rich, C. (2001). Non-verbal cues for discourse structure. In *Proceedings of the 39th Annual Meeting on Association for Computational Linguistics,* pp. 114-123.

Chesebro, J. W., & Bonsall, D. G. (1989). *Computer-Mediated Communication: Human Relationships in a Computerized World.* USA: The University of Alabama.

Chen, V. H., & Duh, H. B.-L. (2007). Understanding Social Interaction in World of Warcraft. In *Proceedings of the International Conference on Advances in Computer Entertainment Technology,* pp. 21–24.

Clement, A. (1996). Computing at work: Empowering action by low-level users. In R. Kling (Ed.), *Computerization and Controversy-Value Conflicts and Social Choices* (2nd ed., pp. 383-406*),* San Diego, CA, Academic Press.

Clement, A., & van den Besselaar, P. (1993). A retrospective look at PD projects. *Communications of the ACM, 36*(6), 29-37.

Clore, G. L., Ortony, A., & Foss, M. A. (1987). The psychological foundations of the affective lexicon. *Journal of Personality and Social Psychology, 53,* 751-766.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.), USA: Sage.

[213]

Cross, N., Christiaans, H., & Dorst, K., (1996). *Analysing design activity*. Chichester: John Wiley & Sons Ltd.

Cross, N. (1999). Natural intelligence in design. *Design studies, 20(*1), 25-39.

Cross, N. (2001). Design cognition: Results from protocol and other empirical studies of design activity. *Design Knowing and Learning: Cognition in Design Education, 7,* 9-103.

Curran, K., & Casey, M. (2006). Expressing emotion in electronic mail. *Kybernetes, 35*(5), 616-631.

Danet, B., Ruedenberg-Wright, L. and Rosenbaum-Tamari, Y. (1997) "HMMM...WHERE'S THAT SMOKE COMING FROM?" Writing, Play And Performance on Internet Relay Chat. *Journal of Computer-Mediated Communication*, 2 (4)

Derks, D., Bos, A. E. R., & Grumbkow, J.V. (2004). Emoticons and Social Interaction on The Internet: The Importance of Social Context. *Computers in Human Behavior, 23,* 842-849.

Dorst, K. (1995). Analysing design activity: New directions in protocol analysis. *Design Studies, 16*(2), 139-142.

Dumas, J. S., & Redish, J. C. (1993). *A Practical guide to usability testing*. Norwood, NJ: Ablex.

Ehn, P. (1989). *Word-oriented design of computer artifacts* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Ehn, P. (1993). Scandinavian design: On participation and skill. In D. Schuler, & A. Namioka (Eds.), *Participatory design: Principles and practices* (pp. 41-77). USA: Lawrence Erlbaum Associates.

Ehn, P. (2008). Participation in design things. In *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008,* pp. 92-101.

Ehn, P., & Kyng, M. (1984). A tool perspective on design of interactive computer support for skilled workers, In M. Sääksjärvi, (Ed.), *Proceedings from the Seventh Scandinavian Research Seminar on Systemeering*, Helsinki, pp. 211-230 + app.: pp. 231-242

Ekman, P. (1971). Universals and cultural differences in facial expressions of emotion. In J. Cole (Ed.), *Nebraska Symposium on Motivation* (pp. 207-283), Lincoln, NE: University of Nebraska Press.

[214]

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48*(4), 384-392.

Ekman, P., & Friesen, W. V. (1972). Hand movements. *Journal of Communication, 22*(4), 353-374.

Ekman, P., & Friesen, W. V. (1981). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. In A. Kendon (Ed.), *Nonverbal Communication, Interaction, and Gesture* (pp. 57-106), The Hague: Mouton.

Ekman, P., Friesen, W. V., & Press, C. P. (1975). *Pictures of facial affect.* Palo Alto: Consulting Psychologists Press.

Ermi, L., & Mäyrä, F. (2005). Player-centred game design: Experiences in using scenario study to inform mobile game design. *Game Studies, 5*(1)

Fabri, M. (2006). *Emotionally Expressive Avatars for Collaborative Virtual Environments,* (PhD Thesis, Leeds Metropolitan University).

Finnegan, R. (2006). Using documents. In R. Sapsford, & V. Jupp (Eds.), *Data collection and analysis* (2nd ed., pp. 138-151). London: SAGE Publications.

Fridlund, A. J. (1991). Sociality of solitary smiling: Potentiation by an implicit audience. *Journal of Personality and Social Psychology, 60*(2), 229-240.

Friedrichs, J., Ludtke, H., Derr, N., & Gallasch, A. (1975). *Participant observation: Theory and practice.* Saxon House.

Fulk, J., Schmitz, J. A., & Schwarz, D. (1992). The Dynamics of Context-Behaviour Interactions in Computer-Mediated Communication. In M. Lea (Ed.) *Contexts of Computer-Mediated Communication* (pp. 7-29). Hertfordshire: Harvester Wheatsheaf.

Furnham, A. (1999). *Body language at work.* London: Institute of Personnel and Development.

Gaver, B., Dunne, T., & Pacenti, E. (1999). Design: Cultural probes. *Interactions, 6*(1), 21-29.

Gero, J. S., & Tang, H. (2001). The differences between retrospective and concurrent protocols in revealing the process-oriented aspects of the design process. *Design Studies, 22*(3), 283-295.

Gillies, M., & Ballin, D. (2004). Integrating autonomous behavior and user control for believable agents. In *Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems-Volume 1*, pp. 336-343.

Gould, J. D., & Lewis, C. (1985). Designing for usability: Key principles and what designers think. *Communications of the ACM, 28*(3), 300-311.

Greenbaum, J., & Kyng, M. (Eds.) (1991). *Design at Work: Approaches to Collaborative Design*, New Jersey: Lawrence Erlbaum.

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology, 64*(6), 970-986.

Habermas, J. (1985). *The Theory of Communicative Action: Reason and the rationalization of society.* Beacon Press. (Translated by T. McCarthy)

Hart, J. (1999). *The art of the storyboard: Storyboarding for film, TV, and animation* . Oxford: Focal.

Helander, M. (2006). *A guide to human factors and ergonomics.* CRC Pressl Llc.

Hemp, P. (2006). Avatar-based marketing. *Harvard Business Review, 84*(6), 48-57.

Hess, U., Banse, R., & Kappas, A. (1995). The intensity of facial expression is determined by underlying affective state and social situation. *Journal of Personality and Social Psychology, 69*(2), 280-288.

Hinde, R. A. (Ed.) (1972). *Non-verbal communication.* Cambridge University Press.

