

UNCAGED:

**A novel, 'telesymbiotic' approach to
bridge the divide between the physical
world and the virtual world of
computers?**

By

Ralf Nuhn

**A thesis submitted to Middlesex University in
partial fulfillment of the requirements for the
degree of Doctor of Philosophy.**

**School of Arts
Middlesex University (UK)**

November 2006

Abstract

The main subject of this thesis is my artistic project *UNCAGED*, which explores interrelationships and transitions between computer-based virtual environments and their immediate physical surroundings. The underlying motivation behind my approach was to ‘uncage’ screen-based realities from the confines of their digital existence and to bring the remote computer world closer to our human experience. In particular, my work was opposed to the notion of immersive ‘virtual reality’ where the physical world is more or less excluded from the participants, but instead attempted to situate the virtual domain within the physical world.

Initially, I will discuss the theoretical framework behind *UNCAGED*, ranging from aesthetic considerations, the particular role of sound, human computer interaction (HCI) to technical issues, and afterwards describe the creation process of *UNCAGED*. Based on a study of audience behaviour with *UNCAGED* at a major London museum, I will claim that the work’s popularity seems to relate to its perceptually intriguing fusion between the virtual domain and the physical world, and in this respect my project can be deemed successful. Furthermore, on the basis of an extended review and analysis of related work in the broad area of ‘mixed reality’, I will suggest that my own approach can indeed be viewed as a novel way to bridge the divide between the physical world and the virtual world of computers. The innovation relates, in particular, to its unique balance of formal simplicity and technical sophistication. In the last chapter, I will provide a more critical evaluation of *UNCAGED*, largely informed by Jean Baudrillard’s conception of the ‘real’ and the ‘virtual’, which raises questions about the very idea of integrating digital technology in our lives in a meaningful and satisfying way. Finally, I will present my subsequent practical work, which strongly engages with my critical reflections on *UNCAGED*. In particular, it is informed by a new heightened sensitivity regarding the role of digital technology in my artistic practice.

Acknowledgements

A very special thanks to Cécile Colle for making possible an extremely stimulating artistic partnership and her creative feedback for this thesis.

I would like to express my deepest gratitude to Dr. John Dack for his encouragement to commence my doctoral research and his invaluable support and constructive comments throughout my studies.

Furthermore, I would like to thank Dr. Magnus Moar for his inventive software creations for *UNCAGED* and his helpful input for this thesis.

I would also like to thank Jey Malaiperuman and Richard Thomas for their artistic contributions to *UNCAGED* as well as Martin Robinson for his interface designs for *UNCAGED* and, above all, his ingenious programming work for *Digital Communication*.

I must also thank Prof. Huw Jones, former head of the Lansdown Centre for Electronic Arts at Middlesex University, his successor Dr. Stephen Boyd Davis as well as Tony Gibbs for their overall support and confidence in my work.

There are two more people I wish to thank, my mother Inge and my father Heinrich, whose limitless support and faith has given me strength throughout this journey.

Finally, I would like to acknowledge that my program of studies has been funded by an AHRC doctoral award as well as a Middlesex University studentship.

Contents

Abstract	2
Acknowledgements	3
List of illustrations	5
Chapter 1 Towards <i>UNCAGED</i>: a series of six ‘telesymbiotic’ installations	6
1.1 Introduction	6
1.2 Initial inspiration	7
1.3 First artistic intentions	9
1.4 Theoretical framework	11
1.5 Creation of <i>UNCAGED</i>	21
1.6 Illustrated description of <i>UNCAGED</i>	25
1.7 Technical description of <i>UNCAGED</i>	34
1.8 Conclusions	47
Chapter 2 <i>UNCAGED</i> goes ‘live’	48
2.1 Introduction	48
2.2 Installation and presentation of <i>UNCAGED</i> at the MOC	49
2.3 Description and evaluation of <i>UNCAGED</i> ‘live’	52
2.4 Conclusions	63
Chapter 3 Related work: mixed reality	66
3.1 Introduction	66
3.2 Categorization of the six <i>UNCAGED</i> exhibits	67
3.3 Different approaches to mixed reality	69
3.4 Conclusions	80
Chapter 4 Critical evaluation of <i>UNCAGED</i>	82
4.1 Introduction	82
4.2 Revised view of <i>UNCAGED</i>	82
4.3 Revisiting Baudrillard	84
4.4 Considering <i>UNCAGED</i> on the basis of Baudrillard’s conceptions of reality	97
4.5 Conclusions	101
Beyond <i>UNCAGED</i>: in lieu of a conclusion	104
Bibliography	112
Appendices	116
This thesis includes a DVD (attached to the back cover) containing:	
<i>UNCAGED</i> : two early studies (half-size image)	02:05min
<i>UNCAGED</i> at the MOC	11:01min
<i>Digital Communication</i>	05:11min

List of illustrations

Fig. 1	Ralf Nuhn, <i>Staccato Death/Life</i> , 2001	8
Fig. 2-4	Ralf Nuhn, <i>Blow Life</i> , 2003-2004	26+27
Fig. 5-7	Ralf Nuhn, <i>Bubblelabub</i> , 2003-2004	27+28
Fig. 8-10	Ralf Nuhn, <i>Glitchy & Scratchy</i> , 2003-2004	29
Fig. 11-13	Ralf Nuhn, <i>Square Pusher</i> , 2003-2004	30+31
Fig. 14-16	Ralf Nuhn, <i>PONG (telesymbioitc version)</i> , 2002-2004	31+32
Fig. 17-19	Ralf Nuhn, <i>Not Only Jingle Bells for two Spuikars and other Players</i> , 2002-2004	33
Fig. 20	Ralf Nuhn, <i>Spuikar</i> , 2002	44
Fig. 21	Ralf Nuhn, <i>Bass Spuikar</i> , 2002	44
Fig. 22	Ralf Nuhn, <i>Piano</i> , 2004	44
Fig. 23	Ralf Nuhn, <i>Bell</i> , 2003	45
Fig. 24	Ralf Nuhn, <i>Whistle</i> , 2003	45
Fig. 25	Ralf Nuhn, <i>Three Tubes</i> , 2004	46
Fig. 26	Jeffrey Shaw, <i>The Golden Calf</i> , 1994	73
Fig. 27	Jeffrey Shaw, <i>The Golden Calf</i> , 1994, detail	73
Fig. 28	Blast Theory, <i>Desert Rain</i> , 1999	75
Fig. 29	Fabrizio Plessi, <i>Electronic Waterfall</i> , 1999	78
Fig. 30	Niklas Roy, <i>Pongmechanik</i> , 2003-2004	79
Fig. 31	Philippe Geluck, <i>Le chat a encore frappé</i> , 2005	80
Fig. 32	Ralf Nuhn, <i>CCT - Toaster mit Schnittstelle</i> , 2004	105
Fig. 33	Ralf Nuhn, <i>CCT - Two Networked Toasters</i> , 2005	105
Fig. 34	Ralf Nuhn, <i>CCT - Four Networked Toasters with Hub</i> , 2005	105
Fig. 35	Ralf Nuhn, <i>Cyber-Spatialism #1</i> , 2005	106
Fig. 36	Ralf Nuhn, <i>Cyber-Spatialism #1</i> , 2005, detail	106
Fig. 37	Luigi Fontana, <i>Concetto Spaziale - Attese</i> , 1967	107
Fig. 38	Ralf Nuhn, <i>Cyber-Spatialism #2</i> , 2005	107
Fig. 39	Luigi Fontana, <i>Concetto Spaziale - Attese</i> , 1964	107
Fig. 40	Ralf Nuhn, <i>Cyber-Spatialism #4</i> , 2005	108
Fig. 41	Luigi Fontana, <i>Concetto Spaziale - Attese</i> , 1959	108

Chapter 1 - Towards *UNCAGED*: a series of six 'telesymbiotic' installations

1.1 Introduction

This chapter will present my journey towards *UNCAGED*, which constitutes the initial practical output of my mixed mode PhD investigation. *UNCAGED* is a series of six 'telesymbiotic' installations exploring interrelationships and transitions between screen-based digital environments and their immediate physical surroundings. The term 'telesymbiosis' is sometimes used in biological research where it refers to a mutually beneficial relationship between organisms at a distance (cf. Turner, 2004, p 68). I have adopted this term to describe the quasi-symbiotic relationships - between the physical world and the distant computer world - in *UNCAGED*. This means that both the screen-based digital domain as well as the surrounding physical elements in *UNCAGED* are interdependent and perceptually enriched through their combination with each other.¹

I will commence with a discussion of my initial inspiration for this artistic project, outline the general concept of my approach, and introduce the initial practical studies I created on the basis of my new ideas. This will be followed by an overview of the theoretical framework informing the further development of my practical approach, ranging from aesthetic and formal considerations to issues regarding human computer interaction (HCI) and social interaction within (art) exhibition spaces. I will then describe the creation of *UNCAGED*, from its research and development phase to the final production phase, and, where appropriate, I will attempt to illuminate the decision making process concerning the creation of the work. This will lead to a general description of the six final exhibits, illustrated by a series of photographs, taken during the first exhibition of *UNCAGED* at the V&A - National Museum of Childhood in London. Finally, I will provide a detailed technical description of each exhibit. I should point out that this description might be less relevant to those readers who do not have an interest in subject areas such as software

¹ Admittedly, the term 'telesymbiosis' might be misleading as it is also used (synonymously with the term 'telepresence') in the context of 'virtual reality', where it refers to a person's feeling of being present in a virtual or remote environment (cf. Luciani et al., 2004, p 509). To be more precise, in this case the immediate physical surrounding would be excluded from the system and the symbiosis would occur between a participant and a virtual world.

development and physical interface design, etc. On the other hand, it reflects the multidisciplinary nature of my project and my concern to address a wider readership.

1.2 Initial inspiration

The initial motivation to focus my artistic practice on the exploration of relationships between the physical world and the virtual world of computers can probably be linked to several inputs. However, I believe there is one key event, which has helped to concretize a formerly rather subconscious artistic inclination towards this direction.

During a conference on computer music in Barcelona in November 2001², a speaker³ introduced a new EU-funded research initiative which, on the whole, was concerned with improving the relationships between virtual technologies and physical spaces. The presentation introduced the concepts of ‘mixed reality’⁴ and ‘presence research’⁵ and, in particular seemed to focus on the scenario of video conferences, with the question of how to enhance the notion of ‘being there’ (in the physical space) of the person(s) who participate(s) in the conference via a remotely linked video screen. I was immediately fascinated by the underlying idea of the presentation, to look for novel ways to extend the virtual world into the physical world and vice versa, and to mix the two domains more or less seamlessly. On my return journey from Spain to London, I formed some initial ideas about how to approach this area from my personal artistic perspective.

Certainly, the conference presentation in Spain provided an academic research context, including an appropriate vocabulary, which would at least initially serve as a framework for my new artistic endeavours. On the other hand, I believe that on a more subconscious level, I had already been working towards the notion of combining physical elements with the virtual world of computers. For instance, I would argue that my new artistic approach

² ‘MOSART Workshop on Current Research Directions in Computer Music’ held in Barcelona at the Pompeu Fabra University from 15-17 November 2001.

³ The speaker was Alexandros Bakalakos, project officer for the ‘IST - Future and Emerging Technologies’ programme at the European Commission.

⁴ ‘Mixed reality’ has now become a standard notion in areas like media art, architectural design as well as medicine. It refers to environments that mix computer generated realities with (representations of) the physical or ‘real’ world.

⁵ ‘Presence research’ is a relatively new discipline and is concerned with the notion of ‘being there’. It is often applied to ‘virtual reality’ with the rationale to measure how much a participant is immersed within a virtual environment.

was a direct development – at least from a perceptual and technical point of view - of my sound installation *Staccato Death/Life*, created in April 2001 (fig.1).

Staccato Death/Life is a sculptural collage of eleven household objects, taken from a kitchen environment, which are set into vibration by the plunger strokes of twelve electromagnets. The activity of the electromagnets is controlled by a computer, which functions as a dual interface: First, in ‘composer mode’, the different solenoids can be triggered directly by the participants via an on-screen push-button interface, using the computer mouse or the keyboard. Second, in ‘automatic play mode’, the computer randomly selects from over ten different, mostly chance based, (musical) algorithms.



Fig. 1: Ralf Nuhn, *Staccato Death/Life*, 2001

Full view of the installation, featuring computer to the left and sculptural collage of eleven household objects to the right hand side.

Even though *Staccato Death/Life* was originally conceived with a different idea in mind, i.e. to create a ‘performance situation’ which is focused on the relationships between everyday objects and their sonic characteristics rather than on the (musical) gestures and interpretations of a live player, I became over time more and more interested in the relationship between the computer and the physical sculpture.

I believe that my new interest was at least partially triggered by my observations and discussions with audiences during the initial exhibition at the 291 Gallery in London during May 2001. Despite the fact that the user interaction of *Staccato Death/Life* is very basic, I would argue that participants are simply fascinated by the fact that their action in the virtual domain causes an event in the physical domain. In fact, people appear to be more intrigued by the ‘magical’ relationship between the computer and the physical

sculpture than by the sounds themselves; an assumption which has often been confirmed in conversations with participants.

1.3 First artistic intentions

As mentioned above, almost immediately after the conference presentation in Barcelona, I had some initial intuitive ideas as to how I could approach the notion of mixed reality. The underlying motivation behind my approach was to ‘uncage’ screen-based realities from the confines of their digital existence and to bring the remote computer world closer to our human experience. In particular, my approach was opposed to the notion of immersive ‘virtual reality’ where the physical world is more or less excluded from the participants, but instead attempted to situate the virtual domain within the physical world. I feel it is useful to briefly outline the first two practical studies I designed on the basis of these ideas. This will provide a background for the subsequent section, in which I will discuss the theoretical considerations, which would to some extent inform the progression from these initial ideas into what would become the *UNCAGED* series.

Significantly, from a technical point of view, both studies are based on a very similar hardware and software set-up as the aforementioned piece *Staccato Death/Life*. For me this is an important fact, because it reflects the notion, that my artistic ideas are often based on the scope of my technical horizon. I do not mean this in a restrictive sense, nor to say that my creations are simply an application of my technical skills. Rather, it underlines my conviction that as an artist working with and about technology, it can be advantageous to have a strong command of a certain set of tools in order to realize ideas more or less spontaneously - that is, without the mediation through technical experts or having first to acquire the necessary skills in order to realize a particular idea.

The first study, which would later be developed into the exhibit *PONG (telesymbiotic version)*, features a virtual ball moving back and forth from the left to the right edge of the computer screen. Two thrust-pin type solenoids are positioned in close proximity to the left and right edge of the screen. Whenever the ball bounces against either edge of the screen, a trigger impulse is sent to the respective solenoid and its thrust-pin hits the edge of the screen where the ball is positioned. The combination of the sound produced by the impact of the solenoid’s thrust-pin on the computer housing and its clearly visible mechanical action, gives the viewer/listener the impression that the virtual ball is being kicked from one side to the other side by the activity of the solenoids.

The second study, which is not dissimilar to the exhibit *Blow Life* (of the final *UNCAGED* series), comprises a fan, which is positioned next to the computer screen. The screen display features some abstract shapes, reminiscent of waves. When the fan is activated by a trigger impulse of the computer, the on-screen shapes will start to undulate as if moved by the airflow of the fan. When the fan starts slowing down and finally stops the movement of the waves slows down and stops synchronously.

Despite the relative crudity of these first studies, I feel that they are already very characteristic of my approach to link the physical world with the virtual world of computers. In particular, these examples evoke very direct transitions between screen-based digital environments and their immediate physical surroundings which, I believe, is at least from a formal perspective, the main difference of my approach to most other work in this area.

For further illustration of these two studies, please also refer to the video documentation 'UNCAGED: two early studies' featured on the included DVD.

Please note: Due to the low quality of this video, the image is reduced to half the normal size (360 x 288 pixels).

After I had transformed my initial ideas into concrete practical examples and had time to reflect on my creations, I became increasingly interested in the physico-philosophical implications of my approach.

For instance, I could sense a certain relationship of my experiments to the quantum physical notion of non-locality, as proposed by the physicist Niels Bohr, and its implications for the existence of an invisible reality that supports our world - or to put it in different terms, its implication that an action in one part of the world could cause an instantaneous effect in another remote part of the world without there being a perceivable connection (cf. McEvoy and Zarate, 1999, pp 168-170). For me the idea of traversing the distance between the physical and the screen-based world of computers is an assertion of this idea, even though in my approach the link between the two worlds is of course only a make-believe situation.

Further, I considered that by implying a direct physical impact on the virtual image and vice versa, my approach seemed to challenge – at least in a metaphorical sense - Jean Baudrillard's concept of a 'hyperrealist' world where any direct experiences of the world are replaced by televised virtual images (cf. Baudrillard, 1993, pp 79+80; 1988, pp 11ff).

Arguably, these contemplations would not play a major role in the further development of my approach into the final *UNCAGED* series, and they might seem out of context at this point. However, I feel mentioning them is relevant with regards to subsequent chapters, which will contextualize my approach within a socio-philosophical discourse about the relationships between the ‘real’ and the ‘virtual’.

1.4 Theoretical framework

The methodological approach for the initial practical part of my project could be best described as experimentation and reconfiguration of existing technologies which result in new creative inventions and designs. This ‘blue-sky research’ was primarily led by my artistic taste, personal intuition and experience. However, this does not mean that I worked without any guidelines. In the following section I will outline the theoretical framework behind my approach ranging from formal and aesthetic considerations, the particular role of sound, aspects of HCI to social implications.

Based on my initial motivation as well as the formal conception of my approach, I conceived the project title *UNCAGED*. Obviously, at this time I did not have a precise idea about the eventual outcome of my work, and so the name *UNCAGED* was first used to refer to the project as a whole, whereas later it would refer to the final series of the six exhibits. I will from now on use the term *UNCAGED* more or less synonymously with the terms ‘approach’ or ‘work’, assuming that it will be clear from the context when I refer to the work in progress or the final series of six exhibits.

Prior to the discussion about the theoretical framework behind *UNCAGED*, I would like to address a terminological issue regarding the term ‘virtual’. In the preceding sections I have used ‘virtual’, often combined with the terms ‘world’ (virtual world) or ‘domain’ (virtual domain), when referring to the visual content displayed on a (computer) screen. In my view, this use of the term is legitimate, bearing in mind that the common dictionary definition of virtual is ‘as if’. For instance, in my example given in the previous section, where a ball is moving back and forth from the left to the right edge of the computer screen, we are not dealing with an actual physical ball but with a computer animated image which, on the whole, looks and behaves as if it were a physical ball. In other

words, the ball is a virtual ball situated within what one might call a virtual domain or even ‘virtual reality’.

However, the term ‘virtual’, and in particular the term ‘virtual reality’, demand further clarification. Michael Heim states that today we refer to many things as ‘virtual’, ranging from automated teller machines (ATMs) which function as if they were a human bank teller, virtual corporations connecting teams of workers located across the country, virtual romances flourishing through electronic mail and internet chat rooms to computer games. According to Heim these phenomena are ‘pale ghosts of virtual reality, invoking “virtual” to mean anything based on computers’, and for him they belong to what he calls the ‘weak sense’ of the term. What is more, according to Heim, this ‘weak sense of virtual reality grows increasingly fuzzy’, and now even television broadcasts are sometimes referred to as virtual reality (Heim, 1998, p 3).

By contrast, the ‘strong sense’ of virtual reality refers to a certain kind of technology and can be traced back to the computer scientist Jaron Lanier who coined the term in 1986.

Virtual reality, or in short VR, in the strong sense:

‘[...] is an immersive, interactive system based on computable information. These defining characters boil down to the “three I’s” of VR: immersion, interactivity, and information intensity. Immersion comes from devices that isolate the senses sufficiently to make a person feel transported to another place. Interaction comes from the computer’s lightning ability to change the scene’s point-of-view as fast as the human organism can alter its physical position and perspective. Information intensity is the notion that a virtual world can offer special qualities like telepresence and artificial entities that show a certain degree of intelligent behaviour. Constantly updated information supports the immersion and interactivity, and to rapidly update the information, computers are essential’ (ibid., pp 6+7).

In my view, the most striking difference between Heim’s strong sense of VR and my own approach relates to concerns of immersion. As mentioned before, my own approach attempted to situate the virtual domain within its immediate physical surroundings and establish relationships and transitions between both domains. By contrast, VR, according to Heim, aims to sufficiently isolate the participants from their immediate physical surroundings in order to transport them to another place.

A more concrete aspect, highlighting the difference between the notion of virtual reality in *UNCAGED* and Heim’s strong sense of the term, was my intention to use the computer monitor as the central medium to mediate the virtual domain in *UNCAGED*. This very

technology though, is in itself contrary to Heim's strong meaning of VR:

'The strong meaning implies full sensory immersion - not keyboards and monitors. The keyboard and the monitor are relics of typewriters and television sets. The screen, the keyboard, the joystick, and the trackball are a far cry from immersive technologies. We associate them with "virtuality" only in the weakest popular sense' (ibid., pp 46+47).

Notwithstanding the terminological problems of the term 'virtual' pointed out by Heim, I felt inclined to continue with its usage because, in the context of my research, it seems to provide an indispensable antonym to the term physical. However, to acknowledge that the screen-based realities of *UNCAGED* do not correspond with Heim's strong sense of VR, I have avoided this apparently very specific term in favour of the more general terms virtual world, virtual environment and virtual domain.

1.4.1 Aesthetic and formal considerations

Following on from the two early practical studies described above, I conceived of a set of aesthetic and formal guidelines, which would underpin the further development of my work.

To give a brief summary, I presumed that the work would consist of screen-based animations as well as (digitally processed) video material and images, linked to different computer-controlled electronic devices and automated sculptures positioned in close proximity around the screen. The off-screen devices would be triggered by different events happening in the virtual domain and vice versa. Thus, relationships between what happens on-screen and what happens off-screen would be established. The linkage would primarily be based on isomorphic visual and audio-visual relationships between both domains.

Since the early 1990's there have been a number of artistic and non-artistic projects that revolve around mixed reality environments and the idea to integrate the virtual with the physical world. Many of these projects involve video capturing devices and novel projection platforms that intricately combine virtual image worlds with physical artefacts, environments and participants.⁶

By contrast, my intention was to propose a direct extension of the conventional monitor screen into the physical domain and vice versa, in order to investigate if it would be

⁶ Please refer to chapter three for a detailed discussion of different mixed reality approaches.

possible to convincingly combine the physical world and the virtual domain in a more literal and straightforward way. Further, my approach was informed by the aspiration to be more referential to our usual experience of computer and television mediated realities. In particular, I hoped that in this way I would be able to explicitly challenge the accustomed presentation of 'virtual media', usually being framed off from our physical environment.

From a perceptual point of view, the overall vision of my approach can be well illustrated by a certain special effect, sometimes used in films or TV adverts. I am referring to the fictional situation where someone is watching TV, and all of a sudden humans, animals or objects start to come out of the TV box and invade the physical space of the viewer. I envisioned that my approach would to some degree 'materialize' the essence of this captivating special effect by creating 'magical' relationships between what happens on the screen and what happens around the screen.

My confidence in the success of this approach was based on my belief that people seem to have a strong desire for make-believe situations; possibly because they defy the rationality of the scientific age we are living in. I hope that it will become clear from the project description, that much of what defines my approach relies on people's fascination with irrational situations, and their willingness to use their own imagination.

Gaby Wood, when exploring the public's fascination with Kempelen's *Chess Player* automaton in late 18th century, points out that the *Chess Player* 'fulfilled what the historian Richard Altick has called "the public's desire to be baffled". It didn't matter how many times the inventor insisted the automaton was merely an "illusion"; it was constructed during the Age of Reason, yet many found reason less appealing than enchantment' (Wood, 2002, p 77). Even though, Wood's socio-psychological viewpoint is concerned with a situation of more than 200 years ago, I am inclined to argue that it is still (or perhaps we might say it is once again) applicable to our ultra technological society.

On the whole, I intended the nature of the off-screen sculptures as well as the screen-based visuals to be fairly crude and/or minimal. In particular, I did not aspire to any form of high-definition realism. This choice was not only based on aesthetic considerations and personal taste, but it is also an expression of my belief that the extent of engagement with a system does not so much depend on the degree to which it imitates the real world. What is important, in my view, is how much it stimulates the participants' imagination.

There seems to be a general agreement about this point of view amongst two theoreticians who, on the whole, have rather different standpoints regarding modern technologies: the media theorist Marshall McLuhan, who regarded modern technologies as ‘extensions of man’ (McLuhan, 1994, p 3), and the postmodern sociologist Jean Baudrillard, who claims that we should see modern technologies rather as ‘expulsions of man’ (Baudrillard, 1996, p 35).

Baudrillard, when discussing the ‘cinematic development from silents to talkies and now to 3-D and the current range of special effects’, argues that the ‘cinematographic illusion faded as the technical prowess increased [...] The more we move towards the perfect definition, that useless perfection, the more the power of the illusion is lost.’ Baudrillard illustrates his position with the following example:

‘To appreciate the truth of this [Baudrillard’s point made above], one only has to think of the Peking Opera and how, with the mere movement of their bodies, the old man and the girl brought to life on the stage the sheer size of the river and how, in the duel scene, the two bodies, skimming each other with their weapons yet not touching, made the darkness in which the duel took place tangible. That was total illusion – an ecstasy more physical and material than aesthetic or theatrical, precisely because all realist presence of the night or the river had been excised. Today, they would pipe tons of water into the studio, and the duel would be shot in the darkness with infra-red cameras’ (ibid., p 30).

McLuhan expresses a quite similar view on the issue of high definition in his concept of ‘hot’ and ‘cool’ media. According to him:

‘A hot medium is one that extends one single sense in “high definition”. High definition is the state of being well filled with data. A photograph is, visually, “high definition.” A cartoon is “low definition,” simply because very little visual information is provided. [...] hot media do not leave so much to be filled in or completed by the audience. Hot media are, therefore, low in participation or completion by the audience’ (McLuhan, 1994, pp 22+23).

It should be evident from the above outline that my approach would best fit within the category of ‘cool’ media, and, following McLuhan, is therefore susceptible to be high in ‘participation or completion by the audience’.

Furthermore, I presumed that some of the off-screen electronic sculptures would be based on modified toys or use mechanisms modelled on toys. I find many toys particularly interesting to work with because they are amongst the few things in our cultural

environment, which use technology without any productive purpose but instead are used in a playful, educational and often refreshingly nonsensical way.

Finally, I decided, that the work should allow for active user interaction through various tangible user interfaces. Even though, artistically, I was mainly interested in the perceptual interaction between on-screen and off-screen artefacts, I believed that the introduction of user interaction would increase the engagement with the exhibits and enhance the linkage between the virtual and the physical world. At the same time, I was quite certain that the level of user interaction should be fairly simple in order not to distract from the on-screen/off-screen interaction. For instance, I anticipated that the final work could feature some game-like characters which would not require a complex set of rules to be followed and would resonate with familiar games.

Apart from my artistic concerns, this choice also seemed to have useful practical implications. I reasoned that keeping the level and scope of direct user interaction at a minimum, would be beneficial for an evaluation of the final work. To put it simply, if *UNCAGED* would be able to attract and capture a large audience despite its fairly monotonous ways of user interaction, it could be followed that its fascination arises from the ‘telesymbiotic’ nature of the work.

1.4.2 Sound and vision

As mentioned above, the linkage between the virtual (screen-based) domain and the physical (off-screen) domain would be based on visual and audio-visual relationships between both domains.

With regards to the audio-visual aspect, I am particularly interested in the notion of ‘synchresis’. The term, coined by the French composer-filmmaker-critic Michel Chion, is a combination of the words synchronism and synthesis and refers to the cerebral process of ‘forging an immediate and necessary relationship between something one sees and something one hears at the same time’ (Chion, 1994, p 224). According to Chion, synchresis is independent of any rational logic and makes possible various audio-visual techniques used in film production such as dubbing, postsynchronization and sound effect mixing. ‘For a single body and a single face on the screen, thanks to synchresis, there are dozens of allowable voices - just as, for a shot of a hammer, any one of a hundred sounds will do’ (ibid., p 63).

For me, the most interesting aspect of synchresis is that it ‘can even work out of thin air - that is, with images and sounds that strictly speaking have nothing to do with each other, forming monstrous yet inevitable and irresistible agglomerations in our perception’ (ibid., p 63).

This phenomenon is extremely relevant for my work, because the sounds are created by computer-controlled electromechanical devices in the physical domain and are linked to visual events happening on the screen. Hence, the sounds and the on-screen visuals have no inherent relationship, but the linkage is solely constructed in the mind of the perceiver. For instance, in a further preliminary experiment, I linked the movements of a bouncing on-screen square with the sound of an electromechanical hammer hitting a wooden board placed underneath the monitor screen. In this example, the user can throw an animated square on a touch screen, and every time the square bounces off the bottom of the screen the hammer hits the wooden board. Even though, the bouncy movements of the square and the sounds created by the hammer have obviously no real cause and effect relationship, I believe that a more or less inevitable linkage between the two is formed in the mind of the participant. What is more, with regards to *UNCAGED*'s aim of bridging the gap between the virtual and the physical world, one could argue that the vibrations and ‘live’ sounds (in contrast to recorded or synthesised sounds) synchronised to the square’s movement imply a materialisation of the virtual image and create the illusion of the square being a heavy physical object.

1.4.3 Human computer interaction

Even though my interest in the notion of mixed reality was primarily inspired by the invention of playful, perceptually intriguing art installations rather than developing new technologies to be used in a scientific or commercial context, I could sense a potential relevance of my approach to issues concerning computer sciences, i.e. in the area of human computer interaction (HCI). I feel, that initially my approach was in some respects rather positivistic and, certainly, I had no absolute reservations towards digital technologies. In particular, I anticipated that the practical work might be able to address certain issues regarding our difficulties to engage with computers in a meaningful and satisfying way and, if not offer straight solutions, might at least suggest new directions to overcome these difficulties. In some ways my approach intended to integrate the remote computer world into our physical world and thus bring the computer world closer to our

human experience. In this respect *UNCAGED* can also be viewed as a response to my research at Sheffield University, which I conducted between June 2001 and June 2002. My investigations for Sheffield University were based on a qualitative analysis of electroacoustic composers 'at work' and showed that many composers who work with computer based systems 'suffer' from the distance between the physical reality and virtual computer data. For instance, my study revealed 'a need for more direct, tactile means of seeking and manipulating sounds in composition and performance [which] was expressed by the desire for malleable interfaces that would allow for a sculptural shaping of sounds.' Further, my research showed that 'there seems to be a general desire to physically touch the sounds which implies the need for force feedback interfaces' (Nuhn et al., 2002, p 578).

Although, in the context of interactive art, I find it rather questionable to follow current interaction design paradigms, instead of challenging them, there have been a certain number of resources, particularly in the aforementioned field of presence research, which provided some useful starting points for my research. For instance, I fully subscribed to Davies et al. when they discuss the role of presence in mixed reality:

'When considering the role of presence in Mixed reality, we may have to revisit our definition and understanding of what we mean by the term. Mixed reality is often used to enhance our communication in or behaviour with the real world, and therefore we have no wish to exclude the real world from the participant. [...] a person with a high sense of presence will behave intuitively, interacting with the mixed environment in a natural manner' (Davies et al., 2003, pp 157+158).

I should point out that the concept of 'presence' is usually used within the context of VR where it serves as an indicator of how much a user feels herself to 'be there' in the virtual world as opposed to the physical world (cf. Ijsselsteijn and Riva, 2003).

In line with Davies et al., the idea behind *UNCAGED* was opposed to the notion of immersion in an artificial world, but instead aimed at bridging the gap between human and computer reality by making the computer environment adapt to human experiences rather than expecting participants to engage with the computer on a solely virtual and inhuman territory.

Regarding the design of appropriate physical input interfaces for my work, I was very much stimulated by the approach taken by the Tangible Media Group at the MIT Media

Laboratory. They advocate the use of every day objects as a basis for input devices with the rationale to look ‘towards the bounty of richly-afforded physical devices of the last few millennia and inventing ways to reapply these elements of “tangible media “ augmented by digital technology’ (Ishii and Ullmer, 1997, p 236).

The Tangible Media Group has created a bottle interface which is based on a simple glass bottle with a cork lid. The bottle is connected to a computer via wireless sensing technology and by means of small electromagnetic resonator tags placed around the opening of the bottle it is possible to detect when the cork is removed from the bottle or whether the bottle is closed. The bottle interface is used in the Tangible Media Group’s project *musicBottles* consisting of three glass bottles. Essentially, the removal of the cork will trigger a particular soundtrack to start and the closing of the bottle will cause the music to stop. Conceptually it was important for the group to maintain the coherence between the new digital meaning of the interface and its everyday functionality as a physical object. The basic affordance⁷ of a bottle is of course to store content inside and in the installation this content is represented by musical sound. According to the Tangible Media Group participants ‘quickly understood the bottle metaphor’ and despite its simplicity ‘the overall reaction of visitors was very emotional’ (Ishii et al., 2001, p 188). For me, the approach taken by the Tangible Media Group is an assertion of my belief that user interaction with computer based systems should be an organic extension of our interaction with the physical world, rather than a showcase for new technological possibilities that bear no resemblance to our normal interaction with the world.

1.4.4 Audiences

Artistically, it was important for me that *UNCAGED* would work on different levels. For some participants the exhibits could simply be fascinating machines or games, for others they would perhaps stimulate reflections on the socio-philosophical dimension of the work, e.g. the relationship between virtual and physical reality.

In particular, I expected that *UNCAGED* might be very interesting and accessible for a younger audience, ranging from small children to teenagers. I find children a very interesting audience, especially for interactive artwork, because they usually approach the work very freely and intuitively and are not blocked by issues such as how to behave in a

⁷ An affordance is a property of an object that determines or indicates how that object can be used. Affordances may be actual physical properties, or perceived properties. The term was first introduced by psychologist James J. Gibson in his book *The senses considered as perceptual systems* (1966).

museum. Furthermore, over the last decade or so the influence of computers on our daily lives has increased extensively and due to extensive (UK government) campaigns, e.g. 'tools for schools', has found its way into the classrooms of many schools. The computer has therefore become a ubiquitous artefact that many people, particularly school children and their parents, have formed some sort of relationship with. In this light, I felt that *UNCAGED* is extremely relevant for younger audiences as well as parents because it might challenge their mental concepts about the computer and its potential role in our lives.

In a public (art) exhibition context, my work also seemed to address issues regarding social interaction and, in particular, was motivated by recent studies by the Work Interaction and Technology (WIT) research group at King's College London which suggest that most conventional screen-based exhibits in galleries and museums 'not only undermine co-participation and collaboration at the exhibit itself, but remove the possibility of others seeing and making relevant sense of what people are doing elsewhere within the scene'. Their research suggests that 'whilst interactive exhibits, in particular those relying on computing and information technologies, can often enhance an individual's experience they inadvertently impoverish the social interaction which can arise with and around exhibits in museums and galleries' (Heath and v. Lehm, 2003, no pagination). I was curious to find out if my screen-based approach could evade the problem of inhibiting social interaction amongst gallery audiences, because of its extension into the physical domain, and if it would provide the possibility for shared experiences amongst participants.

Finally, I would like to mention that audience feedback is an integral part of my artistic practice. For instance, as mentioned above, my own interest in the notion of mixed reality was partially triggered by the response of the audience during the exhibition of my sound sculpture *Staccato Death/Life*.

It is an established notion that many live performers are largely influenced by how audiences react to their performance and the interaction between performer and audience can often determine the success or non-success of a performance. With *UNCAGED*, my intention was to replace the immediate audience feedback in a live situation by a proactive engagement with audiences during the eventual exhibition of the work by means of informal conversations and (video) observations. I was confident, that this

feedback would be useful in the evaluation of the quality of my approach and would possibly inspire new ideas for future developments of my work.

1.5 Creation of *UNCAGED*

I feel it is useful to separate the creation of *UNCAGED* into a research and development phase and a production phase. Despite the theoretical considerations underpinning my approach, as outlined in the previous section, I would argue that the research and development phase can be best described as a kind of ‘blue-sky research’ which was primarily led by my artistic taste, personal intuition and practical experience. By contrast, the production phase was lead by more specific practical considerations, i.e. bearing in mind the eventual exhibition of the work at the V&A - National Museum of Childhood.

During the research and development phase as well as the production phase, there has been a certain amount of collaboration on an artistic as well as on a technical level. While it is not always easy or appropriate to identify specific reasons for decisions concerning the artistic way of working, I would argue, that my desire to collaborate with other artists is in some ways an organic extension from my group performance practice. With *UNCAGED*, I wanted to create an open platform where other artists could explore their ideas in the framework of my installation set-up. In my view, this intention has been particularly well realised with one of the exhibits (*Not Only Jingle Bells for two Spuikars and other Players*, described in 1.6.6), which allows for the presentation of several versions of animations created by different artists.

My decision to collaborate with a team of technical experts is, of course, primarily a pragmatic decision, but at the same time it is grounded in my belief that with a multidisciplinary work, such as *UNCAGED*, it is problematic for the leading artist to become an expert in all of the areas involved, e.g. software programming, electronics etc. This is because by getting too deeply involved in all the technical details of the work, it is in my view very easy for the artist to lose focus of the work’s overall artistic unity. At the same time, I believe that it is important for the artist to have a certain level of expertise in all of the areas involved, and to be able identify what is technically possible and to communicate her requirements clearly to the technical experts. If this is not the case, the artwork can often be pushed into a showcase for technological possibilities, or, in the other extreme, not be realised to its full technical potential.

1.5.1 Research and development phase

During the research and development phase around fifteen different practical studies were developed which in many ways were quite similar to the two initial studies described in 1.3. The studies were based on video loops and simple animations interacting with different computer controlled electronic devices placed around a screen display. In particular, all studies established transitions between the screen-based domain and the surrounding physical environment in a very direct or literal way. In most cases the electronic devices were based on slightly modified off-the-shelf equipment, e.g. a fish-tank air pump, a door bell, two turntables etc., but I also constructed some rather intricate automated musical instruments, which would later feature as an orchestral assemble in the exhibit *Not Only Jingle Bells for two Spuikars and other Players* (see 1.6.6).

Initially, most of the studies were conceived without a user-interactive element, but instead focused on the perceptual interaction between what happens on the screen and what happens around the screen. For instance, for one study, which would later be developed into the exhibit *Bubblelabub* (see 1.6.2), I looped a short video clip of someone blowing air into a plastic tube. Using a physical plastic tube, I extended the on-screen tube from the virtual image to a glass bottle filled with water. The physical tube was connected to a hidden air pump, the activity of which could be controlled by a computer in relation to the playback of the video loop. In this way, I could vary the amount of bubbles generated in the water bottle according to the blowing intensity of the on-screen person and, thus, create the impression that the blowing action of the on-screen person is causing the bubbles in the water bottle. In contrast to the final exhibit *Bubblelabub*, there was no possibility for user interaction at this stage, but, instead, the video clip would simply play back repetitively.

At a quite early stage, I identified touch screens as a potential user interface. I believe, that this rather conventional technology, mainly found in commercial kiosk-type applications, is often used rather unimaginatively, i.e. as a simple button interface to select from various options, and its potential as a more imaginative user interface is generally not explored. In the context of *UNCAGED*, I felt that the idea to directly touch and manoeuvre the virtual image and, in this way, cause related events in the physical domain, would be a promising approach for linking the two worlds in a compelling way. Some of the preliminary studies were conceived on the basis of this technology, and therefore entailed a user-interactive element right from the start. The first experiment

which would incorporate touch screen technology was the aforementioned study, where a bouncy square can be thrown across a touch screen. This study would later be developed into the exhibit *Square Pusher* (see 1.6.4). When the square bounces off the bottom of the screen it triggers a ‘banging’ sound and vibrations, which are caused by a thrust-pin type solenoid hidden underneath the screen. Even though, when touching the screen one can clearly feel the square not being a physical object, i.e. one cannot feel any weight, form or texture, I would argue that the sound and vibrations are so intrinsically linked to the square’s movements, that one gets the impression of the square acquiring the properties of a heavy physical object just when it hits the bottom of the screen. In this sense, the use of touch screen interfaces emphasises on the notion that what happens on the screen is not as such part of the physical world, but still it can have an immediate impact on the physical world.

In order to increase the engagement with the eventual exhibits I intended to add user-interactive elements also to those studies, which at first were conceived without this possibility. At the same time, I did not want the user-interactive part to become the main focus of the work. In particular, I did not want to introduce interfaces, which are highly complex, but instead make the user interaction as intuitive and evocative (of everyday interaction) as possible. For instance, I reasoned that, where appropriate, a simple push-button interface allowing participants to activate or play with an exhibit would be preferable to a more complex interface, like, for instance, motion capture devices etc. Furthermore, I was keen to develop my preliminary studies, where suitable, into exhibits, which in the overall structure, might be reminiscent of familiar games or are evocative of everyday experiences. From the relatively great number of preliminary studies, I identified those studies, which seemed to be most suitable to be developed into interactive exhibits, following my requirements in terms of intuitiveness of user interaction. Based on my knowledge of what would be technically possible, I developed some designs of how to introduce user interfaces for some of the studies. However, those interfaces were not created until the production phase.

1.5.2 Production phase

As mentioned in 1.4.4, more or less right from the start, I was convinced that *UNCAGED* could be interesting for a wide range of audiences, including children. I therefore felt it

appropriate to approach the V&A - National Museum of Childhood in London (MOC) with regards to my project. After several meetings with Stephen Nicholls, the exhibitions manager of the MOC, during summer 2003, at which I presented video documentations of some of the preliminary studies and discussed my ideas as to how to further develop my studies into interactive exhibits, we arranged an exhibition of *UNCAGED* during May and June 2004. It was agreed that the exhibition would feature six individual exhibits based on my preliminary studies.

The commission of my work for an exhibition at this particular space imposed certain requirements on the work. For instance, the exhibits would have to be of relatively low height so that even small children would be able to interact with the exhibits. Moreover, with the exhibition at the MOC in mind, there was certainly a tendency to further emphasise on the playful character of my work and to develop my preliminary studies into exhibits reminiscent of familiar games or childhood themes.

On the whole, one could say that during the research and development phase there was a notion of divergence in terms of inventing a great number of possible exhibits, whereas in the production phase there was a notion of convergence, meaning that the most appropriate studies were selected and developed into high-quality exhibits, which could be presented to a public audience. As implied above, the main focus of this final development was to add appropriate user interfaces to those studies which, up to this point, did not entail this feature. For the production of these interfaces I relied strongly on the knowledge and skills of experts, who essentially designed and constructed the interfaces on the basis of my own ideas. Further, a certain amount of refinement of the screen-based visuals and automated sculptures were required, which again involved a great deal of work by the team of technical experts.

Following my formal considerations outlined in 1.4.1, an essential feature of *UNCAGED* is the relatively simple set-up of each installation. All the digital visuals are displayed on common computer (touch) screens, which interact with their physical surroundings in a very direct way. To some extent, the idea behind this ‘basic’ approach was to be more referential to our daily-life experiences with screen-based media, i.e. the computer and the television.

This basic approach has also been applied to the design of the user interfaces. As mentioned in 1.4.3, in this respect I was very much inspired by the approach taken by the

Tangible Media Group. Even though, my own approach does not involve everyday objects as such, it is designed to be evocative of familiar forms of interaction. For example the exhibit *Blow Life* (see 1.6.1) includes a ‘hand interface’, which is similar to the interface of a fortune telling machine often found at fun fairs. The exhibit *Glitchy & Scratchy* (see 1.6.3) features two virtual records on a touch screen. I assumed that many people would have the urge to spin the records on the screen like a DJ and certainly have some preconceived idea how to do so.

I would therefore suggest that to a great extent the user interfaces of *UNCAGED* aim to involve the participant(s) in a very straightforward way by appropriating well-established forms (of interaction) from the physical world. What is new in *UNCAGED* is how the participants’ engagement affect the interaction between the physical and the screen-based world of the exhibits.

1.6 Illustrated description of *UNCAGED*

UNCAGED has been developed into a series of six separate interactive installations which are linked by the common theme, to explore interrelationships and transitions between screen-based digital environments and their physical surroundings.