Holliday, A. (2007). *Doing and writing qualitative research* (2nd ed.). London: Sage.

Holmlid, S. (2009). *Participative, co-operative, emancipatory: From participatory design to service design.* Paper presented at the 1st Nordic Conference on Service Design and Service Innovation, Oslo, Norway.

Jiang, H., & Yen, C.C. (2009) Protocol analysis in design research: A review, Paper presented at *International Association of*

Societies of Design Research (IASDR) 2009, Seoul, South Korea.

Kafai, Y. B., Fields, D. A., & Cook, M. (2007). Your second selves: Avatar designs and identity play in a teen virtual world. In *Proceedings of the DIGRA 2007 Conference.*

Kahraman, Z. (2010). Using user-centered design approach in course design. *Procedia-Social and Behavioral Sciences, 2*(2), 2071-2076.

Karel, V., Isensee, S., & Righi, C. (2001). *User-Centered Design: An Integrated Approach.* Upper Saddle River: Prentice Hall PTR.

Kitagawa, M., & Windsor, B. (2008). *MoCap for artists : Workflow and techniques for motion capture.* Oxford: Focal.

Kleinsmith, A., De Silva, R., & Bianchi-Berthouze, N. (2006). Cross-cultural differences in recognizing affect from body posture. *Interacting with Computers, 18*(6), 1371-1389.

Kuhn, S. (1996). Design for people at work. In T. Winograd (Ed.), *Bringing design to software* (pp. 272-298). Boston: Addison-Wesley.

Kraut, R. E., & Johnston, R. E. (1979). Social and emotional messages of smiling: An ethological approach. *Journal of Personality and Social Psychology, 37*(9), 1539-1553.

Lazar, J. (2001). *User-centered Web development.* Boston: Jones and Bartlett Computer Science.

Luo, J., McGoldrick, P., Beatty, S., & Keeling, K. A. (2006). On-screen characters: Their design and influence on consumer trust. *Journal of Services Marketing, 20*(2), 112-124.

Madsen, K. H., & Aiken, P. H. (1993). Experiences using cooperative interactive storyboard prototyping. *Communications of the ACM, 36*(4), pp. 57-66.

Manninen, T. (2002) Interaction Forms in Multiplayer Desktop Virtual Reality Games. In *Proceedings of VRIC2002 Conference,* pp. 223-232.

Manninen, T. (2003). Interaction forms and communicative actions in multiplayer games. *The International Journal of Computer Game Research, 3*(1).

Martin, J. (2005). Virtually Visual: The Effects of Visual

Technologies on Online Identification. Paper presented at *DiGRA 2005 Conference: Changing Views – Worlds in play*, Vancouver, Canada.

Matsumoto, D., Keltner, D., Shiota, M. N., O'Sullivan, M., & Frank, M. (2008). Facial expressions of emotion. *Handbook of Emotions, 3*, 211-234.

McCloud, S. (1994). *Understanding comics: The invisible art*. New York: HarperCollins.

McDonnell, J., & Lloyd, P. (Eds.) (2009), *About: Designing: Analysing design meetings*. CRC Press.

McDougall, W. (1926). *An introduction to social psychology*. Boston: Kuce.

McNiff, J., & Whitehead, J. (2002). *Action research: Principle and Principle* (2nd ed.). London: Routledge Falmer.

Meadows, M. S. (2008). *I, avatar: The culture and consequences of having a second life*. Berkeley: New Riders.

Messinger, P. R., Ge, X., Stroulia, E., Lyons, K., Smirnov, K., & Bone, M. (2008). On the relationship between my avatar and myself. *Journal for Virtual Worlds Research, 1*(2).

Mewborn, C. R., & Rogers, R. W. (1979). Effects of threatening and reassuring components of fear appeals on physiological and verbal measures of emotion and attitudes. *Journal of Experimental Social Psychology, 15*(3), 242-253.

Millenson, J. R., & Leslie, J. C. (1979). *Principles of behavioral analysis* (2nd ed.). New York: Macmillan.

Monk, A. (2000). User-Centred Design: The Home Use Challenge. In A. Sloane. & F. van Rijn (Eds.), *Home informatics and telematics: information technology and society* (pp. 181-190). Boston: Academic Publishers.

Morahan-Martin, J. (2000). Women and the Internet: Promise and Perils. *CYBERPSYCHOLOGY & BEHAVIOR 2000, 3*, 683-691.

Muller, M. J. (1991). PICTIVE- An exploration in participatory design. In *Proceedings of CHI' 91*, pp. 225-231.

Muller, M. J. (1992). Retrospective on a year of participatory design using the PICTIVE technique. In *Proceedings* of *CHI'92: Conference on Human Factors in Computing Systems*, pp. 455-462.

Muller, M. J. (2009). Participatory design: The third space. In A. Sears & J. Jacko (Eds.), *Human-Computer Interaction: Development Process* (pp.165-185), USA, Taylor & Francis Group.

Muller, M. J., Blomberg, J. L., Carter, K. A., Dykstra, E. A., Madsen, K. H., & Greenbaum, J. (1991). Participatory design in britain and north america: Responses to the "Scandinavian challenge". In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 389-392.

Muller, M. J., & Kuhn, S. (1993). Participatory design. *Communications of the ACM, 36*(6), 24-28.

Nam, C. S., Lyons, J. B., Hwang, H., & Kim, S. (2009). The process of team communication in multi-cultural contexts: An empirical study using bales' interaction process analysis (IPA). *International Journal of Industrial Ergonomics, 39*(5), 771-782.

Nakamura, L. (1995), Race In/For Cyberspace: Identity tourism and Racial Passing on the Internet, *Works and Days*, 13(1-2), 181-193.

Namioka, A., & Schuler, D. (1992). *Participatory design: Principles and practices.* Erlbaum Associates.

Nielsen, J. (1993). *Usability Engineering.* San Francisco: Morgan Kaufmann.

Neviarouskaya, A., Prendinger, H., & Ishizuka, M. (2010). User study on AffectIM, an avatar-based instant messaging system employing rule-based affect sensing from text. *International Journal of Human-Computer Studies, 68*(7), 432-450.

Norman, D. (2002). Emotion & design: Attractive things work better. *Interactions, 9*(4), 36-42.

Orb, A., Eisenhauer, L., & Wynaden, D. (2001). Ethics in qualitative research. *Journal of Nursing Scholarship, 33*(1), 93-96.

Ortony, A. (1987). Is guilt an emotion? *Cognition & Emotion, 1*, 283-298.