UNCAGED incorporates different electromechanical devices and automated sculptures which interact, visually and acoustically, with computer generated animations and video images. Most of the exhibits are reminiscent of familiar games or feature modified toys, and participants can playfully engage with the installations via touch screens and tangible custom-made interfaces.

As mentioned in 1.5, *UNCAGED* (to be more precise, three of the six exhibits) has been created in artistic collaboration with different artists, namely Cécile Colle, Jey Malaiperuman and Richard Thomas. Their contributions are mentioned with regards to the relevant exhibits in the subsequent description.

Please note: All photographs featured in the following section have been taken during the first exhibition of ‘UNCAGED’ at the V&A – National Museum of Childhood (London) during May and June 2004.

For further illustration of the ‘UNCAGED’ series, please also refer to the video documentation ‘UNCAGED at the MOC’ featured on the included DVD.

1.6.1 *Blow Life*, 2003-2004

Blow Life is reminiscent of a fortune telling machine often found at funfairs. With their hand, participants have to cover a hand image in front of a computer screen (fig. 3). This will activate an electric fan, mounted next to the screen, blowing an on-screen barcode like 'grass in the wind' (fig. 4). After a few seconds the fan stops by itself and participants receive their own 'lucky number' encrypted into a new, randomly generated barcode. If participants move their hand away before the fan has stopped by itself, it will come to a premature standstill. In this case, participants will not receive their own 'lucky number', which means that the resulting barcode will look the same as before.

Artistic collaboration:

Jey Malaiperuman: design and realization of the bar-code animation.



Fig. 2: Ralf Nuhn, *Blow Life*, 2003-2004
Young participant interacting with the exhibit.



Fig. 3: Ralf Nuhn, *Blow Life*, 2003-2004
Participant placing her hand onto the hand image in front of the screen.

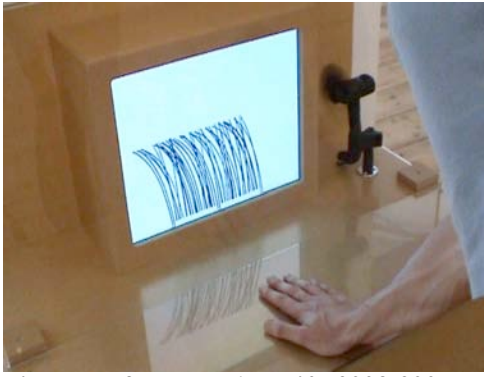


Fig. 4: Ralf Nuhn, *Blow Life*, 2003-2004

The hand image is covered by the participant's hand and the activated fan is blowing the on-screen barcode like 'grass in the wind'.

1.6.2 *Bubblelabub*, 2003-2004

The screen display in this piece features a person blowing air into a tube. The tube is extended from the virtual image to a real glass bottle filled with water (fig. 7). Depending on the amount of pressure applied to a squeezable interface at the front of the exhibit, the cheeks of the on-screen person will inflate or deflate, and the amount of bubbles generated in the water bottle will vary accordingly (fig. 5+6). Contrary to the exhibit *Blow Life*, where the airflow of a fan triggers movements on the screen, *Bubblelabub* creates the illusion that air generated within the virtual domain can transfuse into the physical world.



Fig. 5: Ralf Nuhn, *Bubblelabub*, 2003-2004

Participant squeezing the interface at the front of the exhibit.



Fig. 6: Ralf Nuhn, *Bubblelabub*, 2003-2004

On-screen person is animated by a participant squeezing the interface, and bubbles are generated in the glass bottle.

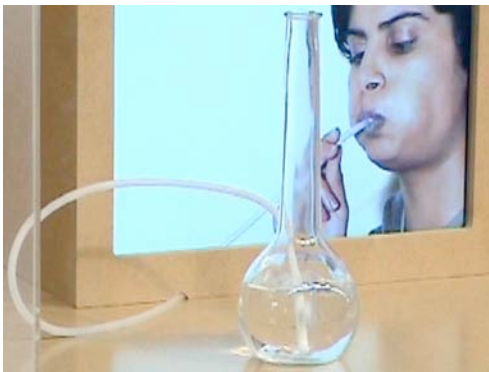


Fig. 7: Ralf Nuhn, *Bubblelabub*, 2003-2004

Close-up of activated exhibit, showing on-screen person blowing into a tube, which is extended from the screen image into the physical world. Bubbles are generated in the glass bottle filled with water.

1.6.3 *Glitchy & Scratchy*, 2003-2004

Like a DJ, the user can spin two records on a touch screen backwards and forwards. The turntables (with vinyl records) on either side of the screen will follow the spin direction and (variable) speed of the respective virtual record. Pressing the left or right button in front of the screen will repeat the most recent scratching pattern of the respective record. The audio output of each turntable is amplified by an active speaker, placed right next to the turntables. Due to the technical limitations of the touch screen – which essentially replaces a common mouse controller - only one record can be moved at a time. However, by spinning one record on the screen, while pressing simultaneously the repeat button of the other record (fig. 10), the sound of both vinyls can be mixed.



Fig. 8: Ralf Nuhn, *Glitchy & Scratchy*, 2003-2004
Participant interacting with the the exhibit via the touch screen interface.



Fig. 9: Ralf Nuhn, *Glitchy & Scratchy*, 2003-2004
A group of children engaging with the exhibit. One child is spinning the right hand side record on the touch screen and watching the movements of the respective turntable. The other children are observing closely what is going on.



Fig. 10: Ralf Nuhn, *Glitchy & Scratchy*, 2003-2004
Close-up of participant spinning an on-screen record with one hand and pressing simultaneously the repeat push-button of the other record.

1.6.4 *Square Pusher*, 2003-2004

Square Pusher is quite similar to the traditional fun fair game known as *Ring-the-Bell* or *Easy Striker*. Like the traditional game, it features a bell mounted high above the ground (fig. 11). Participants can throw a bouncy square on a touch screen. If they hit the top centre of the screen (fig. 13), the bell will ring, and they will earn a ‘100 point bonus’.

When the square bounces off the bottom of the screen it triggers a ‘banging’ sound and vibrations, which are caused by an electromechanical hammer hidden underneath the screen. One could say, that the vibrations and sounds synchronized to the square’s movements imply a materialization of the virtual image, and convey the illusion of the square being a heavy physical object.

Artistic collaboration:

Jey Malaiperuman: design and realization of bouncy square animation.



Fig. 11: Ralf Nuhn, *Square Pusher*, 2003-2004

Full view of the exhibit with bell mounted at ca. 2,50m above the ground.



Fig 12: Ralf Nuhn, *Square Pusher*, 2003-2004

Two participants jointly interacting with the exhibit.



Fig. 13: Ralf Nuhn, *Square Pusher*, 2003-2004
Close-up, showing participant hitting the top centre of the touch screen.

1.6.5 PONG (*telesymbiotic version*), 2002-2004

In this modified version of the renowned video game *Pong*, two solenoid ‘bats’ are mounted at the left and right edge of a computer screen. Using a push-button interface, player(s) have to trigger the bats at the right moment to keep a moving on-screen ball in play. If the ball is missed, it will disappear from the screen.

The push-button interface consists of two white buttons to the left and the right hand side and a red button in the centre (fig. 16).

The two white buttons trigger the respective solenoid ‘bats’ when the ball is in play. The white buttons will also start the game from the respective side, when the ball is off-screen. The red button in the centre will put the game in demo mode. In this case, the ball is automatically hit across the screen for six times. During demo mode the white buttons are disabled and players have to wait until the ball has disappeared before they can start a new game.



Fig. 14: Ralf Nuhn, *PONG (telesymbiotic version)*, 2002-2004
A group of children engaging with the exhibit.



Fig. 15: Ralf Nuhn, *PONG (telesymbiotic version)*, 2002-2004
A single player interacting with the exhibit.

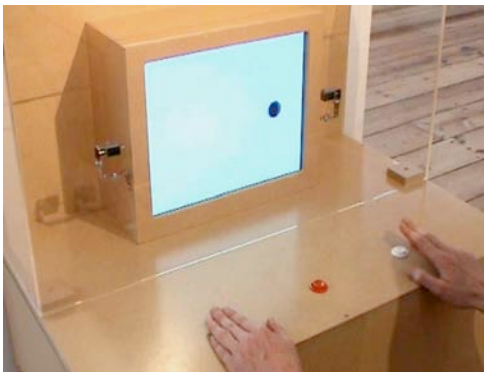


Fig. 16: Ralf Nuhn, *PONG (telesymbiotic version)*, 2002-2004
Close-up of the exhibit, showing a player using the white buttons to keep the on-screen ball in play. (The white button to the left is covered by the player's left hand.)

1.6.6 *Not only Jingle Bells for two Spuikars and other Players*, 2002-2004

An orchestra of automated acoustic instruments - most of which are based on toys - provides 'live' soundtracks to various on-screen animations (fig. 17). On the initial screen display participants can select from four buttons. When the bottom button is selected (fig. 18), the display will change into an interface of thirty-nine 'idle musicians'. Each musician is linked to a different sound in the orchestra of acoustic instruments. The musicians can be animated by the touch of a finger, and then trigger their respective sound (fig.19). Due to the limitations of the touch screen, only one musician can be animated at a time. After a period of sixty seconds, the musicians-interface will automatically revert back to the initial four-button display.

With the top three buttons of the initial display, participants can select from three different ready-made clips, one of which is featured on the included video documentation. The two ready-made clips, not shown in the video documentation, are based on the well-known songs *Jingle Bells* and *Old MacDonald had a farm*.

Artistic collaboration:

Cécile Colle: design of 'idle musicians' interface; creation of *Flash* animation for the ready-made clip *Old Mac Donald had a farm*.

Richard Thomas: creation of short *Flash* animations, which provide the 'raw material' for the ready-made clip *Chien Batu* (as featured in the included video documentation).



Fig.17: Ralf Nuhn, *Not only Jingle Bells for two Spuikars and other Players*, 2002-2004
Full view on the exhibit's 'stage', showing the touch screen in the centre and the surrounding automated instruments. A group of participants is watching and listening to one of the ready-made clips.

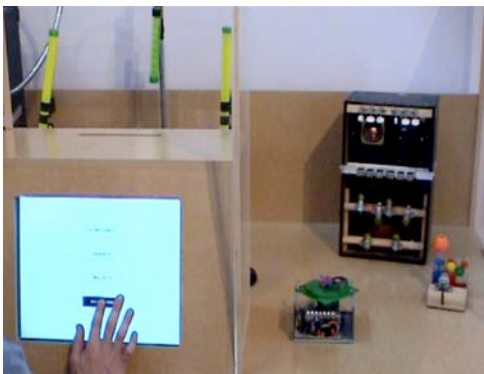


Fig. 18: Ralf Nuhn, *Not only Jingle Bells for two Spuikars and other Players*, 2002-2004
Participant selecting the bottom button of the initial four button display.

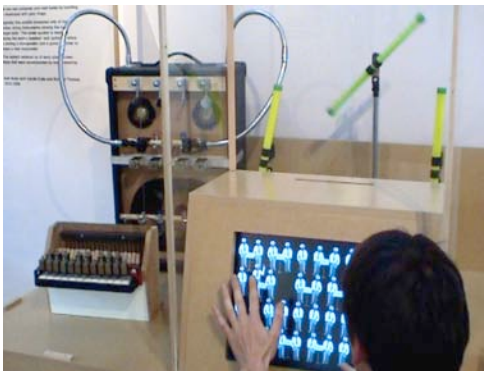


Fig. 19: Ralf Nuhn, *Not only Jingle Bells for two Spuikars and other Players*, 2002-2004
Participant playing with the 'idle musicians' interface.

1.7 Technical description of *UNCAGED*

As mentioned in 1.5, the technical dimension of *UNCAGED* has been realised with technical support by different experts, whose names, professions and relevant expertise are listed below. Where appropriate, I will refer to their specific contributions in the subsequent technical description.

Martin Robinson , lecturer at the Lansdown Centre for Electronic Arts (Middlesex University).

Relevant expertise: hardware interface design and construction.

Dr. Magnus Moar, lecturer at the Lansdown Centre for Electronic Arts (Middlesex University).

Relevant expertise: *Lingo* (*Director's* scripting language) programming.

Al Williams and Jo Ridout, self-employed furniture makers (company: WilliamsRidout).

Relevant expertise: cabinet construction.

1.7.1 General description

The superstructures (the cabinets) of the exhibits are constructed from MDF (medium density fibreboard) and acrylic glass cases/screens (except *Square Pusher*, where no acrylic glass is used). The cabinets have been made to order by Al Williams and Jo Ridout (WilliamsRidout) on the basis of my own designs.

All exhibits are based on a similar hardware and software set-up:

An *Apple Power Macintosh G4/1.25GHz* computer is enclosed in the base unit of each exhibit (except the exhibits *Glitchy & Scratchy* and *Not Only Jingle Bells for two Spuikars and other Players*, each of which contains a pair of two networked computers, as described below). There are several ventilation fans at the rear MDF panel of each exhibit to prevent overheating of the enclosed equipment.

The animations and video images are displayed on 18'' LCD screens (15'' screen for *Glitchy & Scratchy*) and are realized using *Macromedia's Director* environment. The off-screen electromechanical devices and automated sculptures, which interact with the animations and video images, are controlled from within *Director* using the so-called

MIDIio Xtra plug-in. The *MIDIio Xtra* translates the relevant *Director* data into MIDI (Musical Instrument Digital Interface) messages which are then converted into appropriate electric impulses by means of various MIDI operated control interfaces, i.e. MIDI-to-CV interface, MIDI servo controller, MIDI-to-Parallel converter. Two of the user interfaces, i.e. the pressure sensitive tube of *Bubblelabub* and the ‘hand sensor’ of *Blow Life* are communicating with *Director* via an *Atom* microcontroller - which converts changes in the current flow of an electric control circuit (caused by the interaction with the user interfaces) into MIDI control data - and, in this way, changes in the animations and video images can be triggered. The push-button controllers of *PONG (telesymbiotic version)* and *Glitchy & Scratchy* are wired directly to the computers’ keyboards, and are registered like a ‘key-down’ event within the *Director* environment. The touch screens are essentially a replacement of a common mouse controller and connect to the computers via USB (Universal Serial Bus).

The ‘sound emitting’ parts of the exhibits (except *Square Pusher*) are enclosed in acrylic glass cases/screens. The sounds can, to some extent, ‘naturally’ cross the acrylic glass barriers. Moreover, provisions have been made to improve the audibility of the sounds for the participants: in the case of *Blow Life*, *Bubblelabub*, and *PONG (telesymbiotic version)* two ‘sound chutes’ have been cut into the MDF back panel (to be more precise, the section of the MDF back panel which forms the rear side of the acrylic glass case); the acrylic glass enclosure of *Not only Jingle Bells for two Spuikars and other Players* has been left completely open at the top and there are also ‘sound holes’ in the acrylic glass screens at the front; the two acrylic glass cases covering the turntables of *Glitchy & Scratchy* are slightly raised from the MDF base to create a ‘sound gap’.

1.7.2 Detailed technical description of the individual exhibits

The following section will give additional technical information about the essential features of each of the six exhibits.

1.7.2.1 *Blow Life*

Dimensions: 90cm (width) x 110cm (height) x 60cm (depth)

Material used: MDF cabinet with acrylic glass case, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, 18" LCD display, electric fan, hand image, MIDI-to-Parallel converter, *Atom* microcontroller with MIDI output, USB/MIDI interface, various electronic components, cables and PSUs (power supply units).

The 'hand sensor': The 'hand sensor' is based on a simple LDR (light dependent resistor), which is discretely embedded into the hand image in front of the screen, and is more or less invisible to the participants. The hand image is a paper cut-out of a scanned and scaled down image of my own hand and is mounted underneath a transparent acrylic glass sheet. The LDR is part of an electric control circuit connected to an *Atom* microcontroller. When the LDR is covered by a hand, its resistance value decreases, and a change in the current flow of the control circuit is translated by the *Atom* microcontroller into MIDI data, i.e. an 'on-message' when the sensor is covered by a participant's hand, and an 'off-message' when the participant moves her hand away.

The electric fan: The electric fan is a slightly modified 12V car fan, of which the protection cage around the blades has been removed to highlight the rotating action. The computer controls the fan by means of a MIDI-to-Parallel converter (a *MTP-1* unit by *j-Omega Electronics*). A MIDI-to-Parallel converter is essentially a MIDI controlled electric switch. When it receives a MIDI 'on-message' from the computer, it closes (switches on) a 12V electric circuit, which supplies power to the fan. When it receives an 'off-message' the switch opens, and the power for the fan is cut off.

The barcode animation: This animation is written as an interactive *Flash* movie, which is embedded into the *Director* environment. As mentioned in 1.6.1, the configuration of the barcode changes randomly after each completed cycle. I should point out that the different barcodes are not truly generated randomly, but instead the software programme chooses from about ten different pre-designed barcodes. This is because attempts to generate the barcodes completely randomly often resulted in barcodes which would either look almost the same as before or where the distribution of thick and thin bars did not actually look like a typical barcode.

Technical support:

Martin Robinson: construction and programming of the electronics for the 'hand sensor'.

1.7.2.2 *Bubblelabub*

Dimensions: 80cm (width) x 110cm (height) x 75cm (depth)

Material used: MDF cabinet with acrylic glass case, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, 18" LCD display, glass bottle with water, pressure-sensitive user interface, fish tank air pump, MIDI-to-CV interface, *Atom* microcontroller with MIDI output, USB/MIDI interface, various electronic components, cables and PSUs.

The pressure-sensitive interface: The outside layer of this custom-made interface consists of a spongy tube, normally used for insulating water or gas pipes. This relatively delicate tube is covered in a more durable layer of black fabric. The inside of the interface is constructed from a conductive metal tube (in fact, a standard towel rail), which is wrapped in a metal foil. In between the tube and the metal foil is a carbon loaded plastic sheet (usually used to protect static-sensitive devices such as computer chips and expansion cards). The sheet is resistive, and as the two conductive plates (the metal tube and the metal foil) are placed either side, the resistance between the plates is reduced as pressure is applied; this is due to the greater surface-area being in contact as the pressure increases. The interface is part of an electric control circuit connected to an *Atom* microcontroller. When the interface is not squeezed, there is virtually no electric current flowing between the two plates (because of the high resistance of the plastic sheet). The more pressure is applied to the interface, the lower is the resistance between the plates (as described above), and the higher is the current flow in the control circuit. The continuous changes of the current flow are converted by the *Atom* microcontroller into MIDI data. As mentioned in the general description, the MIDI data are 'fed' into *Director* via the *MIDIio Xtra* plug-in and are then used to control the video display and the airflow in the water bottle.

The water bottle with air bubbles: The variable airflow in the (physical extension of the) plastic tube - which is inserted into the water bottle - is generated by a fish tank air pump located in the base unit of the exhibit. The airflow intensity generated by this pump - which corresponds to the amount of pressure applied to the squeezable interface and the blowing intensity of the video image respectively - is controlled via a commercially available MIDI-to-CV interface (a *MCV-24* unit by *Döpfer*). In contrast to a MIDI-to-Parallel converter, which only 'understands' MIDI 'on- and off-messages', the MIDI-to-

CV interface can translate a range of MIDI message values, i.e. 0 to 127, into a variable control voltage (CV). Here, the CV is used change the output voltage of a CV controllable dimmer, which powers the fish pump: the lower the output voltage of the dimmer, the weaker is the airflow generated by the fish pump.

The video image: The screen content of this exhibit is based on a short video clip of a person blowing air into a plastic tube. The clip is divided into four short sections (between one and four frames long). The first section consists of a single frame, showing the person with the tube in her mouth, but not actually blowing into it. The other three sections feature the ‘blowing action’ of the person at various intensities (the cheeks of the person are inflated to different extents). Depending on the amount of pressure applied to the squeezable interface, the ‘playback head’ in *Director’s* ‘timeline’ moves to the appropriate section of the video loop and stops at the last frame of the section until the pressure changes.

Technical support:

Martin Robinson: design and construction of pressure-sensitive user interface.

1.7.2.3 Glitchy & Scratchy

Dimensions: 200cm (width) x 85cm (height) x 60cm (depth)

Material used: MDF cabinet with two acrylic glass cases, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, *Apple iMac G3/400MHz* computer running *MAX/Msp 4.1*, 15” LCD touch screen, two turntables, two active speakers, two game console push-buttons, modified computer keyboard, MIDI-to-Parallel converter, USB/MIDI interface, various electronic components, cables and PSUs.

The two networked computers: As mentioned in the general description, this exhibit is based on two networked computers, one running *Macromedia’s Director*, and the other one running *Cycling 74’s MAX/Msp* environment. The two machines (the two different software applications) communicate with each other using the so-called *OSC (OpenSound Control)* protocol, i.e. the *Director OSCar Xtra* plug-in and a set of *MAX/Msp OSC* ‘externals’.

The virtual records: The two virtual records are realized using *Director* and are displayed and controlled via a touch screen. When the virtual records are moved by a participant, information about their spin direction and (variable) speed is registered by *Director*. The (changing) values about the speed and direction of the virtual records are passed on from *Director* to the other computer running *Max/Msp*, using the *OSC* protocol. In *MAX/Msp* these values are converted into MIDI data and are then sent to a MIDI-to-Parallel converter, which (electrically) controls the speed and direction of the turntable motors.

The turntable control: The rotation direction of the turntable motors is controlled via two relay switches (operated by a MIDI-to-Parallel converter).

The speed of the turntable motors is essentially controlled from within the *MAX/Msp* environment using PWM (Pulse Width Modulation) of on/off signals, which are sent in very short succession to a MIDI-to-Parallel converter (which then sends electric impulses of varying length to the turntable motors). This means, that (when the virtual records are moving) *MAX/Msp* is sending an ‘on-message’ every 16 milliseconds to the MIDI-to-Parallel converter and - depending on the actual speed of the virtual records – a corresponding ‘off-message’ after a period between 1ms and 16ms: the longer the interval between the ‘on-message’ and the ‘off-message’, the longer is the electric impulse sent to the turntable motor, and the higher is its speed.

I should mention that, in principle, it would be possible to control the turntables from within the *Director* environment. However, *Director* (at least when running on a *Apple Power Macintosh G4/1.25GHz*) does not seem to cope with the processing required for the animation of the virtual records and the simultaneous conversion of their speed into the precise on/off intervals, required for the PWM-based speed control of the turntable motors.

The touch screen interface: The touch screen is essentially a replacement of a common mouse controller and connects to the computers via USB. As mentioned in the documentation video, due to the technical limitations of the touch screen, only one record can be moved at a time. However, as shown in the video, by spinning one record on the screen while simultaneously pressing the repeat button of the other record (or by simultaneously pressing both repeat buttons), the sound of both vinyls can be mixed.

The repeat buttons: The two push-buttons in front of the touch screen, each of which corresponds to one of the virtual records, are wired directly to the computer keyboard and essentially replace two of the keyboard keys. The depressing of a push-button is therefore

registered like a ‘key-down’ event within the *Director* environment. When *Director* receives a repeat command (a ‘key-down’ event) the most recent ‘scratching pattern’ of the respective virtual record is repeated. A ‘scratching pattern’ is defined as the period from placing a finger on the virtual record until moving the finger away. Or to put it in different terms, the period between a ‘mouse-down’ to a ‘mouse-up’ event.

The turntables: To ensure that the tone arms of the turntables cannot move outside the playable area of the vinyl records, barriers have been installed on either side of the arms.

Technical support:

M. Moar: software programming for the interactive record animation.

M. Robinson: modification of computer keyboard with push-button controllers.

1.7.2.4 Square Pusher

Dimensions: 60cm (width) x 250cm (height) x 60cm (depth)

Material used: MDF cabinet, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, 18’’ LCD touch screen, electric door bell, thrust-pin type solenoid, MIDI-to-Parallel converter, USB/MIDI interface, various electronic components, cables and PSUs.

The bouncy square animation: The animation has been coded as an interactive *Flash* movie, which is embedded into the *Director* environment. The square can be ‘thrown’ by the participants using a touch screen controller. When the square bounces off the bottom edge of the screen or hits the top centre of the screen *Director* sends out different MIDI messages (see below).

The ‘banging’ sound and the bell: When the square bounces off the bottom of the screen, a MIDI ‘on-message’ followed by an ‘off-message’ in a 30ms interval is sent by *Director* to a MIDI-to-Parallel converter, which translates the MIDI messages into a short on/off electric signal. This signal is sent to a thrust-pin type solenoid hidden underneath the MDF panel in front of the screen. The electric signal activates the thrust-pin of the solenoid, which hits the MDF panel and, thus, causes a ‘banging’ sound and vibrations. Similarly, when the square hits the top centre of the screen, a short electric on/off signal is sent to the electric (door) bell mounted at about 2,50m above the ground.

1.7.2.5 PONG (*telesymbiotic version*)

Dimensions: 90cm (width) x 110cm (height) x 60cm (depth)

Material used: MDF cabinet with acrylic glass case, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, 18" LCD display, two thrust-pin type solenoids, three game console push-buttons, modified computer keyboard MIDI-to-Parallel converter, USB/MIDI interface, various electronic components, cables and PSUs.

The push-button interface: Analogous to the exhibit *Glitchy & Scratchy*, the push-buttons are wired directly to the computer keyboard and essentially replace three of the keyboard keys. The depressing of a push-button is registered like a 'key-down' event within the *Director* environment.

The solenoid 'bats': As mentioned in 1.6.5, in 'play mode' the solenoids on either side of the LCD display are activated via the respective white push-buttons on the left and right hand side. The solenoids are powered by a MIDI-to-Parallel interface, which converts a pair of MIDI messages (an 'on-message' followed by an 'off-message' in a 20ms interval) - sent by *Director* when a 'key-down' event of one of two white push-buttons is received - into a short electric impulse.

In 'demo mode' the white buttons are disabled, and the solenoids are then triggered automatically for six times, whenever the on-screen ball is in the correct position, i.e. when it has almost disappeared underneath the respective screen edge.

The ball animation: The interactive ball animation is coded in *Director*. When one of the white buttons is pressed, a ball will enter the display area from the respective side and move towards the opposite side. If *Director* does not receive a 'key-down' event triggered by the appropriate white button at the very moment the ball is about to leave the screen, the ball will disappear from the screen, and a new game has to be started. If the appropriate 'key-down' event is received at the correct time, the ball will reverse its direction and move back to the other side of the screen, and so on. As mentioned above, a 'key-down' event of the white buttons will also activate the respective solenoid 'bats'. In demo mode, which is activated by the red button, the ball will enter from the right screen edge and automatically reverse its direction whenever it reaches the opposite

screen edge, for six times. Obviously, when the ball changes direction, *Director* also sends out the relevant MIDI messages to activate the appropriate solenoid.

Technical support:

M. Moar: software programming of interactive ball animation.

M. Robinson: modification of computer keyboard with push-button controllers.

1.7.2.6 Not Only Jingle Bells for two Spuikars and other Players

Dimensions: 220cm (width) x 160cm (height) x 100cm (depth)

Material used: MDF cabinet with acrylic glass screens, *Apple Power Macintosh G4/1.25GHz* computer running *Director 8.5*, *Apple iMac G3/400MHz* computer running *MAX/Msp 4.1*, 18" LCD touch screen, various automated instruments using DC motors/servo motors/ thrust-pin type solenoids, MIDI-servo controller, three MIDI-to-Parallel converters, USB/MIDI interface, various electronic components, cables and PSUs.

The two networked computers: Like the exhibit *Glitchy & Scratchy*, this installation is based on two networked computers, one running *Macromedia's Director*, the other one running *Cycling 74's MAX/Msp* environment. The computer running *Director* is processing the screen animations and information received from the touch screen, and the other computer is controlling the electromechanical instruments. Similar to the exhibit *Glitchy & Scratchy*, the second computer is mainly needed to control the speed of various motors, used in some of the instruments, by means of PWM (see 1.7.2.3 for further details about PWM). This is useful, because by changing the speed of the motors, one can control the velocity of the related acoustic sounds, as described below.

The three 'ready-made' clips: As mentioned in 1.6.6, on the initial four button screen display participants can choose from three 'ready-made' clips, namely *Jingle Bells*, *Old Mac Donald had a farm* and *Chien Batu*. Each clip consists of an on-screen animation sonified by the orchestra of acoustic instruments.

Two of the animations (*Jingle Bells* and *Chien Batu*) are created in *Macromedia Flash* and are exported as sequences of single images. The other animation (*Old Mac Donald had a farm*) is based on a sequence of single images created in *Adobe Photoshop*.

These image sequences are imported into *Director*, and each image is placed on a frame in *Director's* 'timeline'. The MIDI messages, necessary to trigger the corresponding sound for an image, are embedded within the same frame, which contains the image. Hence, the synchronization between the animations and the corresponding sounds of the automated instruments can be made extremely tight.

There are different reasons why the animations for the 'ready-made' clips were not created directly within *Director*, which, in principle, would have been possible. First, I had created the animation for *Jingle Bells* using *Flash* at the very beginning of the research phase, when I was not using *Director* at all. The technical set-up at this time was solely based on *MAX/Msp*, which can simultaneously play back a *Flash* animation (converted into a QuickTime movie) and trigger the MIDI controlled instruments. However this simpler set-up did not prove to be very stable, i.e. the synchronization between the animations and the sounds triggered was very unreliable.

Second, the animations used for the clip *Chien Batu* were created by Richard Thomas, who is simply used to working with *Flash* rather than *Director*. Similarly, Cécile Colle, who created the animation for *Old Mac Donald had a farm*, prefers to work with *Adobe Photoshop*.

The 'idle musicians' interface: The 'idle musicians' interface, which is the fourth option on the initial button display, is created as an interactive *Flash* movie embedded into the *Director* environment. As mentioned in 1.6.6, each musician is linked to a different sound in the orchestra of acoustic instruments. The musicians can be animated by the touch of a finger – which is equivalent to clicking it with a mouse controller - and then trigger their respective sound, i.e. an appropriate MIDI message is generated by *Director*.

The instruments:

Spuikars (Spuikar and Bass Spuikar): The two *Spuikars* are based on six guitar (four bass guitar) strings, stretched across the 'face' of disused loudspeakers. Each string can be played in two ways. First, it can be 'strummed' by a rotating textile string attached to a small DC motor (taken from a hand fan). As indicated above, by controlling the speed of the motors the velocity of the string sounds generated can be controlled quite precisely (as can be heard from the acoustic fade-out in the final section of the 'ready-made' clip *Chien Batu*, featured on the documentation video). Second, it can be 'tapped' by the thrust-pin action of a solenoid mounted above each string. Similar to a real guitar, both ways of

playing result in a different timbre (but same pitch) of the sound produced. The solenoids can also be used to change the pitch of each string. Instead of just briefly tapping a string, they can actually press and hold down a string (like a finger on a guitar fret board), which can then be ‘strummed’ by the fan to produce a note at a higher pitch.

The solenoids and fans are controlled via a MIDI-to-Parallel converter inside the *Spuikars*.

The instruments are completely acoustic and the remaining loudspeaker parts are only left for aesthetic reasons. Finally, the names of the instruments reflect the ‘hybridisation’ of the main components used, taken from loudspeakers and (bass) guitars.



Fig. 20: Ralf Nuhn, *Spuikar*, 2002

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.



Fig. 21: Ralf Nuhn, *Bass Spuikar*, 2002

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.

Piano: This instrument is based on a modified toy piano. Twenty-one thrust-pin type solenoids are mounted above the piano keys in order to automate the key action. The solenoids are controlled via a MIDI-to-Parallel converter inside the piano.



Fig. 22: Ralf Nuhn, *Piano*, 2004

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.

Bell: The *Bell* is based on a mechanism taken from a toy telephone and automated by a motor attached to the rotating ‘hitter’ of the bell (The ‘hitter’ was originally operated by the dial disc of the toy telephone). The motor is controlled via a spare channel of the MIDI-to-Parallel converter inside the *Piano*.

By changing the speed of the motor (using PWM) the velocity of the whistle sound can be controlled slightly, but not as well as the velocity of the strings in the *Spuikars*. The bell is mounted on a disused computer PSU (solely for aesthetic reasons).

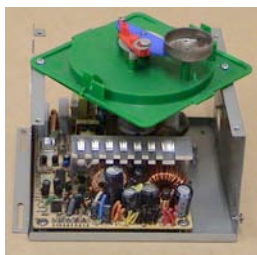


Fig. 23: Ralf Nuhn, *Bell*, 2003

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.

Whistle: The *Whistle* is based on a pneumatic mechanism taken from a toy train and is automated by a motor. As with the *Bell*, the motor is controlled via a spare channel of the MIDI-to-Parallel converter inside the *Piano*, and by changing the speed of the motor the velocity of the whistle sound can be controlled slightly.



Fig. 24: Ralf Nuhn, *Whistle*, 2003

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.

Three Tubes: Three off-the-shelf tube-shaped sound toys (two ‘groaning tubes’ and one ‘rain stick’) – which make a sound when turned upside down - are each attached to a servo motor, which can rotate 180 degrees. The servos are controlled via a MIDI-servo controller (a *SRV-3* unit by *j-Omega Electronics*).

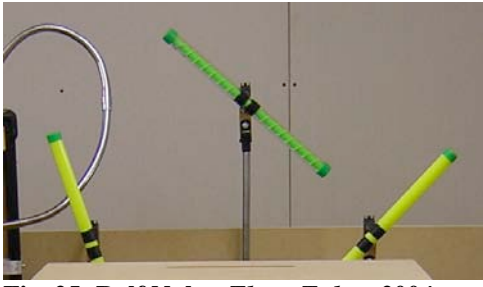


Fig. 25: Ralf Nuhn, *Three Tubes*, 2004

Electromechanical instrument from the installation *Not Only Jingle Bells for two Spuikars and other Players*.

1.8 Conclusions

In this chapter I have outlined my artistic journey towards *UNCAGED*, a series of six ‘telesymbiotic’ installations. I have attempted to pinpoint the original impetus for this new approach by going back to specific personal experiences, which surely have informed my ideas. After that, I have tried to situate *UNCAGED* within my overall artistic development and argued that in some ways my approach was a direct continuation of my previous artistic work. Using my first practical studies as a starting point I have then tried to define a general theoretical framework, which has underpinned the further development of my initial artistic ideas. In this context I have explored aesthetic and formal considerations, highlighted the particular importance of the audio-visual relationships in my approach, situated my approach within the context of human computer interaction (HCI) and finally discussed the role of audiences in relation to *UNCAGED*. This latter aspect will be developed further in the following chapter, which will give an account and evaluation of the work in an exhibition context.

I have then tried, where appropriate, to make a relationship between the theoretical framework and the actual creation of the six *UNCAGED* exhibits. However it is not always easy to illustrate how the theoretical considerations are directly reflected in the practical outcome of the work. I have to point out that many artistic decisions about how to eventually realize the work are certainly more of an intuitive nature than following any theoretical paradigm. Nonetheless, I am hopeful that the theoretical framework might at least have provided some key concepts as to which aspects of the work have been of particular importance to me during the development and creation of the work.

In the final section I have given a fairly detailed account on the technical dimension of *UNCAGED*. This has not been done with the intention to highlight specifically the technical complexity of the work, but in order to illustrate how the (technical) innovative aspect of the work does not so much rely on the development of new technologies. Rather, it is the creative combination of existing materials, and my well-informed demands on the team of technical experts to produce more complex elements of the work, which result in the realization of unique technical set-ups. Moreover, I hope, that the detailed technical account will provide a useful resource for other practitioners working in this area.

Chapter 2 - *UNCAGED* goes 'live'

2.1 Introduction

In this chapter I will describe and evaluate the exhibition of *UNCAGED* at the V&A - National Museum of Childhood in London (MOC) with regard to the work's presentation at the museum, participants' interaction with the exhibits as well as social interaction amongst participants. Where appropriate, this evaluation will also consider technical shortcomings of the work, in particular, where these have affected audience participation with the exhibits.

As noted in 1.4.4, in a public exhibition context, *UNCAGED* seemed to address recent findings by the Work Interaction and Technology (WIT) research group at King's College, London. In particular, I was interested to find out if my approach could avoid the problem of inhibiting social interaction amongst gallery audiences, which, according to the WIT group, is a major problem with many contemporary computer mediated museum exhibits. The group's research is primarily based on observations of audiences (participants) in museums⁸, and, in particular, they have a special interest in studying computer-mediated artworks. In spring 2003, I contacted Jon Hindmarsh, a senior researcher at the WIT group, to present my preliminary studies and ideas about *UNCAGED*, and invited him to conduct a study of audience behaviour during a possible exhibition of my work. Hindmarsh showed great interest in *UNCAGED*, and once I had arranged the exhibition at the MOC, Hindmarsh, with his colleague Katie Best, agreed to conduct a study of audience behaviour at the museum:

'To study the work of Ralf Nuhn was particularly appealing as his work explores the boundaries of the physical and the digital in extremely distinctive and evocative ways. We were keen to examine therefore how visitors would confront and explore his exhibits' (Best and Hindmarsh, 2004, p 2).

Their observations focused on three particular *UNCAGED* exhibits (*Glitchy & Scratchy*, *Not Only Jingle Bells for Two Spuikars and Other Players* and *Square Pusher*), because,

⁸ Please refer to the WIT group's website at <http://www.kcl.ac.uk/depsta/pse/mancen/witrg/> for more detailed information about their research.

in their view, these three exhibits were the most likely to encourage extended amounts of visitor participation. Over a period of five (non-consecutive) days, they collected 25 hours of audio-visual recordings of ‘naturally-occurring visitor conduct’ during the exhibition in May and June 2004.

In line with their broader research programme, their analysis of the audio-visual material paid particular attention to social interaction between visitors and how groups of visitors organise their collaborative exploration of the exhibits. At the same time, it includes comments about more general qualities of *UNCAGED* and about its presentation in the exhibition space.

Their findings have been summarized in an internal preliminary report (see Appendix B), which has proved to be very useful with regards to my evaluation of the exhibition. In the following sections I will frequently refer to this report as a reference to my own observations as well as specifically address certain issues raised in the report.

2.2 Installation and presentation of *UNCAGED* at the MOC

As noted earlier, the exhibition of *UNCAGED* had been agreed with the MOC’s exhibition manager Stephen Nicholls, who was also in charge of coordinating the actual presentation of the work in the museum space.

Due to the self-contained and pre-installed nature of the exhibits, many aspects about the presentation of the work had to be considered during the design and construction of the exhibits’ cabinet structures. Nicholls gave some useful advice regarding how to make the exhibits accessible and safe to use for audiences which were likely to include families with children as well as whole school classes of young, almost non-supervised children. For instance, the user interfaces of the exhibits had to be positioned at a fairly low height, but at the same time still allow easy interaction for adult participants. For the three exhibits involving touch screen technology it seemed to be advantageous to place the screens at an angle. In this way, they could easily be reached by small children while also allowing for good visibility and access for taller participants. Based on my own observations during the exhibition, which are reflected in the included video documentation, I would suggest that, regarding the facilitation of user interaction and co-participation amongst groups of visitors, the installation of the tangible interfaces, including the touch-screens, can be considered successful. Moreover, with respect to the

touch-screens, this personal evaluation has been confirmed by the WIT researchers who noted:

‘Frequently, when screens are placed within galleries, they are located in such a way that other participants cannot see the action occurring on screen. This can prove cumbersome for social interaction where it becomes problematic for co-visitors to show and see the action on the screen. In contrast, the positioning of UNCAGED screens was excellent. The screens used in ...*Jingle Bells...* [*Not only Jingle Bells for two Spuikars and other Players*] and *Square Pusher* seem particularly well-located and angled to allow a relatively high number of observers to continue see the action and to comment on that action. [...] Many museums and galleries have much to learn from UNCAGED about the successful placement and positioning of touch-screens both to afford visibility of action for a number of co-visitors and to facilitate the involvement of children’ (ibid., pp 11-13).

To comply with health and safety regulations of the museum, all fragile or potentially dangerous parts of the exhibits had to be made inaccessible for the participants. Consequently, all the kinetic and sound producing electromechanical elements of the exhibits had to be enclosed in acrylic glass cases and screens. The only parts which could be touched by the participants were the user-interactive elements. Or to put it in more abstract terms, the physical domain, immediately surrounding the virtual domain (the computer displays) of the exhibits, had to be closed off from the extending physical domain (the participants space). I have to point out that the need for this enclosure was for me an unfortunate, but doubtlessly necessary, concession to this potentially very demanding exhibition environment. Even though, aesthetically I consider most of the acrylic glass enclosures rather pleasing, to some extent they seem to undermine the idea of uncaging the distant world of computers by creating a new barrier between the user and the immediate physical domain of the exhibits.

Further, with regards to the sonic dimension of the exhibits, the acrylic glass enclosures of the sound-producing electromechanical elements was also not very helpful. Despite the efforts taken to increase the sound pressure level (see 1.7.1), the high level of background noise in the museum meant that the relatively quiet sounds of most exhibits could hardly be heard at a distance over approximately three meters. In particular, the sound level of *Not Only Jingle Bells for Two Spuikars and Other Players*, which relies heavily on its acoustic properties, was often too low even for participants right in front of the exhibit. This was not only inadequate for the proper perception of the piece, but also appeared to cause some problems in terms of interaction with the exhibit:

‘One frustration that often emerged for visitors exploring ...*JingleBells*... was that they could not hear the sounds and the tunes particularly well (maybe due to the acoustics in the hall?). Therefore they would have difficulties relating label instructions to features of the exhibit – they simply could not hear what was happening and therefore had difficulty making sense of the instructions. This often meant that they would consider the exhibit broken or simply give up in their attempts to figure it out’ (ibid., p 10).

The sound level problem was in some ways even more evident with the sound of the electric fan in *Blow Life* and, above all, the sound of the bubbles generated in the water bottle of *Bubblelabub*. Both sounds can only be heard in a relatively quiet space. However, in my view, the sounds are not very essential for the ‘message’ of these exhibits, because the fusion between the virtual and physical domain is here primarily based on visual cues.

Regarding the placement of the exhibits in the space, I had certain ideas which had to be negotiated with Stephen Nicholls. In particular, I was keen to install the exhibits in such a way that participants could easily view the overall exhibition from any position. This idea was based on my intention to encourage social exchange within the space and to allow people to see (and hear) what is happening in most parts of the space at any given moment. By contrast, Nicholls suggested positioning the exhibits to create a kind of parcours, so visitors would be naturally lead from one exhibit to the next, and each exhibit would be visually shielded off from the other exhibits. In the end, I managed to convince him about my desired layout of the exhibits, which, in my view, was rewarded by extended amount of social interaction during the exhibition, described later in this chapter.

Finally, during the production phase of *UNCAGED*, Nicholls asked me to produce the content for display notes, which would be displayed next to each exhibit. Personally, I would have preferred to design labels which would not include instructions about how to use the exhibits. This attitude reflected my belief and artistic intention that the exhibits should encourage a very intuitive engagement, and that it would be more interesting for participants to playfully discover the exhibits, rather than to follow some instructions. However, due to Nicholls’ concern that participants might not be able to operate the exhibits without instructive labels, I felt compelled to follow his request. Hence, the labels I designed for the exhibition contain the exhibits’ title, the author(s) name, an interpretative note as well as a brief manual (see appendix A). At first sight, the issue about instructive notes on the labels might seem to be of minor importance. However, as

will become evident in the subsequent evaluation of the exhibition, this ‘detail’ would at times have a strong impact on the interaction of participants with the exhibits.

2.3 Description and evaluation of *UNCAGED* ‘live’

UNCAGED was exhibited over seven weeks during May and June 2004 at the MOC.

According to the museum’s statistics over 30,000 visitors from a wide social, ethnic and educational background had a chance to participate in the exhibition.

For me, the wide range of audiences and the museum’s policy that ‘everything can be touched by the audience’ - which is nurtured by the exceptionally discrete conduct of the museum’s attendants and security staff - provided an ideal context to exhibit *UNCAGED*, as I was interested to find out if the exhibits would work on different levels and stimulate playful and explorative engagement by different types of audiences. The ‘interactive atmosphere’ within the museum has also been noted and suitably summarised by the researchers of the WIT group:

‘Galleries often request that visitors “do not touch” exhibits. Therefore to observe the use of interactive artworks can often be frustrating as audiences are not used to the possibilities for “hands-on” participation and are cautious and tentative. However the interactive ethos evident throughout the Museum of Childhood provides an excellent location for a highly interactive work such as *UNCAGED*’ (ibid., p 5).