Ortony, A., Clore, G. L., & Collins, A. (1988). *The cognitive structure of emotions*. New York: Cambridge University Press.

Peña, J. F. (2004). *An interaction process analysis of text based communication in an online multiplayer videogame*. (Master Thesis, Faculty of the Graduate School, Cornell University).

Phillips, W. H. (2009). *Film: An introduction* (4th ed.). Boston, Mass.: Bedford/St. Martin's.

Plutchik, R. (1962). *The emotions: Facts, theories, and a new model*. New York: Random House.

Prahalad, C. K., & Ramaswamy, V. (2002). The co-creation connection. *Strategy and Business.*, Vol. Second Quarte, 50-61.

Preece, J., Rogers, Y., & Sharp, H. (2002). *Interaction design: Beyond human-computer interaction*. New York, NY: John Wiley & Sons.

Rezabeck, L. L., & Cochenour, J. J. (1994) Emoticons: Visual Cues for Computer-Mediated Communication. In *Proceedings of the Annual Conference of the International Visual Literacy Association*, Arizona, October, 1994, pp. 371-383.

Rezabeck, L. L., & Cochenour, J. J. (1998). Visual cues in computer-mediated communication: Supplementing text with emoticons. *Journal of Visual Literacy, 18*, 201-215.

Rodriguez, N., & Ryave, A. (2002). *Systematic self-observation*. Thousand Oaks, Calif.; London: Sage.

Sanders, E. B. –N. (2002). Scaffolds for Experiencing in the New Design Space. *Information Design*, 1-6.

Sanders, E. B. –N. (2008). On modeling: An evolving map of design practice and design research. *Interactions – Designing games: Why and How, 15*(6), 13-17.

Sanders, E. B. -N., & Westerlund, B. (2011). Experiencing, exploring and experimenting in and with co-design spaces. Paper presented at *NORDES'11,* pp. 1-5.

Santoro, G. M. (1995). What is computer-mediated communication? In, Z. L. Berge & M. P. Collins (Eds.), *Computer mediated communication and the online classroom* (pp. 11-28). Cresskill, NJ: Hampton.

Scheflen, A. E. (1979). On communicational processes. In A. Wolfgang (Ed.), *Nonverbal behavior: Applications and cultural implications* (pp. 1-16). Academic Press.

Schroeder R. (2002) Social Interaction in Virtual Environments: Key Issues, Common Themes, and a Framework for Research. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 1-18). London: Springer-Verlag.

Schwandt, T. A. (2007). *The SAGE dictionary of qualitative inquiry* (3rd ed.). London: SAGE.

Shneiderman, B. (1998). D*esigning the user interface: Strategies for effective human-computer interaction* (3rd ed.). Reading, MA: Addison-Wesley.

Slater, M., Howell, J., Steed, A., Pertaub, D., & Garau, M. (2000). Acting in virtual reality. Paper presented at the *Third International Conference on Collaborative Virtual Environments,* San Francisco, California, USA. pp. 103-110.

Slater, M., & Steed, A. (2002). Meeting People Virtually: Experiments in Shared Virtual Environments. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 146-171). London: Springer-Verlag.

Smith, M., Farnham, S., & Drucker, S. (2002). The social life of small graphical chat spaces. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 205-220). London: Springer-Verlag.

Sotamaa, O. (2007). Perceptions of player in game design literature. In *Situated Play: Proceedings of the 2007 Digital Games Research Association Conference,* B. Akira, Ed., the University of Tokyo (Tokyo September 2007), pp. 456-465.

Sotamaa, O., Ermi, L., Jäppinen, A., Laukkanen, T., Mäyrä, F., & Nummela, J. (2005). The role of players in game design: A methodological perspective. In *Proceedings of the 6th DAC Conference,* pp. 34-42.

Spinuzzi, C. (2002). A scandinavian challenge, a US response: Methodological assumptions in scandinavian and US prototyping approaches. In *Proceedings of the 20th Annual International Conference on Computer Documentation,* pp. 208-215.

[221]

Spinuzzi, C. (2003). *Tracing genres through organizations: A sociiocultural approach to information design.* Cambridge, MA: MIT Press.

Steen, M., Kuijt-Evers, L., & Klok, J. (2007). Early user involvement in research and design projects—A review of methods and practices. Paper presented at *the 23rd EGOS Colloquium,* Vienna, 2007.

Stone, R. A. (1991). Will the real body please stand up? Boundary stories about virtual cultures, in M. Benedikt (Ed.). *Cyberspace: First Steps* (81-118), Cambridge, MA: MIT Press.

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

Tang, J. C., & Leifer, L. J. (1988). A framework for understanding the workspace activity of design teams. In *Proceedings of the 1988 ACM Conference on Computer-Supported Cooperative Work,* pp. 244-249.

Taylor, T. L. (2002). Living digitally: Embodiment in virtual worlds. In R. Schroeder (Ed.), *The social life of avatars: Presence and interaction in shared virtual environments* (pp. 40-62). London: Springer-Verlag.

Taylor, T.L. (2004) The Social Design of Virtual Worlds: Constructing The User And Community Through Code. In *Internet Research Annual Volume 1: Selected Papers from the Association of Internet Researchers Conferences 2000-2002.* New York: Peter Lang.

Thompsen, P. A., & Foulger, D. A. (1996). Effects of pictographs and quoting on flaming in electronic mail. *Computers in Human Behavior, 12*(2), 225-243.

Tudor, L. G. (1993). A participatory design technique for high-level task analysis, critique and redesign: The CARD method. In the *Proceedings of the Human Factors and Ergonomics Society,* Seattle.

Turkle, S. (1994) Constructions and Reconstructions of Self in Virtual Reality: Playing in the MUDs. *Mind, Culture and Activity, 1*(3), 158-167.

Turkle, S. (1995). *Life on the screen: Identity in the Age of the Internet,* New York: Simon & Schuster.

[222]

Van Ments, M. (1999). *The effective use of role play: Practical techniques for improving learning* (2nd ed.) Kogan Page.

Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005). Contextmapping: Experiences from practice. *Codesign, 1*(2), 119-149.

Waggoner, Z. (2009). *My avatar, my self: Identity in video role-playing games*. Jefferson, NC: McFarland.

Walther, J., & D'Addario, K. (2001). The Impacts of Emoticons on Message Interpretation in Computer-Mediated Communication. *Social Science Computer Review, 19*(3), 324-347

Watson, J. B. (1930). *Behaviorism*. Chicago: University of Chicago Press.

Williams, A and Cowdroy, R (2002). How designers communicate ideas to each other in design meetings. In Marjanovic D (Ed.), *International Design Conference – Design 2002* (pp. 947-952).

Wolf, A. (2000). Emotional Expression Online: Gender Differences in Emoticon Use. *CyberPsychology & Behavior, 3* (5), 827-833.

Wolfgang, A. (Ed.) (1979). *Nonverbal behavior : applications and cultural implications*. Academic Press.

Yuki, M., Maddux, W.W. & Masuda, T. (2007). Are the windows to the soul the same in the East and West? Cultural differences in using the eyes and mouth as cues to recognize emotions in Japan and the United States. *Journal of Experimental Social Psychology, 43*, 303-311.

Appendix I   Questionnaire for Stimulus Film Clips

Name	
Gender	□Male □Female	Age	
Email Address:	

Q1. What are your favourite films? (Movies, TV series etc)

Q2. Would you explain why you love the films? (Movies, TV series etc)

Q3. In these films, could you describe which characters are impressive?

Q4. Would you explain why these characters are impressive?

Q5. Could you describe which scenes with actors' behaviour attract your attention?

Q6. Would you tell me why these scenes with actors' behaviour attract your attention?

Appendix II Sample respondents' on the Questionnaire for Stimulus Film Clips

Q1. What are your favorite films?

JURASSIC PARK , THE MATRIX , THE MATRIX RELOADED , THE MATRIX REVOLUTIONS , DIE HARD , BATMAN - MANY, MANY OTHERS

Q2. Would you explain why you love these films?

IT IS THE WAY THE STORIES ARE TOLD , VISUALLY. THE DIRECTION IS WHAT SHINES THROUGH , EXPLORING THE CHARACTERS AND THE SITUATIONS THEY FIND THEMSELVES IN.
WITH JURASSIC PARK, THE TECHNICAL MARVEL IN WHICH THE DINOSAURS ARE BROUGHT TO LIFE AND ALSO HOW THEY ARE INTRODUCED.
THERE ARE TECHNICAL BREAK THROUGHS WITH THE MATRIX TRILOGY BUT THE PHILOSOPHICAL ASPECT ALWAYS BRINGS SOMETHING NEW UPON EACH VIEWING.
I LOVE DIE HARD BECAUSE NOT ONLY IS THE MAIN CHARACTER A HERO AND SOMEONE WE ALL WOULD STRIVE TO EMULATE BUT EVEN THE VILLAINS ARE GIVEN DEPTH.
BATMAN STRUCK A CORD WITH ME AT AN EARLY AGE , MOST NOTEABLY THE MUSIC SCORE BY DANNY ELFMAN TO WHICH I STILL LISTEN TO EVEN NOW.

Q3. In these films, could you describe which characters impress you?

NEO , FROM THE MATRIX TRILOGY , THE RELUCTANT HERO WHO IN THE END DOES THE RIGHT THING.
JOHN McCLANE IN DIE HARD , WHO AGAIN IS A RELUCTANT HERO , BUT I WOULD DESCRIBE HIM AS MORE REBELLIOUS.
BATMAN , BRUCE WAYNE , AGAIN A HERO WHO FEELS THE NEED TO REEK VENGEANCE ON WRONG DOERS. I GUESS I'M A SUCKER FOR HEROES.

Q4. How do you think these characters?

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Q5. Could you describe which scenes of these characters impress you?

THE MOMENTS IN DIE HARD WHERE JOHN McCLANE TALKS TO HIMSELF, TRYING TO GET THROUGH HIS SITUATION AND WHEN HE WISE CRACKS. "WELCOME TO THE PARTY, PAL!"

BATMAN WHEN HE USES FEAR TO IMPRESS HIMSELF UPON VILLAINS, MOST PROMINENTLY WHEN WE FIRST MEET HIM.

IN THE MATRIX, WHEN NEO REALISES JUST WHO HE IS AND WHAT HE CAN DO, LIKE WHEN HE 'DIES' AT THE END OF THE FIRST FILM.

ALSO, NEO SAVING TRINITY IN THE MATRIX RELOADED AND THE REALISATION OF CHOICE IN THE THIRD FILM.

DR. MALCOLM IN JURASSIC PARK, WHERE HIS LOGIC CAN FIND FLAWS IN HIS SURROUNDINGS, LIKE WITH HIS WATER DRIP SPEECH OR 'LIFE ALWAYS FINDS A WAY.'

Q6. Would you tell me why these scenes impress you?

AS WITH THE MATRIX TRILOGY, YOU FOLLOW NEO AND LEARN AS HE DOES. THE MOST IMPRESSIVE THING THOUGH IS THAT WITH EACH VIEWING YOU CATCH ONTO THE IDEAS MORE, WHERE BEFORE I WAS SLIGHTLY CONFUSED.

JOHN McCLANE AND HIS WISE CRACKS ARE SIMPLY FUNNY IN AN ASTOUNDING SITUATION.

AS WITH BATMAN, IT'S HOW HE CAN DISTINGUISH HIS TWO PERSONAS FROM EACH OTHER, YET THEY DO TEND TO MELD.

FINDING LOGIC WITH DR. MALCOLM IN JURASSIC PARK IS SIMPLE AND ASTOUNDING BECAUSE HE STATES OBVIOUS BUT IS UNCLEAR UNTIL MENTIONED.

Appendix III   Consent Form for the Workshops

Consent Form

The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that you are free to decide not to participate or to withdraw at any time without affecting your relationship with the investigator or Sheffield Hallam University.

The purpose of the workshop is to *create avatar bodily expression appropriate for computer-mediated interaction through focus group discussion with movie clips.*

Do not hesitate to ask any questions about the project either before participating or during the time that you are participating. The workshop will be recorded and I would be happy to share my findings with you after the project is completed. However, your name will not be associated with the research findings in any way, and your identity as a participant will be known only to the investigator.

There are no known risks and/or discomforts associated with this project. Your signature will certify that you have voluntarily decided to take part in this project. It will also certify that you have had adequate opportunity to discuss the study with me. Please sign your consent with full knowledge of the nature and purpose of the procedures. A copy of this consent form will be given to you to keep.

Signature of Participant _____ Date_____

Name (block letters) _____

Signature of Investigator _____ Date_____

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Appendix IV The Video Experience Note for Co-designing

In this video (#   ), I feel the actor seems …

> Hint:
>
> *Using words to describe <u>feelings, emotions, and status,</u> such as happy, sad, angry, embarrassing, exciting, tried,*
>
> *worried anxious… etc.*
>
> *If you feel it is complex, you can use "+" (plus) to describe, for example: happy + embarrassing + …*

because this actor

> Hint:
>
> *Writing down some keywords to describe actor's behaviour, gesture, posture, and motion, for example, hands cover*
>
> *mouth, turn head, rise right hand… etc.*

Appendix V   Sample Participants' Records on the Video Experience Note

In this video (#   ), I feel the actor seems ...