During the exhibition, I spent about three full days within the space to observe visitors’ conduct with the exhibits and to attempt to speak with visitors about their impressions and experiences. Unfortunately, in many cases, it proved to be extremely difficult or inappropriate to initiate a conversation (in-depth) with people about the work. This might have been due to the fact that many visitors arrived in groups with small children and were too preoccupied with keeping the group together, or the fact that in the fairly large museum space there were many other interesting exhibits which had to be visited within a limited time span. In particular, discussions about the conceptual aspects of *UNCAGED* frequently turned out to be not very fruitful.

As noted earlier, artistically, I was mainly interested in the perceptual, ‘telesymbiotic’ interaction between on-screen and off-screen events. However, I felt it would be useful to observe visitors’ conduct from a user-interactive perspective in order to evaluate the extent to which the exhibits are able to engage audiences. I reasoned that from these

general findings obtained I would be able to deduce more specific conclusions regarding my approach to combine the digital world of computers with the physical world.

In the following sections, rather than providing a comprehensive analysis of audience interaction with and around the exhibits, I will focus on some specific issues which were relevant for me to evaluate my work and which gave rise to further development or revision of my original ideas. The following evaluation will also consider technical shortcomings of the work, and, where appropriate, how these have been responded to. Lastly, whereas the first two sections of this evaluation will mainly be informed by data gathered through audience observation, the third section will focus on audience feedback obtained through informal discussions with visitors. Whilst there is some extent of thematic overlap and reciprocal relationship between data obtained through both forms of inquiry, in general, the verbal feedback seemed to point towards more isolated issues.

2.3.1 User interaction

As a whole, the nature of user interaction was very encouraging. In the majority of cases people from all age groups approached the exhibits very freely and usually did not take long to figure out how to operate the installations. As argued in the first chapter, I intentionally designed the exhibits to be evocative of familiar forms of interaction in order facilitate an intuitive engagement with the work. For instance, the exhibit *Blow Life* includes a ‘hand sensor’ which is similar to the interface of a fortune telling machine often found at fun fairs. Other exhibits feature simple push-buttons, the required form of manipulation of which is even more obvious. Or, as in the case of the squeezable tube of *Bubblelabub*, the handle-like shape, malleable material and exposed positioning of the interface, strongly invites participants to grasp the interface. With regards to the touch screen exhibits this ‘compulsion to touch’ has also been outlined by Best and Hindmarsh:

‘As visitors approached the exhibits, they frequently seemed to be aware that the exhibits required some form of physical manipulation to “work” and in particular that this would take the form of touching the screen. This may be due to any number of reasons (they recognise them as touch-screens, they have seen others using them, have used them on other exhibits already, etc.).

Whatever the case, as many visitors approach the exhibits, they immediately begin to configure one hand (or sometimes two in the case of *Glitchy & Scratchy*) to be able to touch the screen as soon as they reached it’ (ibid., p 10).

In the case of *PONG (telesymbiotic version)*, participants generally understood immediately that they have to press the push-buttons in order to activate the exhibit. Players usually discovered quite easily the different modes ('play mode' and 'demo mode') triggered by the white buttons and the red button respectively. Generally, adults would be more inclined to refer to the exhibit's display note to discover that the exhibit features two different modes, whereas children seemed to often disregard the note and explore the functioning of the exhibit by trying out the different buttons. On the other hand, people seemed to have difficulties to work out the right moment when to activate the respective solenoid 'bats' in order to keep the on-screen ball in play. This suggests that it might be useful to facilitate the interactive element of this piece, i.e. by increasing the time span during which the ball can be successfully hit by the solenoid 'bats'. Surprisingly though, this design flaw did not seem to affect to any great extent people's eagerness to engage with the installation over a protracted period of time. For instance, in a number of cases, participants would put the piece in 'demo mode' and simply watch the ball being automatically kicked across the screen. In other cases, people operated the white buttons despite the installation being in demo mode. This behaviour could be due to the fact that people were happy to simply simulate kicking the ball across the screen or because they were unaware that their actions did not make any difference to keeping the ball in play. In terms of user interaction design, the latter case, in particular, could be regarded as a further shortcoming. However, for me these observations were rather positive, because they suggest that the main point of interest in *PONG (telesymbiotic version)* is not so much the user-interactive component of the exhibit but the perceptual interaction between the physical solenoid 'bats' and the virtual on-screen ball.

With *Glitchy & Scratchy* people seemed to quickly understand that the virtual records on the touch screen could be moved around by touching the screen with their fingers. Users often appeared to be very enthusiastic, and sometimes dazzled, about the fact that their actions on the touch screen were mirrored by the movements and sounds of the physical turntables. In conversation with people it was often pointed out that this is one of their favourite exhibits, because it makes such a strong reference to DJ-ing and provides the opportunity to 'become a DJ oneself'. This feedback implies that my strategy of evoking familiar forms of interaction in order to invite people to playfully explore the exhibits was successful.

Unfortunately, with the type of the touch screen used in this piece, it could be at times difficult for users to spin the records with their fingers. This is, because the touch screen

has a protective glass overlay, which can cause a considerable amount of friction between the human skin and the screen. Depending on the amount of friction, the virtual records will not follow the finger movements very well or not at all. Consequently, people would sometimes approach the exhibit in the ‘right’ way, but due to the difficulties in moving the records they would be confused about how this exhibit is supposed to work or consider the exhibit to be broken.

Due to the limited amount of time, I was not able to fix this problem in a satisfying way during the exhibition at the MOC. When I contacted the touch screen distributor regarding this problem I was given the advice to treat the screen with a furniture polish to reduce the friction or to replace the touch screen with a different model featuring a plastic overlay instead of glass. I achieved some success with applying the polish, but this product would wear off quickly during the extended use by visitors. As a result of the very long shipping time of about eight weeks for the alternative touch screen model I was not able to replace the screen during the exhibition period. However, shortly after the exhibition at the MOC, I was invited to exhibit *Glitchy & Scratchy* as part of the group exhibition *Algorithmic Revolution* at the ZKM - Centre for Art and Media in Karlsruhe, Germany.⁹ For this occasion I was able to replace the touch screen with the model featuring a plastic overlay. This technical improvement was rewarded by participants being able to operate the exhibit much more easily and, one might say, with greater satisfaction. In particular, my observations at the ZKM did not record a single case of visitors not knowing how to interact with the exhibit and, according to reports from the ZKM staff, the exhibit has become an audience hit in the exhibition.

As described in section 1.6.6, the exhibit *Not only Jingle Bells for two Spuikars and other Players* features two different forms of engagement. Via the initial screen display, users can select from three different ‘ready-made’ clips, which will play through from beginning to end without offering any user-interactive possibilities. Alternatively, participants can switch to a user-interactive interface, which allows them to trigger directly the off-screen instruments by touching various animated buttons (‘idle musicians’) on the screen.

My idea behind the ‘ready-made’ clips was ‘simply’ to establish compelling perceptual relationships between the visual events of the on-screen animations and the movements and sounds of the computer controlled acoustic instruments. However, I observed frequently that participants, children as well as adults, touched the screen whilst the

⁹ For details about *Glitchy & Scratchy* at the ZKM please visit http://www01.zkm.de/algorithmische-revolution/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=88 (10/10/2006).

'ready-made' clips were playing. In particular, they appeared to have a clear strategy when touching the screen that is to aim at touching precisely the moving elements of the animations, rather than just manipulating the screen at random. In my view, this behaviour permits the interpretation that participants obviously made a clear relationship between the on-screen animations and off-screen events not only during the user-interactive 'idle musicians' mode but also during playback of the 'ready-made' clips. In this sense one could deem my idea to establish a compelling perceptual relationship between the physical and virtual domain successful. On the other hand, this behaviour also suggests that participants were under the impression that during the playback of the 'ready-made' clips their action of touching the screen would somehow directly affect the activity of the off-screen instruments or the display of the on-screen animations. The reason for this misunderstanding could be that the user-interactive aspect of the initial screen display, and, in particular, the 'idle musicians' interface, would lead people to believe that the touch screen allows for user interaction at all times. Moreover, as suggested by Best and Hindmarsh, this behaviour could also be related to participants reading the accompanying exhibit's display note out of context:

'[...] ...*Jingle Bells*... has a label that assumes that you will approach the machine with the first screen showing. If this is not the case, then the opening line, "touch a button on the screen to start the exhibit", becomes the focus of much visitor confusion, because the visitors are trying to find the "buttons" on the screen when there are none showing. [...] Occasionally, touching an active screen [the screen when displaying one of the 'ready-made' clips] is coincidentally timed with actions from the instruments or movement on the screen. Visitors then believe that they are exerting some control over the instruments chosen to play particular notes or the images appearing on screen, leading to some confusion about how they may be controlling it and how they might continue to do so' (ibid., p 9).

Whichever is the case, viewed from the perspective of good interaction design, the observed behaviour might well be regarded as a flaw in the overall conception of this piece. However, in a way I was rather pleased about this finding, because, as noted earlier, my artistic interest was not about designing correct forms of user interaction. Instead, this misconception seemed to back-up the success of my intention to make a perceptual fusion between the screen-based 'ready made' clips and the off-screen orchestra of automated instruments.

To provide an alternative evaluation of the difficulties observed with regards to reading the instructive labels out of context, I should point that in their report Best and Hindmarsh

suggest the introduction of ‘dynamic labels’ which could be incorporated into the screen content and allow ‘for an intelligible reading at all the temporal stages of an exhibit’ (ibid., p 12).

I would like to affirm that I categorically reject this option. First, it would undermine my intention to encourage playful exploration of my work. For instance, in my view, dynamic labels would convey the impression that the work demands a correct mode of operation. I hope it has become clear so far that this is not at all the case. Second, from an aesthetic point of view, the visual interference of the instructions with the artistic portion of the screen content is, for me, extremely undesirable.

The specific observation about people reading the exhibit’s label out of context relates to the more general issue about displaying instructive notes alongside the exhibits. Whereas my own observations did not reveal any major problems with people who read the instructions - other than my impression that the notes were superfluous and maybe spoiled some participants’ experience by limiting their own playful exploration - the same cannot be said about the findings made by the researchers of the WIT group.

Apart from the confusions, which at times arose from reading the labels out of context, Best and Hindmarsh also observed that children who were accompanied by adults would often demand some sort of explanation about how to operate the exhibits. In many cases the adults would then immediately refer to the labels for some help.

‘However by the time the adults had read an appropriate section of the label the children were often very much engaged in “playing” with the exhibit. Therefore the adults then tended to attempt to strictly structure the child’s activities in order to get them to follow the instructions from the labels. Directions such as “stop doing that for a moment” often featured heavily in these sequences’ (ibid., p 9).

Despite the apparent demand for an explanation about how to operate an exhibit, I would argue that the above scenario illustrates above all visitors (in this case the children) being perfectly able to operate the exhibits by intuitively starting to play with them. It appears to me that the presence of the display notes distracted some adults from exploring the exhibits ‘hands-on’ together with their children and, instead, led them to rigorously instruct their children.

Obviously, in the context of my intention to stimulate explorative behaviour (‘learning through playing’) in audiences, this observation is extremely disappointing, and I regret that I was not more affirmative with my reservations against the display of instructive

notes. As indicated earlier in this chapter, I had agreed to the introduction of descriptive labels as a compromise with the museum's exhibition manager, who was worried that without this information people might not be able to understand how to operate the installations. In hindsight, I would argue that his concerns were unjustified, as my observations have shown that in most cases people were perfectly able and happy to discover how to engage with the exhibits intuitively. Moreover, in my view, it was not important if people operated the exhibits correctly or to their full potential. As I have frequently pointed out before, the main focus for me was the perceptual interaction of the exhibits' on-screen and off-screen artefacts, and I believe that this notion was still conveyed even if participants made some wrong assumption about the user-interactive parts. Surely, one cannot rule out that in some cases people might have simply turned away from the exhibits if – due to the lack of instructive notes - they would not have been able to make sense of them. However, in my view, it is less of a problem to lose some part of the audience than to limit playful exploration of the work by offering manuals for the exhibits.

In further support of my rejection of instructive labels for *UNCAGED*, I would like to point out that in the exhibition at the ZKM the exhibit *Glitchy & Scratchy* is presented without any instructive comments. As noted earlier, in this case, there does not seem to be any problem regarding visitors not being able to discover how to engage with the piece.

2.3.2 Interaction between participants (social interaction)

As proposed in 1.4.4, in some ways my approach was encouraged by the WIT group's previous research, which suggests that many computer (screen) based interactive exhibits inhibit social interaction amongst gallery audiences. Due to its extension of the screen into the physical domain as well as the relatively straightforward ways of engagement with the exhibits, I was hopeful that *UNCAGED* might avoid this problem, and provide the possibility for shared experiences and exchange amongst participants.

As is evident in the included video documentation as well as on some of the photographs featured in 1.6, throughout the exhibition the work was explored either by single participants or in groups of two or more visitors.

For instance, in the case of *PONG (telesymbiotic version)*, participants would either play alone with the exhibit (operating the white buttons with their left and right hand) as well as initiate two player games (each player operating one of the white buttons). Moreover, I

frequently observed groups of people around the exhibit, e.g. groups of school children (fig. 14), watching and commenting on the active player(s)' game. Similarly, with the exhibit *Glitchy & Scratchy*, I often observed one person actively manipulating the virtual records while others were watching and making suggestions to the player with regards to her 'performance'. It appeared that in most cases not only the 'DJ' but also the rest of the group were fascinated by the exhibit and visibly enjoyed to follow the relationship between the on-screen actions and their results in the physical domain. One of these occasions is well illustrated in the included video documentation, and also captured in fig. 9.

Social interaction between visitors also occurred on a more mutual level, in particular, at the exhibit *Square Pusher*. For instance, I frequently observed pairs of visitors touching the screen and attempting to move the square in a collaborate effort (fig. 12). Moreover, this installation, more than any of the other exhibits, proved to encourage groups of visitors to take turns in interacting with it. This conduct becomes partially evident in the included video documentation and has also been well described by the WIT group's researchers:

'Some of the UNCAGED exhibits were designed to evoke "game-like" characteristics. For example, *Square Pusher* resonates with the traditional "ring-the-bell" fairground game. Interestingly visitors do not treat this as simply a game for individuals, but take turns and begin competing against each other whilst simultaneously sharing tips on how to improve their "performance". They create ad hoc competitions around the game. As only one person can play at a time, visitors create a game, where the target is for each individual in the group to ring the bell. [...] People would frequently play for some time and not leave the exhibit until all participants had rung the bell' (ibid., pp 6+7).

Furthermore, the experimental and exploratory nature of the work appeared in itself to trigger much exchange amongst visitors. Best and Hindmarsh reported:

'The relatively curious and unusual character of UNCAGED, coupled with the strange relationships between the digital and physical features of the exhibits routinely led to people trying to figure out the exhibits together. This led to a great deal of discussion, debate, and interaction between visitors. For example, those interacting with the *Idle Musicians* function on *...Jingle Bells...* frequently end up discussing amongst themselves and with strangers which instruments they are controlling by pressing particular on-screen buttons' (ibid., p 6).

Moreover, the relatively exposed nature of the individual exhibits – due to the physical extensions of the screen - together with the overall installation of the exhibits in the space, which allowed visitors to see (and hear) what is happening in most parts of the exhibition at any given point, seemed to facilitate a kind of reciprocal dynamic throughout the exhibition space. For instance, groups of visitors would sometimes split up to approach different exhibits separately. Once one part of the group had successfully mastered a particular exhibit they would often attempt to summon the other members of the group to demonstrate and discuss their discoveries and let the others have a go. In other cases, where group members were reluctant to abandon their own exhibits and join the others, new discoveries would be mediated verbally as well as visually throughout the exhibition space.

2.3.3 Verbal feedback from participants

As mentioned earlier, my conversations with visitors during the exhibition often proved to be rather fruitless in terms of discussing the conceptual aspects of the work. As a whole, people spoke very enthusiastically about their experiences with the work and asserted that the transitions between the physical and screen-based elements of the exhibits are very exciting and/or convincing. Comments like ‘it really works’ or ‘this is fantastic’ were made routinely. Whilst this positive feedback obviously supports some of my earlier assumptions, participants usually did not seem to be prepared to comment more elaborately about the way in which they perceived or were affected by the relationships between the screen-based content of the exhibits and their physical surroundings. Nonetheless, a number of interesting issues have been raised during these discussions, which I will present and discuss in the following section.

Outright negative comments about the work were extremely isolated, which might, of course, be explained by the fact that, generally, people feel shy or awkward to express criticism in direct conversions with the artist. (I should mention that, usually, I presented myself as the main author of the work.) The few negative comments made, were regarding obvious technical problems with the work, which I have already discussed earlier, i.e. the difficulties to hit the ball of *PONG (telesymbiotic version)* at the right moment, the occasional problems to spin the virtual records of *Glitchy & Scratchy* and, above all, the low sound level of the instruments in *Not only Jingle Bells for two Spuikars*

and other Players. Admittedly, these comments did not exactly shed new light on the evaluation of my work but, nonetheless, they confirmed my own observations.

More specifically, a visitor remarked his frustration about the fact that one does not actually receive one's own 'lucky number' (as in a number of digits) in *Blow Life*. He did not seem to be satisfied by my response that the individual 'lucky number' is implied by the unique barcode pattern which appears after each completed interaction cycle (see 1.6.1). In particular, he argued that he did not notice a change in the pattern of the barcode and reaffirmed his suggestion to display an actual number on the screen after a completed cycle. While I reject this idea as such out of aesthetic reasons, I concede that the visitor might have a point, i.e. that the alteration of the barcode pattern is at times too subtle which makes it difficult for participants to detect a change from the previous pattern. Hence, this might be a point for future improvement.

A further, rather negative opinion regarding the cabinets of the exhibits was brought forward by a visitor, who claimed that the exhibits very much resembled common home furniture. For her, the overall design of the exhibits' cabinets was too 'clean' and 'boxy' and seemed to efface the experimental nature of their 'contents'. I have to point out that, to some extent, I sympathize with this view. When I originally conceived of *UNCAGED*, I imagined the work to be presented in a less rigid format. In particular, I intended to mirror the rather crude and experimental nature of the on-screen visuals as well as the off-screen devices through an equally provisional presentation of the work as a whole. For instance, I imagined that the active elements of *Glitchy & Scratchy*, i.e. the touch screen, the turntables, the speakers, could have been placed on a normal table and the computer (including electronic interfaces) visibly placed underneath the table; similar to the set-up of my previous sound sculpture *Staccato Death/Life* (fig.1).

As indicted previously, in some ways, my final decision to present the work within these very rigid, maybe boring, wooden cabinets (with acrylic glass screens) was surely due to the requirements imposed by the extremely demanding exhibition environment at the MOC. At the same time, I do very much like the contrast between the often very fragile and provisional nature of the exhibits' active elements and the solid, protective casing in which these elements are presented.

Several visitors expressed their appreciation about the use of very normal, every-day devices in the physical domain of the exhibits. For instance, one visitor pointed out that

he was pleased to see the use of standard home entertainment turntables in *Glitchy & Scratchy* instead of some professional DJ gear. In his view, this particular choice made the exhibit more accessible to him because he could make a direct relationship of the piece to his own equipment at home. Whilst this is of course a very personal account, to me it suggests that, in part, *UNCAGED*'s success with the audience was due to its apparent references to everyday technologies, even though on a deeper level it is technologically rather complex.

There was also a very interesting suggestion concerning the set-up of *Blow Life*. One visitor suggested that one could implement a light sensitive sensor on the right side of the wooden case, enclosing the exhibit's screen. In this way, if participants put their hand between the screen and the active fan, the barcode animation could be brought to a stand still. I very much liked this proposition, because, on the one hand, it showed that this particular visitor seemed to share my fascination of the way the physical airflow generated by the fan seems to affect the on-screen animation and actively engaged in contemplating how this relationship could be further enhanced. On the other hand, I liked the idea as such, because it involves a very direct and basic form of user interaction, which I believe could be extremely effective.

For me, perhaps the most revealing comment ultimately concerned the very scale of the installations. Using the exhibit *Not Only Jingle Bells for Two Spuikars and other Players* as the most palpable example, a visitor told me about his attempt to make a mental journey through the physical sculptures of this piece. More precisely, he expressed his desire to transform into a dwarf in order to wander through the assemblage of acoustic instruments.

This account seemed to reinforce my own emergent ideas about a possible further development of my approach. I considered that it could be interesting to work with much bigger physical sculptures in order to facilitate a more direct engagement within the physical domain of the exhibits. Naturally, the increase of size of the physical elements would require a much larger display of the screen-based domain and could result in a kind of 'telesymbiotic cinema'.

In a more negative sense, his remarks suggest that the physical domain of *UNCAGED* is simply too 'conceptual' in that it cannot be physically experienced by the audience. Moreover, his feedback points again at the problematic regarding the screening-off of the exhibits' physical domain with acrylic glass barriers.

With particular emphasis on the exhibit *Bubblelabub*, one participant asserted with a very positive undertone that this might be the way in which we will ‘consume television and cinema in the future’. Disregarding the, arguably, restrictive and problematic terminology of this comment, it implies that my own original motivation for *UNCAGED*, i.e. to stimulate new directions for overcoming the encaged nature of screen-based media in our daily lives, has been fully understood and shared by at least some visitors. Further, this comment seems to resonate with my above expressed idea for a ‘telesymbiotic cinema’.

Finally, during a fairly in-depth conversation, a visitor challenged my view, that the fusion between the screen-based and the physical domain of the exhibits is only a make-believe situation. Her argument was that there is a ‘real’ (electronic) connection between the two domains: The computer controls the electronic devices and also generates the animations by emission of discrete electric impulses. At first sight, this point seems to be rather trivial or even miss the point, as it does not address the perceptual fusion between the two domains. For instance, the suggestion that the actual airflow of the fan in *Blow Life* does have an impact on the on-screen animation in terms of physically blowing it, is doubtlessly a make-believe. However, in my view, her argument seems to imply a kind of sameness between the virtual and the physical world and does raise interesting questions about the very nature of virtual worlds, e.g. what exactly is it that makes virtual worlds different from physical reality. In this respect her comment points at philosophical issues concerning different conceptions of reality, which I will discuss further in chapter four.