> **Hint:**
> *Using words to describe <u>feelings, emotions, and status</u>, such as happy, sad, angry, embarrassing, exciting, tired, worried, anxious... etc.*
> *If you feel it is complex, you can use "+" (plus) to describe, for example: happy + embarrassing + ...*
>
> <u>Women</u>.
>   Sad
>   Worried
>   Worry.
>   Nervou.
>
> <u>Men</u>.
>   Angry.
>   tried.

because this actor...

> **Hint:**
> *Writing down some keywords to describe actor's behaviour, gesture, posture, and motion, for example, hands cover mouth, turn head, rise right hand...etc.*
>
> <u>Women</u>.
>   Motion — hand, mouth.
>   turn head.
>   rise a hand. into the.
>   head
>
> <u>Men</u>. — mouth. 5
>   — Body motion

In this video (#   ), I feel the actor seems …

relief

leader → not bother the result of ~~~~ project (not his wishes).

officer → happy to won compeition
        Crazy

because this actor…

won ~~compeition~~ Compeition of project

Leader : don't want spend time on talking with him.

officer . on face " on. I will do ....
        & in heart / out office → crazy happy to
                                   seen the result .

In this video (#   ), I feel the actor seems ...

Man
Happy + Relested.
exciting.

Woman.
Happy + exciting.

2 Boss.
Neutral.
Happy. + Agreee. the Idea p.

Fred outside off.
Jelous.

because this actor...

Man + women.
→ dancing + women. + cllebration

– Boss.
show the big thumb uve happy. + agree the idea. + releve

– Man outside off.
Show the jelous /online face.

Appendix VI Sample Event Logs

The 2nd Workshop in Sheffield: 16th April 2011 [SHF2.1] & [SHF2.2]

SHF2.1	
Time	Event
00:00:22	I told all participants I would play the first film clip.
00:00:51	Participants wanted to play it again.
00:00:53	*S-U4* asked me why there was no sound when play the clip (She was not there when I explained). *S-D1* explained the reason again then I told all participants started to fill in the video experience note.
00:04:10	I reminded participants they had 30 seconds to complete their notes.
00:04:47	Time for filling in the note was up. All participants stopped to write their opinions on their notes and I asked participants how they though this clip based on their notes. (Two designers were laughing because they thought they joined the examination.)
00:05:19	*S-U1* described his observation "the woman started with angry and shocking and after a while, she's turning back to the man" then provided 'angry, shaking, sad, worried and disappointed' these words.
00:05:46	*S-U4* said her feeling about the actress in the clip "the woman is angry then she is worried" and imagined the actress's situation – 'doing something wrong'.
00:06:15	*S-D1* mentioned the word 'annoyed' in the beginning then he described his observation on the actress's facial expression in detail. (*S-D1* also did the same facial expression as well.)
00:06:34	*S-U3* checked her note and said the words - 'worried and angry'. Also, she provided another word 'shaking'. Then she imagined the actor made the actress angry or worried.
00:07:12	*S-D3* imagined that the actress was angry, sad, lose temper and crazy because the actress couldn't accept some truths. (All participants were laughing.)
00:08:08	I asked participants why they though the actress was angry and worried because of experiences or something.
00:08:28	*S-D1* said the actress's face stress on angry. *S-D3* also said the actress's hands were shaking and most of women in the movie are doing that.
00:08:43	*S-D1* explained why people raise and shake their hands when they feel angry based on his logic. (He also did the motion.)
00:09:35	*S-U3* said not only body language bit also facial expression expressed the actress's emotion so people can feel the actress's negative emotions.
00:09:52	*S-U4* though facial expression is important than body language in the movie because everyone will watch actor's face. However, she also mentioned that body language can emphasize the status and emotions.

00:10:19	*S-U1* mentioned his friends don't show the same actions with the actor in the film clip because the actor is doing performance (reflecting his experiences)
00:10:58	I asked all participants to think about the topic for the first clip. *S-D1* said it could be 'anger' but *S-D3* thought it's not always 'anger'. She said it shows 'resentment' but the actress showed 'sad' as well. *S-U1* also mentioned the actress showed 'disappointed'. *S-U4* said people may have the bodily expression when everything goes wrong. Then *S-D3* said the topic could be 'lose temper' appropriate for this situation. All participants agreed with that, therefore, the topic for the first clip was 'lose temper'.
00:12:50	All participants received the sketch paper for drawing their ideas for this topic – 'lose temper'. I told participants that they could use the iPad 2 if they felt uncomfortable to sketch their ideas on paper.
00:13:30	Started to sketch. *S-U4* and *S-U3* were thinking to use the iPad 2 to record their body movements because they worried their sketches. *S-D3* told them could try to draw something because we didn't need good quality sketches. They finally decided to sketch something on the paper. (Users worried their ability of sketch) I also sketched my ideas on the paper.
00:23:37	Started to explain the sketch. I was the first person to show my sketches because no one wanted to show first.
00:25:25	*S-U1*'s sketch was based on the actress's performance and he tiered to describe the detail.
00:27:02	*S-U3* did not want to show her sketch and seemed to be worried. *S-D3* encouraged her to show the sketch. Finally, *S-U3* showed it and mentioned a situation to explain her sketch. However, she seemed to be uncomfortable to explained her sketches
00:28:19	*S-U4* had the similar situation with *S-U3*. She didn't want to tell us more detail.
00:29:02	*S-D3*'s sketch was like the process of 'lose temper' and she explained how to do these body movements.
00:30:58	*S-D1* showed his sketch. He imagined a situation and explained how to lose temper.
00:32:33	All participants discussed body movements in these sketches. They agreed people may be crying when losing temper. Therefore, they decided to take the body movement sketched on *S-D3*'s paper.

SHF2.2

Time	Event
00:00:13	I told all participants I would play the second film clip. All participants were given the new video experience note to record their opinions.
00:02:15	The second clip was played and all participants were allowed to control the play of

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	the clip. The second clip showed many actors' emotions and participants had almost five minutes to take note.
00:08:43	All participants seemed to finish their notes because they stopped to write on the note.
00:08:51	S-U3 described her observation on the clip and tried to interpret the actors' emotions and status. She could guess these actors' status and emotions but not sure what's happened, especially the last actor's facial expression. S-U4 guessed the actor's jealous.
00:11:36	S-U1 checked his note and he noticed the actor who wore a white shirt and tried to interpret the actor's action. He said the actor seemed 'relief from something'.
00:12:11	S-D1 agreed with S-U1's opinion and made a story to reason the actor's action. (S-D1 also showed the same action.)
00:12:58	S-U4 checked her note. She explained her imagination but she guessed the actor proposed something to his boss and the boss was happy with the result.
00:14:52	S-D3 also described her observation but she used a story to describe her observation.
00:15:48	I asked all participants to think about the topic for the second clip. S-D3 was kidding to say the topic could be 'jealous' (because of the last actor's action). S-U1 said it could be 'relief' and I proposed 'celebration'.
00:16:30	S-D3 said the interactions between these actors were complicated so she suggested we could choose the interaction between the actor and actress - 'relief'. S-D1 said the interaction is easy to understand. Other participants agreed the second topic is 'relief'.
00:16:43	All participants received the sketch paper for drawing their ideas for this topic – 'relief'.
00:17:02	S-U4 and S-U3 wanted to use the iPad 2 to record their body movements because they thought it's easy for them.
00:17:32	I told them how to use the iPad 2 to capture their body movements.
00:29:02	Started to explain sketches and clips.
00:29:06	S-U4 showed her body movements on the iPad 2 and explained how she did the actions when she finished her experiment. S-D3 said she could understand the situation what S-U4 mentioned.
00:30:18	S-D1 suggested S-U4 could think about 'hi-five' gesture.
00:30:52	S-U1 showed his sketch but he did funny body movements to explain his idea. I used the iPad 2 to record his action again. Other participants liked his body movements and thought the body movements could be useful to present 'relief'.
00:32:42	S-U3 explained her body movements with the iPad 2. She mentioned her body movements for relief is relevant to Buddhists. Her body movement was like to pray something. S-D3 asked S-D1 how to pray in his religion. S-U4 also explained how

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	to pray the God in her religion.
00:35:39	*S-D3* explained her sketches on the paper. Her idea was based on the story of the clip. She created a story and dialogues. She also reasoned all actors' actions.
00:37:50	*S-U4* liked *S-D3*'s sketches. *S-D3* explained her sketch style was simple because she was trying to let people understand. She also drew the emoticon – smile. Based on *S-D3*'s emoticon, *S-D1* mentioned the difference between Western emoticons and Eastern emoticons.
00:40:18	*S-D1* explained his sketch including the gesture – 'hi-five'. He didn't explain many details because he thought his idea was similar with other participants.
00:42:42	All participants discussed body movements in these sketches and recording videos. Participants considered that relief is related to 'celebration'. They also agreed people may raise hand to celebrate for something. Therefore, they decided to take the body movement sketched on *S-U1*'s paper.

Appendix VII Coder Training Sheet

Match each act to only one of the following categories

Content categories

1. Shows solidarity, raise other's status, gives help and rewards.
2. Shows tension release, jokes, laughs, and shows satisfaction.
3. Agrees, shows passive acceptance, understands, concurs, and complies.
4. Gives suggestion, direction, implying autonomy for other.
5. Gives opinion, evaluation, analysis, expresses feeling, wish.
6. Gives orientation, information, repeats, clarifies, and confirms.
7. Asks for orientation, information, repeats, clarifies, and confirms.
8. Asks for opinion, evaluation, analysis, expresses feeling, wish.
9. Asks for suggestion, direction, implying autonomy for other.
10. Disagrees, shows passive rejection, formality, and withholds help.
11. Shows tension, asks for help, and withdraws out of field.
12. Shows antagonism, deflates other's status, defends or asserts self.
13. Unclassifiable act.

Appendix VIII   Intercoder Reliability Result

Coding of 13 Categories

		1	2	3	4	5	6	7	8	9	10	11	12	13	Total
							Coder A								
	1	21	1	3	0	2	1	0	0	0	0	0	0	0	28
	2	5	92	6	2	5	5	4	0	0	0	1	0	0	120
	3	4	7	55	0	0	0	0	0	0	0	0	0	0	66
Coder B	4	0	0	0	60	15	14	0	0	0	0	0	0	0	89
	5	0	5	4	8	131	8	0	0	0	2	3	1	0	162
	6	3	0	1	5	8	148	0	0	0	4	4	0	0	173
	7	0	4	0	0	0	0	46	1	1	0	0	0	0	52
	8	0	2	0	0	0	0	7	20	2	0	0	0	0	31
	9	0	0	0	0	0	0	4	1	18	0	3	0	0	26
	10	0	0	0	0	0	0	2	2	0	14	0	0	0	18
	11	0	2	0	0	0	0	0	0	0	0	24	0	0	26
	12	0	0	0	0	0	1	0	0	0	0	0	1	0	2
	13	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	Total	33	113	69	76	161	177	63	24	21	20	35	2	0	794

Observed agreement: 0.7935

Chance agreement: 0.1401

Kappa: 0.7598

Appendix IX   Interaction Process Analysis Record by Coder A

Film clip TF1

Analysis part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	0	1	1	1
	2. Shows Tension Release	0	0	0	0
	3. Shows Agreement	6	4	4	2
Task area: Attempted Answer	4. Give Suggestions	6	2	2	1
	5. Give Opinions	7	5	3	5
	6. Give Orientation / Information	6	5	4	2
Task area: Questions	7. Asks for Orientation / Information	2	3	2	3
	8. Asks for Opinions	1	1	0	1
	9. Asks for Suggestions	1	1	1	1
Social-emotional area: Negative	10. Shows Disagreement	0	1	1	0
	11. Shows Tension	1	0	2	2
	12. Shows Antagonism	0	0	0	0

Total acts: 91

Creation part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	0	1	1	1
	2. Shows Tension Release	0	0	0	0
	3. Shows Agreement	0	1	1	1
Task area: Attempted Answer	4. Give Suggestions	3	3	1	1
	5. Give Opinions	2	3	2	1
	6. Give Orientation / Information	6	8	4	5
Task area: Questions	7. Asks for Orientation / Information	2	1	2	1
	8. Asks for Opinions	1	1	0	0
	9. Asks for Suggestions	0	0	0	0
Social-emotional area: Negative	10. Shows Disagreement	0	1	0	1
	11. Shows Tension	0	1	2	2
	12. Shows Antagonism	0	0	0	0