2.4 Conclusions

One might argue that in this chapter, a surprisingly strong focus has been made on issues like the choice of the museum and the actual installation of the work in the museum. I would therefore like to stress that this emphasis reflects the central importance of these issues to my artistic practice and their inseparability from the artistic creation itself.

The subsequent evaluation of user interaction with the exhibits and the social conduct around the work is certainly not exhaustive. However, as noted earlier, to investigate the work from this perspective was never the main focus of my observations. Instead, I was trying to find out, if my very basic approach to bridge the world of computers with the immediate physical surroundings would be successful in terms of captivating and engaging the audience. As indicated before, the actual user interaction was intentionally

restricted to a minimum in order to highlight the perceptual interaction between the physical and virtual world.

My observations also proved useful in terms of identifying technical shortcomings of the work. As described above, in this respect I particularly noticed a need to decrease the level of difficulty to hit the ball at the right moment in *PONG (telesymbiotic version)*, to be aware of the low sound level of *Not only Jingle Bells for two Spuikars and other Players*, i.e. to ensure in future exhibitions that the piece is shown in a very quiet space, and I successfully improved the interaction design of *Glitchy & Scratchy*.

Based on the evaluation of the public presentation(s) of my work, I hold the view that both, the level and quality of user interaction as well as social interaction, was extremely encouraging. Naturally, this is a rather subjective interpretation, but one that has been shared by the more impartial observers of the WIT group:

‘Whereas many pieces of interactive art fail to engage their audience by being overly complex or badly explained, or situated in institutions which normatively seem to discourage hands-on engagement, much of the interaction we recorded in the Museum of Childhood could be deemed successful. They supported playful engagement with complex technologies – a rare feat in contemporary museum. Moreover the exhibits supported and encouraged many forms of participation and gave rise to numerous forms of innovative engagement (e.g. the development of multi-party games around *Square Pusher*; the imitation of DJ-ing in *Glitchy & Scratchy*, etc.)’ (ibid., pp 11+12).

Certainly, on the basis of my own and the WIT group’s observations, one cannot be sure about what exactly made *UNCAGED* such a success with the audiences. However, I would argue that in the light of a ubiquitous presence and accessibility of – in terms of complexity of (games) design, user-responsive graphics and sounds, etc. – far more elaborate interactive entertainment media, e.g. arcade games, game consoles, commercial multimedia applications, the fascination with *UNCAGED* cannot be explained by the possibilities of user interaction as such. In my view, this fascination is mainly related to how the user interaction affects the ‘telesymbiotic’ dimension of the work, namely the interaction between the on-screen and off-screen elements of the exhibits. I would therefore suggest that, on the whole, my ultimately very simple approach to perceptually bridge the gap between screen-based realities and their immediate physical surroundings has been successful. This underlines my earlier expressed belief that it does not depend on technical sophistication or illusionistic perfection, but rather on the ability to stimulate people’s imagination, to make a system work.

Finally, my direct conversations with visitors resulted in a fair amount of new impetus for my work and, on the whole, they seemed to strengthen my conclusions drawn from the observational data.

Chapter 3 - Related work: mixed reality

3.1 Introduction

In this chapter I will provide an overview of other work which has been done in the area of mixed reality and discuss this work in relation to *UNCAGED*. This will include artistic and non-artistic projects which have approached mixed reality in ways which are fundamentally different to *UNCAGED* as well as a number of works which correspond with certain aspects of my own project.

It is perhaps unusual to give an account of related work after a project has been completed. However, I feel it is more fruitful to be able to refer to *UNCAGED* in its final form rather than to the mere conception of my approach. In this way, it is also possible to further illuminate certain aspects of the work by means of concrete comparisons to other projects.

Furthermore, whereas the first chapter deals with different areas of interest which have directly influenced the conception of *UNCAGED*, this third chapter also reflects my continuous research and interest in how other people have approached the notion of mixed reality and what might have been their specific concerns.

I should emphasize that my contextualization will by and large disregard the user-interactive dimension of both, *UNCAGED* and, where applicable, the related work. This is because, as mentioned in the previous chapters, for me, what is most interesting and relevant in this investigation is the ‘telesymbiotic’ dimension of the work, based on the automated interactions between the screen-based world of the exhibits and their immediate physical surroundings. As mentioned in 1.1, I have adopted the term ‘telesymbiotic’ to underline that the screen-based digital domain as well as the surrounding physical elements in *UNCAGED* are interdependent and perceptually enriched through their combination with each other.

To further illustrate my belief that the strength of *UNCAGED* and some other mixed reality works of combining the virtual with the physical world does not so much depend on the participants interaction with the artefacts, but rather on how physical elements in the visual field interact with virtual elements and vice versa, I would like to briefly

consider *Je sème à tout vent* by Edmond Couchot and Michel Bret (1990). The piece features a computer-generated flower (a dandelion) displayed on a standard monitor. When participants blow onto the monitor surface, an animation is triggered which shows the dandelion's plumed seeds being blown away in the wind. Similar to the exhibit *Blow Life*, the idea behind this piece is obviously to create the illusion that the airflow generated within the physical domain can transfuse into the virtual domain. However, in *Je sème à tout vent* the link between the physical and the screen-based world is solely based on the user interaction with the monitor screen. In particular, there is no portion of the physical world – except the participant herself – which is combined with the virtual domain. Essentially, this piece offers ‘just’ an imaginative variation to mouse or keyboard operations of a traditional desktop setup. This might explain why, when I interacted with the piece, I did not have the impression that it was actually the air of my blowing action which triggered the on-screen animation. Rather, I seemed to consciously trigger an airflow sensor positioned at the bottom of the screen. Even though this piece is a nice idea, personally, I did not experience the same perceptually convincing fusion between the physical world and the virtual world as with *Blow Life*.

Finally, it is evident that despite a unifying concept behind *UNCAGED* – to establish interrelationships and transitions between screen-based digital environments and their immediate physical surroundings - the six different exhibits realize this theoretical concern in various forms. In some instances it has proven to be slightly problematic to refer to *UNCAGED* in its entirety when making relationships to other work.

Hence, prior to the discussion of related work I will attempt to construct a categorization of the six exhibits with the intention to facilitate their subsequent contextualization.

3.2 Categorization of the six *UNCAGED* exhibits

To begin with, I would like to reconsider the essential aspects of the relationships between the on-screen and off-screen elements of the exhibits, leaving aside the user-interactive features:

- *Blow Life*: The airflow of a physical fan propels an on-screen animation of a moving barcode.
- *Bubblelabub*: The breath of an on-screen person transfuses into a glass bottle filled with water where it creates air bubbles in the water.

- *Glitchy & Scratchy*: The movements of on-screen records are mirrored by the movements of physical (vinyl) records.
- *Square Pusher*: The contact of a virtual square with the bottom edge of the screen area causes acoustic sounds and vibrations underneath the screen. Its contact with the top edge of the screen causes an electric bell to ring.
- *PONG (telesymbiotic version)*: The plunger of a solenoid (a physical ‘bat’) hits a virtual ball.
- *Not only Jingle Bells for Two Spuikars and other Players*: The movements of on-screen animations correspond with movements and sounds of automated physical instruments.

On the basis of this review, three main categories of relationships can be identified:

- Category one: virtual domain impacts on physical domain (*virtual>physical*)
- Category two: physical domain impacts on virtual domain (*physical>virtual*)
- Category three: physical and virtual domain operate in parallelism (*physical=virtual*)

The six exhibits should then be grouped as follows:

- *virtual>physical*: *Bubblelabub, Square Pusher*
- *physical>virtual*: *Blow Life, PONG (telesymbiotic version)*
- *virtual=physical*: *Glitchy & Scratchy, Not only Jingle Bells for Two Spuikars and other Players*

Arguably, in the case of *Glitchy & Scratchy* and the ‘idle musicians’ feature of *Not only Jingle Bells for Two Spuikars and other Players*, the relationships between the virtual and the physical domain might be understood as being rather of a *virtual>physical* nature. In particular, a participant manipulates an image on the screen and in this way triggers an event in the physical world. However, I repeat that my categorization disregards the user-interactive aspect of the exhibits. In my view, from a solely audio-visual perspective, there is no clear impact from one domain on the other. Instead the artefacts of both domains appear to operate in parallel.

Further, I would like to point out that my chosen nomenclature might be a bit misleading because it implies unilateral cause and effect relationships between both domains in the

first two categories. However, it is important to remember that the relationships between the two domains in all three categories are of a ‘telesymbiotic’ nature, which means that both domains are interdependent and engaged in a mutual beneficial relationship.

3.3 Different approaches to mixed reality

Mixed reality has been described ‘as Virtual Reality and Reality combined, though [...], various representations of reality can be mixed without involving Virtual Reality’ (Davies et al., 2003, p 153). Even though this definition seems to be rather vague, I agree with it because it reveals that there are many different approaches and understandings of mixed reality. As we shall see later, the nature of both, the virtual and the ‘real’ component, in mixed realities and the way in which they are combined does vary immensely.

Importantly, the notion of mixed reality has evolved in the early 1990’s as a ‘subclass’ of virtual reality (VR), understood here as a display environment which is exclusively computer generated (cf. Milgram and Kishino, 1994, pp 1321-1323). This explains why a number of mixed reality projects do in fact resemble VRs, in Heim’s strong meaning of the term (see 1.4), in the sense that the environment presented to the participants might involve some portion of the ‘real’ world, but is so intertwined with a ‘high tech’ rendering of a virtual world that one has the impression of being more or less excluded from the physical world.

3.3.1 Mixed reality overlays

In *A taxonomy of mixed reality visual displays* Milgram and Kishino focus on early approaches to mixed reality which are achieved by using overlay techniques in which ‘real-world’ images or objects are combined with virtual ones in varying degrees. They propose a continuous classification of mixed reality artefacts, which is based on which of the two realities is the dominant one, ranging from augmented reality (where computer generated visuals are added to an otherwise dominant physical scene) to augmented virtuality (where ‘real-world’ visuals are added to an otherwise dominant virtual scene). Interestingly, their conception of mixed reality reveals a particular understanding of reality, because in their view a ‘real’ scene can either be viewed directly ‘or it can be sampled and then resynthesised via some display device’ (ibid., p 1325). This means that

reality is here also understood in terms of mediated representations of reality, e.g. video images of the physical world.

For instance, in image-guided surgery a neurosurgeon, who is faced with the task of removing a brain tumour, might resort to a real-time video view of a patient's head displayed on a monitor (the 'real' portion of the display). This video view is then overlaid with a previously created computer model of the patient's brain (the virtual portion of the display), which shows the exact position of the tumour. In the first instance, the surgeon is now able to make a pre-assessment of the surgery and to determine where exactly she will make an incision on the patient's head. Using a pen she can draw the exact position of the tumour and other important internal structures onto the patient's shaved scalp by correlating her actions on the patient's head with the mixed reality view on the monitor. This is possible because, as mentioned above, the mixed reality scene on the monitor screen includes a real-time video view of the patient's head area, which also relays the position of the physical pen to the monitor view.¹⁰

While the user of the above mixed reality system is not as such excluded from the physical world, it is important to point out that what constitutes the mixed reality scene, according to Milgram and Kishino's understanding, is confined to the view displayed on the monitor. To be more precise, the user could likewise be fully immersed within a head mounted display (HMD) environment.¹¹ In this case, the view of the physical world would be relayed by two motion-tracked cameras attached to the user's head and combined with a virtual computer model in the HMD, as described in Edwards et al. (1993).

Whereas I do not intend to make any limitations to the scope of mixed reality, I contend that exclusively display based forms of mixed reality are not particularly relevant to my own approach. This is because my personal interest in mixed reality is based on the inclusion of an 'unmediated' portion of physical reality which is combined with a display of a virtual world, where the term virtual is understood in Heim's weak meaning of the term (see 1.4). Significantly, my own understanding of mixed reality also includes artefacts which explicitly combine televised or video representations of the 'real' world with the physical world.

As a special category of mixed reality Milgram and Tishino identify a method of

¹⁰ For further details on image-guided surgery see Grimson et al, 1999.

¹¹ A HMD is a device which covers both eyes of the user with miniature (computer) screens. In this way the user can be fully immersed within an, often stereoscopic, view of a virtual environment.

overlaying physical objects onto an otherwise virtual scene. To differentiate this type of mixed reality artefacts, which does include an ‘unmediated’ portion of the physical world, from those approaches which are exclusively display based, the authors suggest the term ‘hybrid reality’.

To give an example, *Mixed Reality Pong* by Kiia Kallio (2001) – also noteworthy because it references the same classical video game as my own *PONG (telesymbiotic version)* – comprises of a table surface (the game area) onto which a computer generated virtual ball is projected from above. The ball can be hit by players, standing on opposite sides of the table, with their hands or other ‘real-world’ objects. The input is realized with a web camera capturing the playing table and gathering information about the movement of the real-world objects. This information is handled by a computer and relayed to the behaviour of the virtual ball. According to the artist, ‘the game physics simulate the behaviour of a real ball, except that the virtual ball doesn't slow down at all’.¹²

At first sight, this approach seems to be more relevant to *UNCAGED* than the example given before, because of the inclusion of an ‘unmediated’ portion of the physical world within the mixed reality scene. On the other hand, to me the focus of *Mixed Reality Pong* does not appear to be an extension of the virtual domain into the physical world, but at best an interesting approach to physically access and interact with an otherwise virtual world. In a sense, the idea to manipulate virtual displays directly with physical objects or with one’s own hand is very much comparable to my use of touch screen technology in *UNCAGED*. For instance, in *Square Pusher* the virtual square can be manipulated directly by the participant’s hand. However, for me, the notion of mixed reality is here not achieved by physically manipulating the virtual domain but by the immediate effect the virtual square appears to have on the surrounding physical environment, i.e. to cause ‘real’ sounds and vibrations.

3.3.2 Mixed reality boundaries, traversals and transforms

As an alternative to the overlay approach, or augmentation of realities, Benford et al. have introduced the concept of ‘mixed reality boundaries’, involving separate non-overlaid distinct physical and virtual spaces. A ‘simple’ version of this approach would consist of:

¹² Further details and an artistic statement about *Mixed Reality Pong* are available at: <http://mlab.uiah.fi/~kkallio/mr-pong/> (10/10/2006).

‘[...] a physical environment into which are projected graphics and audio from the virtual environment [...]. A group of people in this environment would have a shared view of the contents of the virtual environment, including its occupants who would typically be represented as avatars [¹³]. In turn, a video camera and microphone capture video and audio from the physical environment and this is transmitted back to the collaborative virtual environment over a computer network. The live video image is then displayed [...] within the virtual environment. A group of people in the virtual environment would have a shared view of the contents of the physical environment. The net result is the creation of a transparent bi-directional window between the physical and virtual environments’ (Benford et al., 1999, p 8).

While this description reveals a completely different formal realization of combining the virtual with the ‘real’ world, I would argue that the concept of mixed reality boundaries is in itself much closer to my own approach than the aforementioned overlay techniques. First, the idea of a boundary seems to emphasize that the mixed reality environment is a combination of two distinct spaces which always includes an ‘unmediated’ portion of physical reality. Second, ‘a distinguishing feature of this approach is that it places equal weight on physical and virtual environments’ (ibid., p 8). This characteristic strongly resonates with the very concept of ‘telesymbiosis’, where both domains are interdependent and engaged in mutual beneficial relationships. In particular, it seems to fit with the notion of parallelism between the physical and the virtual world implied in the *UNCAGED* exhibits of the third category (see 3.2). In the above example of an environment based on a simple mixed reality boundary this kind of parallelism might not be obvious for the participants themselves. However, from an observer’s perspective one could argue that, comparable to *UNCAGED*’s third category, events in the physical and virtual space are mirrored within the respective opposite domain.

Jeffrey Shaw’s installation *The Golden Calf* (1994) features a form of mixed reality boundary which, on a formal level, seems to be more congruent with *UNCAGED*. As with my own approach, the separate spaces involved here comprise a monitor display and its physical surrounding.

The work consists of a white pedestal with a portable monitor placed on top of it. The monitor is connected to a computer via an extensible cable running through the pedestal. A participant can pick up the screen and is supposed to hold it in front of her facing the empty pedestal (fig. 26). On the display, the participant will now see a computer-generated image of a golden calf standing on a virtual pedestal, which resembles the

¹³ In the context of computer based worlds an avatar is a computer-graphical representation of a participant.

physical one (fig. 27). Due to a sophisticated spatial tracking and graphics computer system, the perspective and scale of the virtual calf and pedestal follow the participant's movements in relation to the physical pedestal. If the participant moves further away from the physical pedestal the image becomes smaller, by moving around the pedestal the virtual image can be seen from all sides as well as from above and below.

Apart from the very rich symbolic dimension of the piece – e.g. ‘the Golden Calf as a simulated pagan object of worship for a postreligious culture that ritually propagates its myths and desires through electronic media’ (Shanken, 1996, no pagination) – it also offers a captivating approach to establishing relationships between the virtual and the physical world on a more immediate level. When I tried the piece at the *Cinémas du Future* exhibition in Lille (2004), my impression was that the display could sense something in the ‘real’ world which my bare eyes could not see. It might be unnecessary to point out, what made this piece interesting, was not the display information in itself, but how it relates to the physical environment, i.e. the empty pedestal. Rather than to fix my eyes on the display, it was more rewarding to constantly compare the physical environment with the monitor information. It was a striking experience to realize that even when the ‘truth’ about physical reality was immediately accessible to me, it was impossible for me not to have some belief in what I saw on the screen.



Fig. 26: Jeffrey Shaw, *The Golden Calf*, 1994



Fig. 27: Jeffrey Shaw, *The Golden Calf*, 1994, detail

Extending the approach of mixed reality boundaries Koleva et al. have introduced the idea of ‘traversable interfaces’ which ‘establish the illusion that a physical space is joined to an adjacent virtual space and that participants physically pass from one to the other (appearing to dematerialise from physical space and rematerialise in virtual space or vice versa)’ (Koleva et al., 2001, p 39).

Blast Theory's *Desert Rain* (2000), is a noteworthy example of this idea. The traversable interface(s) used in this piece are six rain curtains - a fine water spray into which images can be projected. *Desert Rain* is a combination of performance, installation and computer

game for six players and two performers that involves a journey through a combination of physical and virtual spaces.

As the work is too multifaceted to be described here in detail, I would like to concentrate on one key moment of its staging. During the first part of the piece, the six players are positioned in separate fabric cubicles where they stand on footpads allowing navigation through a virtual world. Six personal views of this shared virtual world are projected on respective rain curtains. Each player has to complete certain tasks in the virtual domain until she reaches a white virtual cylinder, where a sign is displayed that says 'wait here'. At this moment, one of the performers who has been following the action from the other side of the rain curtain, steps through the interface and in a ghostly manner approaches the player, gives her a plastic swipe card and turns back to disappear again behind the rain curtain. 'Given that the players have been concentrating hard on the virtual world and that they are likely to be feeling somewhat disorientated, this is usually experienced as a highly dramatic, even shocking, event by the players' (ibid., pp 39-40).

I would argue that the very idea of traversing from one world into the other corresponds rather well with *UNCAGED*. In particular, it seems to resonate with the effect created in *Bubblelabub* where the airflow of the on-screen person seems to transfuse into the physical world (into the glass bottle). However, on a formal level, *Desert Rain* evidently differs considerably from *UNCAGED*. The overall set-up appears to be very complex and, in my view, far removed from our normal experience to engage with 'virtual media'. Further, as can be followed from the description above, in order to achieve the illusion of crossing the boundaries between the virtual and the physical domain *Desert Rain* seems to rely on the disorientation of the players resulting from their temporary immersion within a 'high tech' virtual environment (fig.28). In turn, this means that the players do not exactly feel anchored in their immediate physical surrounding when they encounter the performers. I would therefore suggest that *Desert Rain* does not bring the virtual domain closer to our human experience – in the way *UNCAGED* attempts to achieve - but is rather staging a mixed reality spectacle in which the participants are being left confused about what is 'real' and what is virtual. I should emphasize that this assessment is in no way meant to devalue the piece. In fact, it reflects the artists' very intention 'to provoke participants to reevaluate the boundaries between reality and fiction, and between the real and the virtual' (ibid., p 38).

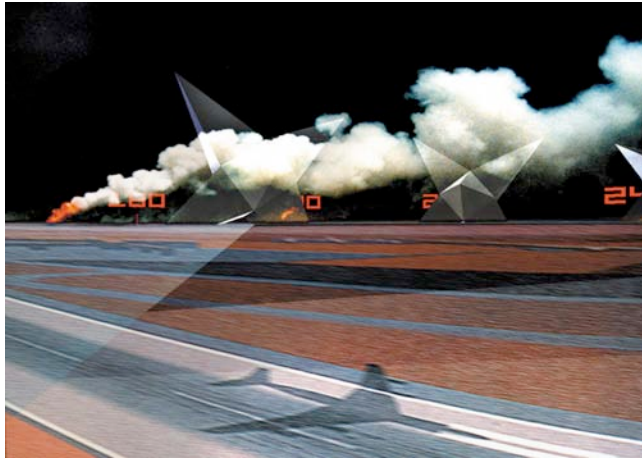


Fig. 28: Blast Theory, *Desert Rain*, 1999
Scene from the virtual display of the work

In addition to the performers being able to traverse the display interface and to appear in the physical space of the players, they also have an effect on the physical world, i.e. they give an object to the players. This idea of making changes in the opposite world has been conceptualised by Rogers et al. as ‘mixed reality transforms’ and has been realized quite differently from *Desert Rain* by the interdisciplinary research collaboration EQUATOR in the project *The Hunting of the Snark* (2001).¹⁴ One feature of this mixed reality adventure game for children is a ‘magic well’ where participants can feed a virtual computer-generated dragon with physical, electronically tagged plastic food, e.g. a chicken, a tomato or an onion. To be more precise, the dragon image is projected via a data projector into a physical model of a well where the food is inserted into an electronic ‘feeding chute’. This device can read the various types of food by means of the electronic tag and relays this information to the computer that generates the dragon animation. Depending on the type of food inserted, the dragon’s ‘facial expression’ accompanied by an appropriate sound will indicate its appreciation or dislike (cf. Rogers et al., 2002). The concept of mixed reality transforms fits well with the *UNCAGED* exhibits of category one and two (see 3.2) as here events in one domain also seem to cause changes in the respective opposite domain. However, without intending to imply any superiority, I would argue that due to the relatively simple nature and arrangement of the virtual and physical components these transformations are much more immediate in *UNCAGED* than in *Desert Rain* and *The Hunting of the Snark*.