Total acts: 60

Film clip TF2

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	0	2	1	0
	2. Shows Tension Release	0	0	1	1
	3. Shows Agreement	5	5	3	4
Task area: Attempted Answer	4. Give Suggestions	6	3	4	3
	5. Give Opinions	7	6	9	8
	6. Give Orientation / Information	5	3	5	4
Task area: Questions	7. Asks for Orientation / Information	2	1	2	1
	8. Asks for Opinions	0	1	1	1
	9. Asks for Suggestions	1	1	2	1
Social-emotional area: Negative	10. Shows Disagreement	1	0	1	0
	11. Shows Tension	0	0	0	1
	12. Shows Antagonism	0	0	0	0

Total acts: 102

Creation part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	0	2	2	1
	2. Shows Tension Release	8	11	11	13
	3. Shows Agreement	0	3	1	4
Task area: Attempted Answer	4. Give Suggestions	1	1	1	1
	5. Give Opinions	4	6	4	5
	6. Give Orientation / Information	6	6	8	6
Task area: Questions	7. Asks for Orientation / Information	1	4	3	5
	8. Asks for Opinions	1	1	0	2
	9. Asks for Suggestions	0	0	1	0
Social-emotional area: Negative	10. Shows Disagreement	1	1	0	1
	11. Shows Tension	1	2	2	2
	12. Shows Antagonism	0	0	0	0

Total acts: 133

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Film clip TF3

Analysis part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	2	1	1	1
	2. Shows Tension Release	2	3	2	2
	3. Shows Agreement	1	1	1	2
Task area: Attempted Answer	4. Give Suggestions	6	3	1	2
	5. Give Opinions	9	8	5	5
	6. Give Orientation / Information	4	5	3	2
Task area: Questions	7. Asks for Orientation / Information	2	2	1	2
	8. Asks for Opinions	1	1	2	0
	9. Asks for Suggestions	0	0	1	1
Social-emotional area: Negative	10. Shows Disagreement	1	0	0	1
	11. Shows Tension	0	0	1	0
	12. Shows Antagonism	0	0	0	0

Total acts: 88

Creation part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	1	1	1	0
	2. Shows Tension Release	1	1	2	1
	3. Shows Agreement	0	1	1	3
Task area: Attempted Answer	4. Give Suggestions	1	1	0	0
	5. Give Opinions	3	4	2	3
	6. Give Orientation / Information	10	9	6	4
Task area: Questions	7. Asks for Orientation / Information	3	2	2	1
	8. Asks for Opinions	0	1	1	0
	9. Asks for Suggestions	0	0	0	0
Social-emotional area: Negative	10. Shows Disagreement	0	0	0	0
	11. Shows Tension	1	1	1	2
	12. Shows Antagonism	0	0	0	0

Total acts: 71

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Film clip TF4

Analysis part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	0	2	1	0
	2. Shows Tension Release	4	3	2	5
	3. Shows Agreement	2	1	2	2
Task area: Attempted Answer	4. Give Suggestions	4	3	3	4
	5. Give Opinions	8	6	8	7
	6. Give Orientation / Information	6	5	7	5
Task area: Questions	7. Asks for Orientation / Information	1	2	2	1
	8. Asks for Opinions	1	0	0	1
	9. Asks for Suggestions	0	1	2	1
Social-emotional area: Negative	10. Shows Disagreement	1	0	1	1
	11. Shows Tension	1	1	0	1
	12. Shows Antagonism	0	0	0	1

Total acts: 109

Creation part

Function area	Category	Background			
		Designer		User	
		D1	D2	ND1	ND2
Social-emotional area: Postive	1. Shows Solidarity	1	2	3	2
	2. Shows Tension Release	9	10	11	10
	3. Shows Agreement	1	1	3	3
Task area: Attempted Answer	4. Give Suggestions	3	2	2	2
	5. Give Opinions	4	5	3	4
	6. Give Orientation / Information	6	7	7	8
Task area: Questions	7. Asks for Orientation / Information	1	1	2	3
	8. Asks for Opinions	2	1	1	0
	9. Asks for Suggestions	1	2	1	1
Social-emotional area: Negative	10. Shows Disagreement	2	1	1	2
	11. Shows Tension	1	2	2	3
	12. Shows Antagonism	0	0	0	1

Total acts: 140

Appendix X   **Research Ethics Policy at Sheffield Hallam University**

Sheffield Hallam University

UNIVERSITY RESEARCH ETHICS COMMITTEE

RESEARCH ETHICS POLICY

5th Edition February 2012

Contents

1. Coverage

1.1 This policy and associated procedures apply to all research undertaken under the auspices of the University. Any research undertaken by staff or students (undergraduate or post graduate) of the University which involves direct contact with human participants, whether clinical, biomedical or social research, or the secondary use of human and animal materials or specimens, or where there may be any other ethical issues, should be subject to ethical review. Researchers are required to demonstrate that this review has occurred. Research supervisors have overall responsibility for ensuring that appropriate ethical scrutiny of their students' research occurs and are required to advise on the processes required.

1.2 Responsibility for undertaking the review will depend on the nature of the research. While demonstrating that ethical scrutiny of research projects has occurred is the responsibility of supervisors or principle investigators, under the university self-regulation policy not all research projects will need to be formally approved by a committee. Very low risk projects can be self-assessed using the university checklist. However, for all low risk research with human participants a copy of the self-assessment checklist must be lodged with the faculty research ethics administrator.

1.3 All research by staff or students which involves National Health Service (NHS) or Social Care Services staff or patients or tissue is subject to NHS and Social Care Governance procedures specified by the Department of Health (DoH). For NHS research, there is now a national Research Ethics Service (NRES) portal, the Integrated Research Application Service (IRAS) which provides a more integrated service for obtaining the necessary approvals. For social care research there is a national Social Care Research Ethics Committee which shares the NHS IRAS system. Both systems require that the scientific quality of research proposals is evaluated before ethical approval is requested. The

research being undertaken in this region. Both systems require a detailed research protocol, which must be submitted to the relevant SHU Faculty Research Ethics Committee for methodological evaluation and any required changes must be undertaken before it is submitted to the local NHS Committee. The research quality evaluation is a requirement of the DoH Research Governance Framework.

2 Guiding Principles

2.1 Research undertaken by staff and students must confirm to all legal requirements. This will include compliance with relevant data protection legislation, appropriate screening of researchers working with vulnerable groups and strict adherence to licensing requirements for any animal or biomedical research.