¹⁴ For more information about EQUATOR and *The Hunting of the Snark* please refer to: <http://www.cogs.susx.ac.uk/interact/projects/index.htm> (10/10/2006).

A most remarkable example of mixed reality transforms, in terms of immediacy and simplicity, is Jean-Marie Dallet's *Déjà vue* (2004). The piece consists of a desk-top computer with seventeen inch monitor displaying the classic *Microsoft Windows* screensaver, which features a large number of *Windows* logos (a kind of window-like flag) floating from the distance towards the front of the screen. Placed on top of the monitor is a conventional desk fan (ca. twelve inch in diameter) which is constantly running. Notably, there is no interface between the computer and the fan. Despite this simple arrangement, one has the impression that the airflow of the fan is the source of the flags' movement inside the monitor. I have experienced the work at the *Update_01* exhibition in Gent (2006) but I find it difficult to describe in words the convincing illusion this 'simple' piece creates. Importantly, apart from the visual interactivity between the fan and the flags' movement, it seems to be the airflow of the fan, blowing right at the spectator, which adds substantially to its effectiveness.

I have to acknowledge that in a sense this piece captures the essence of my own approach in a more sovereign way than *UNCAGED*. As mentioned before, I wanted to create compelling relationships between the screen-based world of computer and the surrounding physical world in a very simple and direct way. However, in my view, compared to *Déjà vue*, *UNCAGED* seems relatively contrived and complex. Dallet's piece impressively shows that the illusion of interrelationships between the two domains can work on an even more basic level. Further, it nicely demonstrates that this illusion is largely dependent on the viewer, 'who wants to see interactivity there where there isn't any' (Dallet, 2006, p 9). On the other hand, because *Déjà vue* is based on a unique assemblage of two non-interfaced, pre-existing items - or to put it in the artist's own terms, it is a 'non-programmed ready-made' – in my view, there is not much potential for further development or variations in Dallet's approach.

A further artist who has been exploring the mixture of screen-based realities with the surrounding physical world in a very direct way is Fabrizio Plessi. The artist refers to his own works not as mixed reality installations but 'simply' as video installations. This is probably due to the fact that usually the screen-based portion of his works consists of simple video loops featuring 'real-world' phenomena, i.e. they are not computer-generated. However, as mentioned before, from my own understanding, many of his works fit with the notion of mixed reality, because they combine elements of the physical world with virtual (in the weak sense) images.

In many cases Plessi's work features fairly large physical reconstructions of settings or structures, taken from the 'real' world. For instance, *Acquedotto* (1996) consists of a viaduct-like wooden structure, into the gutter of which a row of monitors is placed. The monitors display a video loop of fluvial water, which seems to flow from one monitor to the next one. In this way, the impression is created that a virtual water stream is running within the physical sculpture.

While most of his work features imaginative juxtapositions between physical structures and virtual displays, like in *Acquedotto*, some pieces also imply transitions from one domain to the other. In particular two of his works seem to be evocative of my exhibits of the second category (see 3.2) because here the virtual scenario appears to have an effect on the physical world. In *Liquid Time II* (1989 – 1993):

'An upright wheel, reaching to a height of five meters and made of steel, is mounted so that it turns slowly above a long steel tank, along the base of which water flows in a gutter beneath a grating. We recognize this arrangement immediately as that of a mill wheel, yet in each of the scoops the water we would expect to find is replaced by a monitor, its screen showing video footage of cascading water. As the wheel turns, the water shown on each of the monitor screens briefly meets the real water bubbling along the gutter in the tank' (Syamken, 1997, p 215).

His piece *Electronic Waterfall* (1999), comprises of thirty-six monitors which are fitted into an iron structure of fourteen meters height (fig. 29). The monitors are arranged into three upright columns of twelve stacked units, each displaying the same video loop of water falling downwards. Underneath this structure, which has the appearance of a virtual, or electronic, waterfall, a cascade of physical water is installed. In this way, Plessi achieves to create the illusion that the screen-based waterfall transforms into a 'real' waterfall.

While the parallels between these two pieces by Plessi and *UNCAGED* are quite striking, I would suggest that they nevertheless differ considerably. Plessi's approach seems to be particularly referential to 'natural' situations and therefore his choice of material in a sense prefigures an organic fusion between the monitor displays and the physical sculptures. Due to this a priori relationship between the physical and virtual elements his work does not require any computer technology to interface between the two domains. At the same time, this means that the relationships between the physical and the screen-based environment are constantly the same, they repeat in a continuous loop. By contrast, the fusion between the physical elements and the screen-based elements in *UNCAGED* is generally less self-evident. It considerably relies on precise synchronizations and

manipulations of events in both domains, which is made possible by the use of computers. On the whole, I would argue that the specific technological nature of *UNCAGED* enables a higher degree of responsiveness and flexibility between the virtual and physical elements and, in this way, allows the creation of a wider spectrum of relationships between the two domains. This might also explain why, in my view, the ‘telesymbiotic’ relationships in *UNCAGED* are somewhat more surprising and spontaneous while Plessi’s work appears to be of a more atmospheric and contemplative nature.



Fig. 29: Fabrizio Plessi, *Electronic Waterfall*, 1999

3.3.3 Mixed reality implied

Niklas Roy’s *Pongmechanik* (2003-2004) provides an interesting variation to the idea of mixed reality. This is because the piece does not combine the virtual with the physical world in an actual way, but instead seems to collapse the boundaries between the two metaphorically. As the name suggests, *Pongmechanik* is a (electro-) mechanical reproduction of the video game *Pong*, and according to the creator, ‘an absolutely physical game’.¹⁵ The work comprises a table-like construction made of glass and wood and all the mechanics are visible to the participants and onlookers (fig. 30). A relay computer, controls the game’s display elements, e.g. the ball (a white plastic square), the racquets (two white plastic triangles), via various motors and strings. The display consists

¹⁵ An artistic statement as well as a detailed description and video documentation of *Pongmechanik* can be found at <http://www.cyberniklas.de/pongmechanik/index.html> (10/10/2006).

of two closely spaced glass plates between which these elements are moved. The score is shown by numbers on rotating discs visible through two slots in the playing field. The sound is produced by the plunger strokes of two solenoids hitting wooden blocks. The players interact with the game via two conventional joysticks connected to the relay computer.

Evidently, Roy has paid great attention to detail, mirroring each screen-based element of the classic video game with a physical counterpart. One could argue that, in this way, the impression is created that the original ‘virtual’ *Pong* has rematerialized in the physical world. Further, considering that in the first instance the video game was of course a ‘virtual’ copy of a table tennis (ping pong) game, Roy’s piece could be viewed like a reincarnation of the latter, having completed its journey through virtuality and now reappearing in the ‘real’ world.



Fig. 30: Niklas Roy, *Pongmechanik*, 2003-2004

Finally, I would like to draw attention to an artwork from a quite different field because, for me, it brilliantly captures the humorous, somewhat absurd, character of my own approach. As I was delighted to discover, Philippe Geluck, a comic illustrator and creator of the book series *Le Chat*, had based one of his illustrations on an idea very similar to *Blow Life*. His illustration features a cartoon cat blowing against the underside of a television set (fig. 31). The television screen displays a shot from a film scene, taken from *The Seven Year Itch* (1955, directed by Billy Wilder), where Marilyn Monroe's skirt is lifted up by a rush of wind from a subway vent (cf. Geluck, 2005, p 34).

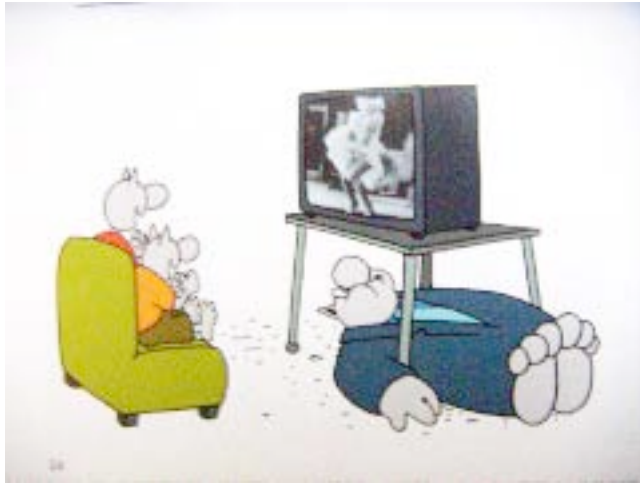


Fig. 31: Philippe Geluck, *Le Chat a encore frappé*, 2005
Illustration taken from the comic book *Le Chat a encore frappé*.

3.4 Conclusions

My overview of different approaches to mixed reality has shown that it is difficult to put a clear label on this field of research. While the general definition of mixed reality as a combination between the virtual world and the ‘real’ world holds true, I have shown that due to different understandings of these terms the conceptual ideas and practical realisations to combine the two domains vary considerably. I have argued that my own approach differs fundamentally from those projects, which are generally referred to as augmented realities, where different techniques are employed to overlay ‘real’ scenes with virtual ones within the same display environment. This is because in these approaches the ‘real’ is often understood as representations of the physical world, i.e. video samples, and they rarely include an ‘unmediated’ portion of the physical world. Conceptually *UNCAGED* corresponds rather well with those approaches which include a boundary between the virtual and ‘real’ space, in particular, with the idea of traversing this boundary and making changes (transforms) in the opposite domain. However, most projects, which are explicitly informed by the idea of boundaries, usually realize this idea quite differently from my own approach. In particular, they might involve video capturing devices, electronically tagged objects and novel projection platforms that intricately combine virtual image worlds with physical artefacts, environments and participants. The crucial difference of *UNCAGED* to the majority of this type of mixed reality works relates to *UNCAGED*’s comparatively simple set-up, facilitating the creation of very direct and literal relationships and transitions between the screen-based and the physical domain.

While I have also identified some works which, on a formal level, correspond rather well with *UNCAGED*, I have argued that, due to their specific (technological) nature, they do not provide the same potential for further development. This does not mean that I consider *UNCAGED* to be superior to those approaches. What seems more important here is that these works are nonetheless impressive realisations of the idea to combine the ‘real’ and the virtual world. However, *UNCAGED*’s particular technological underpinning, i.e. the use of computers and their appropriate interfacing with physical and virtual artefacts, appears to provide greater flexibility for the creation of ‘telesymbiotic’ relationships and has the potential to be applied more universally in further research. On the whole, I would contend that in the area of mixed reality *UNCAGED* provides a unique balance between formal simplicity and technological sophistication. In this sense, then, *UNCAGED* can indeed be regarded as a novel, ‘telesymbiotic’ approach to bridge the divide between the physical world and the virtual world of computers.

Chapter 4 - Critical evaluation of *UNCAGED*

'[...] the value of thought lies not so much in its inevitable convergences with truth as in the immeasurable divergences which separate it from truth.'

(Baudrillard, 1996, p 94)

4.1 Introduction

Up to this point the underlying tenor of this thesis was based on my initial motivation behind *UNCAGED*, which was to uncage computer based realities from the confines of their digital existence and to bring the remote computer world closer to our human experience. This very motivation certainly expresses some degree of critical awareness about mainstream developments within digital technology industries. In particular, as I have pointed out before, my own approach can be seen as an attempt to provide a possible alternative to the widely pursued area of immersive virtual reality, where the physical world is more or less excluded from the participants.

However, as a whole, my argumentations so far, have not questioned the potential of digital technology to be incorporated within our lives in meaningful and satisfying ways, but, if anything, rather sought to undermine the dominant paradigm of their developments and applications. I must confess, though, that this relatively optimistic narrative only reflects in part my attitude towards the project. In reality, things have been much more ambiguous and, in part, the *UNCAGED* project (including the previous theoretical account of it) has been a struggle to give meaning and understanding to an idea which began to crumble before it was even fully realised.

4.2 Revised view of *UNCAGED*

Already, during the early stages of the research and development phase of *UNCAGED*, but in particular after the work had been completed, I began to question the initial motivation behind the project. I believe that my reservations towards this, with hindsight, rather starry-eyed agenda arose from two coinciding, arguably interrelated, notions.

First, my critical examination of the work itself nourished the impression that despite the perceptual fusion between the digital and the physical world, *UNCAGED* actually seems to highlight the distance between the two domains. In my view, all six exhibits bear an underlying absurdity, which arises from the very fusion between their physical and digital components. For me, this absurdity ultimately hints at the fallacy of the initial motivation behind *UNCAGED* and, in a wider context, questions the very idea to seek in virtual worlds a place for meaningful human exchange and experiences.

Second, temporally coinciding with, but not necessarily causally linked to the creation of *UNCAGED*, my former enthusiasm for the computer as a working tool was clouded by a growing frustration and, to put it bluntly, my reluctance to spend a good deal of my life (isolated) in front of the computer screen.

Admittedly, in the light of my original motivation, one could argue that the very objective of *UNCAGED* was precisely about improving our relationship with digital technology, and that therefore *UNCAGED* could be regarded as a step towards overcoming my own frustration with the computer. I do believe that *UNCAGED* is successful in bridging the gap between the digital world and the physical world on a perceptual basis, and I feel the six installations certainly incorporate digital technology in a rather enjoyable and stimulating way. However, for me the fusion between the digital and the physical world in *UNCAGED* only seems to work within the context of installation art or simply games, but ultimately, applied to ‘real life’, it does not offer much hope to make the digital world a more satisfying space to engage with.

This negative, or at least disillusioned, evaluation might come as a surprise for the observer of my practical work and reader of the previous chapters. Retrospectively, it is difficult for me to trace whether the absurdity perceived in the work appeared to me as a sudden revelation, or whether it was not always inherent in the conception of the work. As mentioned in the first chapter, I was always aware that the fusion in *UNCAGED*, between the virtual and the physical world, would be some kind of make-believe situation and not be dissimilar to special effects used in TV/film or the work of a magician. Right from the start, there was surely a certain amount of humour, maybe even irony, within my approach, and I did not claim to offer ‘real’ solutions in improving our relationship with the computer. At the same time, there was also a great deal of personal amazement regarding the effectiveness of this very simple and direct way to link the ‘real’ and the virtual world, and, if at all, I did not perceive the absurdity of my experiments as a problem regarding the initial, ‘humane’ motivation behind the project.

Whereas in most other mixed reality approaches (see previous chapter) this absurdity might be veiled or distracted from the participants through greater technological sophistication or an overall subtler approach in mixing the virtual with the physical elements, I would now suggest that the simplicity of my approach brings to light an intrinsic absurdity of the very idea to fuse the physical with the virtual world.

4.3 Revisiting Baudrillard

As the first chapter of this thesis suggests, since the early beginnings of *UNCAGED I* have been interested in the writings of Jean Baudrillard. Initially, I took his rather apocalyptic ‘prophecy’ of a total virtualisation of our world, or the ‘murder of the real’¹⁶ as he has put it, as a challenge against which to measure my own approach, which seemed to imply a direct physical impact on the virtual domain and vice versa (see 1.3). However, in the light of my shrinking optimism in the possibilities of humanizing the virtual world of computers, I felt it useful to revisit and deepen my understanding of his texts, relevant to the issues at stake, with the hope to find some clues or answers to exactly why I had the impression that my project had failed. In particular, I was interested to explore further his accounts on the specific nature of the ‘virtual’ and how it differs from the ‘real’.

As I am not a professional philosopher, I do not make any claims to fully comprehend Baudrillard’s ideas within a wider socio-philosophical context; neither with regards to the entirety of his own oeuvre, nor that of related thinkers. In the subsequent section, I will attempt to sketch a summary of his concepts relevant to my investigation, and afterwards try to further evaluate *UNCAGED* on the basis of my own understandings of Baudrillard’s work. To me, the flavour of Baudrillard’s concepts is often more accessible than their substance. I hold the view that even if my understandings might not necessarily reflect the full depth and implications of his concepts, they might nevertheless serve as useful inspirations for me to make new sense of my practical work.

Further – and to some extent in favour of my intuitive interpretation - the very rationale to use Baudrillard’s work as a theoretical framework for analysis seems to be rather problematic. This is, because, as I understand it, Baudrillard does not intend to provide any definite truths or concepts which could be applied directly to ‘real life’. In practising

¹⁶ Cf. Baudrillard, 2000, pp 61ff.

what he calls the process of ‘radical thought’, his texts rather have to be seen as provocations, mystifications and denials of any objective analysis. For Baudrillard:

‘Radical thought is a stranger to all resolving of the world in the direction of an objective reality and its deciphering. It does not decipher. It anagrammatizes, it disperses concepts and ideas and, by its reversible sequencing, takes account both of meaning and of the fundamental illusoriness of meaning’ (Baudrillard, 1996, p 104).

Finally, due to Baudrillard’s very idiosyncratic, often aphoristic and, in my view, almost poetic writing style – which, no doubt, is also a reason why I have been so fascinated by it in the first place - I found it frequently very inappropriate, sometimes impossible, to paraphrase his ideas without losing the essential flavour of his points. I have therefore decided to include in the following sections a rather large amount of quotations from his texts (in translation), and hope that my own commentary will serve as a useful guidance in revealing the relevance of his writings to my own investigation.

4.3.1 The ‘real’ and the ‘hyperreal’

To most, Baudrillard is probably best known for his accounts on ‘hyperreality’ based on the notions of the simulacrum and simulation. His ideas became widely known in the 1980’s through his publication *Simulacres et Simulations* (1981), which was partially translated into English in 1983 under the title *Simulations* and fully translated in 1994 as *Simulacra and Simulations*. The concept of hyperreality is a good starting point for my own investigation, as his earlier writings do not seem to be of great relevance to my question of what exactly is the difference between the ‘real’ and the ‘virtual’.

According to Baudrillard - mediated by our contemporary mediascape, i.e. (reality) television, advertisement and (real-time) digital technology¹⁷ – Western societies are infused with simulations of reality, producing images and signs which are no longer mere representations of our primary reality but which have lost any reference to reality. To put it in Baudrillard’s terms, they have become their ‘own pure simulacra’¹⁸.

¹⁷ One might also say ‘virtual media’, where virtual is understood in Heim’s weak sense of the term (see 1.4).

¹⁸ It should be mentioned that the notion of the simulacrum acquires a special meaning in Baudrillard’s writings. Whereas the common dictionary definition of simulacrum is simply an image or a copy of

At first sight, the notions of the simulacrum and simulation often seem to be used interchangeably in Baudrillard's writings. However, there appears to be a slight difference between the two as the term simulation bears rather the notion of process, whereas the simulacrum has more of a static image or system (Best and Kellner, 1999, no pagination)

Typically, due to their omnipresence and high-definition realism, simulated realities and the simulacra they produce are perceived to be more real than our primary reality and are therefore referred to as being hyperreal. However this does not mean that we take the hyperreal for something other than reality, but rather that it has become almost impossible for us to distinguish between the two.

Whereas 'in the old days', according to Baudrillard, simulation was based on a representational model of the 'real' world, nowadays the simulation of the 'real' no longer bears any resemblance to the 'real'. To illustrate this point, Baudrillard often refers to a Jorge Luis Borges fable, where the cartographers of an empire draw up a map so detailed that it ends up covering the territory exactly. For Baudrillard this fable is the most beautiful allegory of simulation 'in the old days'. By contrast, in contemporary Western societies the territory no longer precedes the map, but the map is created with no reference to reality whatsoever, and it is the map (the simulation) which is the model for reality:

'Today abstraction is no longer that of the map, the double, the mirror, or the concept. Simulation is no longer that of a territory, a referential being, or a substance. It is the generation by models of a real without origin or reality: a hyperreal. The territory no longer precedes the map [...]. It is nevertheless the map that precedes the territory [...] that engenders the territory [...] Something has disappeared: the sovereign difference, between one and the other, that constituted the charm of abstraction' (Baudrillard, 1994, pp 1+2).

As a useful example to illustrate the above notions, one might consider the 'Lara Croft story'. Initially created as the heroine of the action video game *Tomb Raider* in 1996, Lara Croft is a simulation of an all powerful, beautiful, sexy and intelligent woman. In her absolute 'perfection' she does obviously not bear any resemblance to a 'real' personage, but instead could be regarded as 'pure simulacrum'. Surely, none of her creators make any serious claims about her authenticity and ultimately it is probably obvious to most people that Lara Croft is not a 'real' person. However, she has gone beyond being just a

something, in Baudrillard's terms the simulacrum is defined as an image that has 'no relation to any reality whatsoever', as it is produced by simulation rather than representation of the real (Baudrillard, 1994, p 6).

popular video game character. What really makes Lara a prime example of a simulacrum is her transcendence into a (hyper-)real lifestyle icon whose image is omnipresent in numerous magazines, advertisements and internet fan sites where she is treated, at times, as if 'real'. For many people she has become a raw model, the perfect ideal, they can aspire to. Hence, one could argue that the hyperreal universe around Lara Croft is in fact engendering the life of 'real' people. What is more, by attaching to the character a detailed and fairly realistic biography, by using 'real' (fashion) models to act as Lara for the promotion of the game(s) and by making two cinema films¹⁹ based on the video game adventures - where Lara is played by a 'real' actress - the distinction between the simulation of the 'real', the hyperreal, and the 'real' is blurred further. For instance, when we refer to Lara Croft, it is not at all clear, if we refer to the film actress, one of the promotional models or the video image(s). Lara Croft is recreated in an endless succession of simulacra, which are ever more detached from any origin in reality.²⁰

From this account of Baudrillard's thought one could get the impression that he actually believes in the notion of an unmediated direct access to a primary reality, which is masked by an artificial, hyperreal universe. However, this does not seem to be the case. In fact, what we commonly refer to as reality is, for Baudrillard, itself nothing but 'a particular case of simulation' (Baudrillard, 1996, p 16):

'I have already said that, as I see it, to bring a real world into being is in itself to produce that world, and the real has only ever been a form of simulation. We may, admittedly, cause a reality-effect, a truth-effect or an objectivity-effect to exist, but, in itself, the real does not exist. [...] Reality, as we know, has not always existed. We have talked about it only since there has been a rationality to express it, parameters enabling us to represent it by coded and decidable signs' (Baudrillard, 2003, p 39+40).