2.2 Research should be undertaken in accordance with commonly agreed standards of good practice such as are laid down in the Declaration of Helsinki, The ESRC Research Ethics Framework, by the Medical Research Council and Research Councils UK. These fundamental and widely accepted principles may broadly be categorised as:

- Beneficence - 'doing positive good'
- Non-Malfeasance - 'doing no harm'
- Integrity
- Informed Consent
- Confidentiality/Anonymity
- Impartiality

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All research must conform to

2.3 Beneficence and Non-Malfeasance

- Terms such as risk, harm and hazards include emotional and mental distress as well as physical harm.
- The importance of the objective should be in proportion to the inherent risk to the participant. Concern for the interests of the participant must always prevail over the interests of science and society;
- The research should be preceded by careful assessment of predictable risks in comparison with foreseeable benefits to the participants or to others;
- Research should not be undertaken where the hazards involved are not believed to be predictable;
- Adequate facilities and procedures should be in place to deal with any potential hazards.
- Due concern should be given to minimising risks to the environment.

2.4 Integrity

- The research should be scientifically sound and the purpose should be to contribute to knowledge;
- The research should be undertaken and supervised by those who are appropriately qualified and experienced; must be accountable for the research they undertake;
- The university requires research supervisors to take reasonable steps to ensure the research integrity of their students' research, e.g. listen to interview tapes, check lab books, or examine data sets.

2.5 Informed Consent

- Each potential participant must be adequately informed of the aims, methods, anticipated benefits and potential hazards of the research and any discomfort it may entail;
- Any documentation given to potential participants should be comprehensible and there should be an opportunity for them to raise any issues of concern;
- Consent should normally be in writing and records of consent should be maintained;
- Potential participants must be informed that they are free to withdraw consent to participation at any time;
- There should be a procedure for making complaints and participants should be made aware of this;
- All participants should be volunteers. Considerable care should be taken where consent is sought from those in a dependent position and it should be made clear that refusal to participate will not lead to any adverse consequences. For example, students must be assured that any decision not to participate will not prejudice in any way their academic progress;
- Any inducement offered to participants should be declared and should be in accordance with appropriate guidelines;
- Consent must be obtained from a legal guardian in the case of minors or any others who do not have the legal competence to give informed consent.

2.6 Confidentiality/Anonymity

- All research should conform to data protection legislation;
- Details that would allow individuals to be identified should not be published, or made available, to anybody not involved in the research unless explicit consent is given by the individuals concerned, or such information is already in the public domain;
- All reasonable steps should be taken to ensure that confidential details are secure;
- Great care must be taken where there is an intention to use data collected for one study, for another study. It is important that relevant guidelines are followed.

2.7 **Independence and impartiality**
Researchers should be honest with respect to the conduct of their research from inception to publication. Conflicts of interests are not necessarily unethical but should be declared and dealt with appropriately. The MRC suggest that researchers ask themselves, "Would I feel comfortable if others learnt about my secondary interest in this matter or perceived that I had one?" The recommendation is that if the answer is no, disclosure is required.

2.8 This guidance is only intended to be an introduction to the issues and an indication of the mattes that will be considered by University Research Ethics Committees. A list of further guidelines and codes of practice is available via the Research Support Intranet site at https://staff.shu.ac.uk/enterprise/research/ethics.asp or from the Secretary to the University Research Ethics Committee. In addition, Faculties should make researchers aware of guidance that relates to particular disciplines and professions via their websites.

3. Authority

3.1 The ultimate responsibility for the care of human participants rests with the researcher. However, in discharging its duty the University has established a University Research Ethics Committee and empowered Faculties to establish their own research ethics committees (designated committees). In addition, where appropriate, decisions are referred to the DoH NHS and Social Care Governance procedures.

3.2 The researcher or supervisor in the case of student research has the responsibility for deciding what authorisation, if any, should be sought. If researchers are in doubt as to what is appropriate they should seek advice. However, it is possible to give a general indication, as follows:

3.3 **Self-Regulation**
There are a number of straightforward procedures where it may not be necessary for researchers to seek Research Ethics Committee approval. However, in these cases the researcher still has a responsibility to consider ethical issues and take note of any relevant codes of practice. Procedures which may come under this category include:
- Questionnaires and interview schedules where there are no major issues relating to confidentiality or sensitive information or controversial subject matter and which do not involve vulnerable participants;
- Research already granted permission by other ethics committees;
- Group research exercises such as laboratory practicals or work-based learning projects where category approval has previously been given by the FREC.

For all low risk research with human participants a copy of the checklist (SHUREC1) must be lodged with the faculty research ethics administrator for auditing purposes.

3.4 However, where there is any doubt about any ethical issues relating to the project, it should be referred to the most appropriate delegated committee. Also researchers should seek advice from more experienced colleagues, within or outside the University.

3.5 It is important to note that consideration by an ethics committee does not replace other procedures and advice relating to insurance cover, contract authorisation and health and safety issues.

3.6 **Delegated Committees**
Faculties are required to have a Faculty Research Ethics Committee which is responsible for ensuring that all research is appropriately scrutinised.

It is the responsibility of these delegated committees to develop their own terms of reference and procedural guidelines for approval by the University Research Ethics Committee. Faculty Research Ethics Committees may be sub-committees of the Faculty Committees responsible

for Research and Knowledge Transfer. If this is the case reporting relationships should be administered accordingly.

The University Research Ethics Committee shall:
- approve the terms of reference, membership, policies and procedures of the delegated committees;
- act as an appeal body for delegated committees;
- monitor the activities of delegated committees through the receipt of annual reports, minutes of all meetings and other reports as appropriate;
- issue clear instructions and guidelines to the delegated committees on the standards of support and record keeping required.

3.7 In the first instance, all projects requiring ethics committee approval should be submitted to the delegated faculty committee. The University Research Ethics Committee may act as a 'court of appeal' in difficult cases.

3.8 **External Research Ethics Committees for Research Involving Human Participants**
In some cases approval must be obtained under NHS and Social Care Governance procedures specified by the Department of Health. This applies to any research project that involves:
- NHS patients or social services clients and staff; people recruited as participants by virtue of current or past contact with the NHS or Social Services including those being treated under contract with private sector providers;
- access to records of previous or former NHS patients or Social Services clients;
- individuals who because of mental incapacity cannot give informed consent themselves;
- clinical trials.

3.9 It is essential that the delegated committees maintain a record of any application to any external ethical committee and the related decision.

4. **Research involving animals**
The use of animals is tightly governed and monitored by law and by the Home Office, specifically under the Animals (Scientific Procedures) Act 1986 and its accompanying codes of practice and processes. Researchers using animals should operate in accordance with these.

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