Our understanding of the world as objective reality seems to be engendered by our overall trust, or at least indulgent belief, in science and technological progress, which aim at rationalizing and simulating our universe through logical and operational models of reality. This results in rendering the world absolutely transparent and explicable. It is in this way, that we experience, what Baudrillard calls, a 'reality effect'.

¹⁹ The two films referred to are *Lara Croft: Tomb Raider*, directed by Simon West (2001) and *Lara Croft Tomb Raider: The Cradle of Life*, directed by Jan de Bont (2003).

²⁰ The Lara Croft example is not meant to suggest that there was any conspiracy on the part of the Lara Croft creators. It should rather be looked at as a phenomenon reflecting the particular dynamics of a postmodern cultural environment.

As a characteristic example of our quest to render the world completely objective and positive, Baudrillard refers to the 'Human Genome Project' which seeks to uncover all the secrets of our human life, in order to rid ourselves of any imperfections, or negativity as Baudrillard would put it. According to Sherry Turkle, the Human Genome Project is often justified on the grounds to find the genetic codes of many diseases, so that these can be better treated, but there is also 'talk about finding the genetic markers which determine temperament, personality, sexual orientation and, possibly, mortality' (Turkle, 1995, p 25). Arguably, the ultimate aim of this project is then to clone the perfect, positive, immortal human being.

As far as I understand Baudrillard, the enterprise to uncover the (biological) secret of human life by the total transcription and understanding of its genetic code is itself only a simulation or a model of an objective reality.

With this understanding of the physical world, Baudrillard's concept of the hyperreal almost seems to lose any meaning. In a sense, the hyperreal and the physical real when understood as an objective real seem to belong to the same 'family' of simulated realities. However, I would argue that whereas the notion of the hyperreal refers rather to a simulation of the 'real' propagated by the contemporary mediascape, the notion of the real, as a form of simulation, is related to our comprehension of the physical world, which, in our case, is grounded in seemingly objective scientific knowledge and models of the world.

4.3.2 Radical illusion and the Other

For Baudrillard the opposite of simulation is not then the 'real' but illusion, or better the 'radical illusion' of the world. In his view:

'[...] the illusion of the world is the way things have of presenting themselves for what they are when they are not actually there at all. In appearance, things are what they give themselves out to be. They appear and disappear without letting anything shine through. [...] They signal to us, but are not susceptible of decipherment' (Baudrillard, 1996, pp 16+17).

The 'material definition' of this radical illusion, according to Baudrillard, is the physical fact that in this universe nothing exists in real-time:

‘By the fact of dispersal and the relative speed of light, all things exist only in a recorded version, in an unutterable disorder of time-scales, at an inescapable distance from each other. And so they are never truly present to each other, nor are they, therefore, “real” for each other’ (ibid., p 52).

Baudrillard further illustrates this physical foundation of illusion by our perception of the stellar system. It is well known that due to the time the light of the stars takes to reach us, we can perceive stars which might already have disappeared. The actual presence of stars in real-time is therefore an objective physical illusion. In the same way, even if our environment appears to be a homogeneous whole, it is in fact an illusion as nothing can ever be present at the same time, because the light of any being or physical object around us takes a certain amount of time to reach our sensory system (cf. Baudrillard, 1996, p 51; 2000, p 71).

Baudrillard seems to suggest that with regards to his ‘proper’ concept of radical illusion, this physical foundation of illusion has to be seen in a rather metaphorical way (Baudrillard, 2000, p 74). From my understanding - being aware of possibly simplifying his concept - ultimately Baudrillard’s notion about the ‘illusion of the world’ expresses his belief that there is something more, a kind of deep reality, or ‘the Other’, which hides behind the world of appearances through illusion.

Baudrillard often describes the Other on the basis of sexual attraction. The ‘radical otherness’ between sexual partners makes possible sexual seduction, and it is through sexual play and seduction that we discover otherness; that is, not only do we discover the Other in the sexual partner, but also within ourselves (cf. Baudrillard, 1996, pp 115ff).²¹ Ultimately, the notion of the Other seems to be a rather universal concept and it might be summarized as being everything which cannot be rationalised, reduced to scientific models, expressed in language (except, maybe, in poetry), simulated a priori, described by cause and effect relationships etc.

To give an idea of the range of the concept of the Other: it can be experienced through ‘singular events’ which take place outside the universe of already performed events through simulation in hyperreality; it can be found in the practice of symbolic exchange practised in certain ‘primitive’ cultures which defies the logics of economic exchange and

²¹ It is important to note that Baudrillard makes a clear distinction between otherness and difference. From my understanding, whereas difference would refer to qualities which are different in a sense that they can be logically described or produced, otherness marks a difference which defies the realm of rational description and production. For instance, Baudrillard asserts that the idea of sexual difference in fact denotes a kind of sameness, because it is derived from within a structural system of rational, objective thinking. In contrast, sexual otherness, or the ‘strange attraction’ towards a partner, is something which can be experienced (in sexual play and seduction) but not put in words or described by rational concepts.

is exonerated from the idea of (commodity) value and production, characteristic for our own economy (cf. Baudrillard, 2003, p 16); it can be found on a psychological level, for instance, in the strange pleasure we take in irrational excess and surplus (cf. Baudrillard, 1993, p 53); it can be experienced on a subatomic scale where matter behaves absolutely strangely, illogically, and does not follow our scientific models (cf. Baudrillard, 1996, p 14).

To come back to the example of the Human Genome Project given above, I would suggest that the Other would be that part of human life which cannot be made transparent through the transcription of our genetic code.

More generally, it is the Other which engenders the mystery of our world and resists our attempt to make the world completely positive. It is therefore also referred to as negativity. This does not mean that the Other is negative in a way of being evil, but rather negative in a sense of being the opposite of the artificial positivity or sameness of our world.

However, due to our enterprise to homogenize the world and render it absolutely positive, an operation which is based on the ignorance of otherness, the Other is nowadays primarily experienced as Evil, e.g. new incurable diseases (like AIDS and cancer), terrorism (like the September 11 attacks), extreme violence (like hooliganism, the Columbine disaster), etc.:

‘In a society which seeks – by prophylactic measures, by annihilating its own natural referents, by whitewashing violence, by exterminating all germs [...], by performing surgery on the negative – to concern itself solely with quantified management and with the discourse of the Good, in a society where it is no longer possible to speak Evil, Evil has metamorphosed into all the viral and terroristic forms that obsess us.’ (Baudrillard, 1993, p 81).

I should point out that the scepticism and rejection of the idea to be able to analyze, objectively and truthfully the physical world that surrounds is not at all exclusive to Baudrillard’s thinking but a standpoint distinctive for postmodern thinking in general (Butler, 2002, pp 37+38).

Furthermore, Baudrillard is aware that modern sciences, i.e. the ‘subatomic sciences’, offer us other schema than that of our reality principle which seem to defy rationality, e.g. the theory of non-locality, mentioned in the first chapter (cf. Baudrillard, 1996, p 54; 2003, p 45). Although this theory is widely accepted as a valid scientific hypothesis, it

seems to have no practical impact on the conduct of most new sciences, like Genetic Engineering, Artificial Intelligence (AI) and Robotics, which operate on the basis of an ‘ontological simplification’ of the universe and are ‘trying to persuade us that technology will inevitably produce good’ (Baudrillard, 1996, p 18).

This notion seems to coincide with Weber’s analysis of the current techno-scientific narrative. Despite being aware, in principle, about the constructiveness of knowledge underlying their research, as a whole the techno-scientific community seems to conduct and present their research and creations as if being grounded in an objectively knowable reality (Weber, 2003, p 150).

4.3.3 Virtual reality

With the notions of the radical illusion and the Other in mind, let us briefly reconsider the above question about the difference between the hyperreal and the physical (objective) real. What seems to be the crucial here, is that even if the physical real has been made almost completely transparent by different models of simulation, in contrast to the hyperreal, on the level of physical reality we still encounter some ‘resistance’ of the Other (unfortunately in the form of ‘true’ Evil), which puts up against our project to render the world completely positive.

For Baudrillard, virtual reality (VR) - understood in Heim’s strong sense of the term (see 1.4)²² – seems to be a kind of final ‘coming together’ or synthesis between the notions of hyperreality and objective reality.

On the one hand VR seems to be a continuation or perfection of hyperreality:

‘[...] the virtual coincides with the notion of hyperreality. Virtual reality, the reality that might be said to be perfectly homogenized, digitized and “operationalized”, substitutes for the other [hyperreality] because it is perfect, verifiable and non-contradictory. So, because it is more “complete”, it is more real than what we have established as simulacrum’ (Baudrillard, 2003, p 39).

²² Interestingly, Baudrillard’s definition of VR as ‘immersion, immanence and immediacy’ seems to resonate with Heim’s ‘three I’s of VR’ which are ‘immersion, interactivity, and information intensity’ (cf. Baudrillard, 2005a, p 31; Heim, 1998, p 7). Without implying any direct influence between the authors, I feel that this overlap substantiates my approach to consider Baudrillard’s notion of virtual reality in the light of Heim’s strong meaning of the term virtual.

In my view, the notion of hyperreality seems to describe a world where the simulation of the world is based on a rather loose almost incidental nexus of different ‘virtual media’ – understood in Heim’s weak sense of the term (see 1.4) - and their interrelationships with physical reality. VR, by contrast, is a more intentional and rigorous construction of a fully virtual world based solely on computational models of simulation:

‘With the very latest Virtual Reality we are entering a final phase of this enterprise of simulation, which ends this time in an artificial technical production of the world [...] Virtual Reality, the highest stage of simulation, the stage of the final solution by the volatilization of the world’s substance into an immaterial realm and a set of strategic calculations’ (Baudrillard, 2005a, pp 34+44).

On the other hand, on an ontological level, VR seems to be directly derived from our understanding of the physical world, as an objective universe, and our enterprise to make it completely positive. According to Baudrillard, in VR the radical illusion of the world will be finally extinguished:

‘It is in the Virtual that we have the ultimate predator and plunderer of reality, secreted by reality itself as a kind of self-destructive viral agent. Reality has fallen prey to Virtual Reality, the final consequence of the process begun with the abstraction of objective reality – a process that ends in Integral Reality. What we have in virtuality is no longer a hinterworld [a kind of deep reality]: the substitution of the world is total [...] We have moved, then, from objective reality to a later stage, a kind of ultra-reality, that puts an end to both reality and illusion’ (Baudrillard, 2005a, p 27).

This complete substitution of the ‘real’ world by its virtual double, or to put it more precise, the total elimination of the ‘original illusion’, the Other and negativity has been speculated on by Baudrillard as being ‘the perfect crime’, in his 1996 publication with the same name (original French edition published in 1995 under the title *Le crime parfait*):

‘The perfect crime is that of an unconditional realization of the world by the actualization of all data, the transformation of all our acts and all events into pure information: in short, the final solution, the resolution of the world ahead of time by the cloning of reality and the extermination of the real by its double’ (Baudrillard, 1996, p 25).

And further:

‘By shifting to a virtual world, we go beyond alienation, into a state of radical deprivation of the Other, or indeed of any otherness, alterity, or negativity. We move into a world where everything that exists only as idea, dream, fantasy, utopia will be eradicated, because it will immediately be realized, operationalized. Nothing will survive as an idea or a concept. You will not even have time enough to imagine. Events, real events, will not even have time to take place. Everything will be preceded by its virtual realization. We are dealing with an attempt to construct an entirely positive world, a perfect world, expurgated of every illusion, of every sort of evil and negativity, [...]. This pure, absolute reality, the unconditional realization of the world – this is what I call the Perfect Crime’ (Baudrillard, 2000, pp 66+67).

However, in *The Perfect Crime*, Baudrillard seems to suggest that ‘fortunately, the crime is never perfect’ (Baudrillard, 1996, p 7). This is, because of our own human imperfections we will always leave traces, signs of imperfection, in the artificial, virtual paradise (ibid., p 40). By contrast, the undertone of his 2005 publication, *The Intelligence of Evil or the Lucidity Pact* (original French edition published in 2004 under the title *Le Pacte de lucidité ou l’intelligence du Mal*), seems to imply that with the latest advancements in VR technologies, maybe his apocalyptic prophecy of the perfect crime might become reality.

This change of mind would resonate with his revised assessment on the notion of the simulacrum, which, apparently, he put forward more as a provocation than something he really believed in. However, with hindsight, he later asserted that sadly, reality had proved him right:

‘[...] you are disarmed by the lamentable confirmation of your words by an unscrupulous reality. So, for example, you put forward the idea of the simulacrum, without really believing in it, even hoping that the real will refute it [...]’ (Baudrillard, 1996, p 100+101).

4.3.4 Raison d’être

From my reading of Baudrillard, to put it simply, the ultimate metaphysical reason for us to create this artificial universe - a world which is fully operational and positive - seems to be our desire to rid ourselves from our ‘existentialist condition’. That is to design a world where we are no longer required to take responsibility for our own actions, to decide what is right or wrong and to expunge death by becoming immortal in a virtual immaterial world:

‘One day, perhaps, all that substance will be transformed into energy and all that energy into pure information. [...] Delivered from ourselves, we shall enter the spectral, problem-free universe. That is what is meant by the great model of Virtuality. [...] In a real world, death too becomes real, and secretes a commensurate horror. Whereas in a virtual world we dispense with death and birth, as we dispense with a responsibility so diffuse and overwhelming that it becomes impossible to bear. We are doubtless ready to pay this price so as no longer to have perpetually to perform the overwhelming task of distinguishing between true and false, good and evil, etc. [...] Perhaps by paying this price we shall pass death by, in the transparent shroud of a made-to-measure immortality’ (ibid., p 37).

Beyond Baudrillard’s eloquent critique on Western societies’ dream and radical pursuit of life ‘perfected’ by technology, his own metaphysical position, his idea of a *raison d’être*, seems to be quite ambiguous.

On the one hand, he does not seem to believe in an ultimate truth or meaning of the world, but instead believes in Nothingness (cf. Baudrillard, 1996, pp 13, 97+98; 2005a, p 38). At the same time we cannot accuse Baudrillard of a totally nihilistic position as he seems to suggest that the illusion of the world is the only thing we have and it is ‘real’ (Hegarty, 2004, p 83). As shown above, in Baudrillard’s view, without the illusion of the world life will lose all its magic, fascination and seduction. The total realization, of the world – made possible by the latest technologies such as VR and Genetic Engineering - will in the end be unbearable to us, because it deprives us of any dreams, utopia, phantasms and uncertainty:

‘In the end we prefer the *ab nihilo*, prefer what derives its magic from the arbitrary, from the absence of causes and history. Nothing gives us greater pleasure than what emerges or disappears at a stroke, than emptiness succeeding plenitude. Illusion is made up of this magic portion, this accursed share which creates a kind of absolute surplus-value by subtraction of causes or by distortion of effects and causes. This machination of the Nothing, which means that things contradict their very reality, may be conceived either as poetic or as criminal’ (Baudrillard, 1996, pp 58+59).

Finally, maybe surprisingly, there seems to be a belief on Baudrillard’s side in destiny. However, he emphasizes that his concept of destiny is not to be understood in a religious sense or in sense that life has a clear purpose:

‘As a counter to the completely computerized universe, we are being offered or promised, I could easily imagine a world that would be nothing but coincidences. Such a world would be not a

world of chance and indeterminacy, but one of destiny. All coincidences are, in a sense, predestined. Then, standing opposed to destination, to that which has a clear purpose, would be destiny or, in other words, that which has a secret destination, a pre-destination, though not in a religious sense' (Baudrillard, 2003, p 69).

He further elaborates his conception of destiny as being not an individual destiny, but instead a dual form, an exchange, a kind of complicity between things, 'as in a poem where you have the impression that the words were always preordained to meet' (ibid.). I must confess that I find Baudrillard's idea of destiny, which seems to exclude the existence of any kind of higher being or supernatural force, rather elusive. It appears that, ultimately, Baudrillard's idea of destiny, or predestination, is just another way of expressing his concept of the Other. For instance, analogously to his illustration of the Other by sexual seduction, he asserts that there is a form of predestination in seduction as in the one being always destined for the other (ibid.).

4.3.5 The Arts

Baudrillard's concern for the Other can also be sensed in much of his rejection of contemporary art.

In the first instance, Baudrillard distanced himself from an artistic movement emerging in the 1980's, commonly known as Neo-Geo (short for Neo-Geometrical conceptualism). Artists of that movement, such as Peter Halley, Ashley Bickerton and Jeff Koons, were maybe the first to explicitly point at Baudrillard as their 'spiritual guru'. Their art was to a certain extent influenced and concerned with Baudrillard's conception about the disappearance of reality into simulation (Hegarty, 2004, p 159). For instance, Jeff Koons 'parodied consumer culture by presenting real consumer goods as works of timeless beauty' (Tate Online Glossary). Arguably, this gesture reflects Baudrillard's work, in as much as in a hyperreal universe, (aesthetic) values are being simulated in and extracted from the ubiquitous world of advertising.

Regardless whether or not these artists adopted his ideas in the right way or not, Baudrillard seems to disagree with art being a mere reflection of the world but is looking for something deeper in art, one might say an allusion to the Other. For him, on the whole, contemporary art has become obsessed with banality and mediocrity and is constantly recycling itself. Apparently, 'all of this mediocrity claims to transcend itself by moving art to a second, ironic level'. But even on the ironic level, it is for Baudrillard as

empty and meaningless as at face value (Baudrillard, 2005b, p 27). It seems that, if at all, contemporary art simply reiterates ideas about the world which have already been put forward – for instance by himself. However, it fails to unlock a new, unknown view of the world, one where we might experience otherness:

‘On the one hand, there is art, which is capable of inventing a scene other than the real, another set of rules; on the other, there is realist art, which has fallen into a kind of obscenity by becoming descriptive, objective or the pure reflection of the decomposition – the fractalization – of the world’ (Baudrillard, 2003, p 28).

Interestingly, Baudrillard’s understanding of ‘valuable’ art seems to resonate with Immanuel Kant’s (1724-1804) notion of the ‘sublime’ which can be evoked in the creations of the artistic genius. According to Mary Warnock, Kant, in his *Critique of Judgement*, describes the sublime as something we are amazed by, something which we could not have created by ourselves, by the application of a rule. The idea embodied in the sublime object is beyond representation or complete explanation and it is when we recognize sublimity that we create a concept of infinity and of eternity which we recognize as literally beyond us. For Kant the feeling of encountering the sublime can be evoked by strong natural phenomena, such as threatening rocks, thunder storms, the vastness of the ocean etc., but can also be bodied forth by the extraordinary imaginative capabilities of the artistic genius, who can trigger our own imagination to sense a second nature in the materials (of the art work) used, which reaches ‘beyond the mere appearance of things, to that which lies behind them’ (Warnock, 1994, pp 29+30).

I would like to stress that there is surely a deep ontological gap between Kant’s notion of the sublime and Baudrillard’s idea of the Other, even though both notions seem to point towards what lies behind the appearance of things. According to Scruton, ‘it is from the presentiment of the sublime that Kant seems to extract his faith in a Supreme Being’ (Scruton, 2001, p 110). By contrast, as outlined before, Baudrillard’s Other does not want to be understood in a religious sense nor in a sense that there is a clear purpose for life hiding behind the appearances.

4.4 Considering *UNCAGED* on the basis of Baudrillard's conceptions of reality

Following from the previous section, from my understanding of Baudrillard, one could conclude that there are four different notions of reality.

First, there is primary reality, the realm we commonly refer to as the 'real' world.

According to Baudrillard, our primary reality is a world of appearances and we are only experiencing it as the 'true real', because we seem to have succeeded in objectivizing these appearances and, in this way, brought into existence a 'reality-effect'. Importantly, in Baudrillard's view, this 'reality-effect' is merely a simulation of a 'true real' as it is based on an ontological simplification of the world which ignores its ultimate strangeness or otherness.

Second, there is a virtual (in Heim's weak sense of the term), hyperreal universe which is produced by our contemporary mediascape. Both realities seem to seamlessly overlap and it is increasingly difficult for us to make a difference between the two. What is more, it is actually the hyperreal which engenders primary reality.

Third, underlying primary reality, there is a more profound reality, a kind of 'hinterworld', which hides behind the world of appearances through the radical illusion of the world. To this third kind of reality we do not have direct access, but it is vital to keep alive the world's mystery, the notion of the Other. Baudrillard suggests that in our artificial universe the illusion of the world is being destroyed by simulation and that the Other is now only experienced through forms of Evil.

The fourth notion of reality would be virtual reality (VR), where these last vestiges of the Other are lost, because in VR, there is no place for an underlying profound reality. This is because VR is a completely simulated world based solely on the actualization of computational data.

When applying the above framework directly to *UNCAGED*, one could consider the screen-based domain of the exhibits as being an instance of the second notion of reality (the hyperreal or the virtual in the weak sense of the term) and the physical domain as being an instance of primary reality, the world of appearances.

In this light, then, the idea behind *UNCAGED* to bridge the gap between the physical or primary world and the screen-based world of computers seems rather naïve.

Not, though, in the sense that this project would be doomed to fail because of an unbridgeable distance between the two domains, as implied in my revised interpretation

at the beginning of this chapter. On the contrary, it seems naïve, because, according to Baudrillard, the virtual, hypereal world is already inextricably linked with primary reality. In a sense, the perceptual fusion between the physical and the virtual artefacts of *UNCAGED* reiterates, at least in a metaphorical way, Baudrillard's idea about the sameness between the 'real' and the hyperreal; the idea that, ultimately, both are simulations. This viewpoint is underlined, on a more technical level, by the fact that not only the virtual but also all the physical artefacts of the exhibits (including the user interfaces) correspond with certain predefined algorithms within the computer. From this perspective, the physical world of *UNCAGED* appears to be highly evocative of our artificial and operationalized primary reality. Hence one could argue that the domain of primary reality in *UNCAGED* is certainly not a place where Baudrillard's Other might be found. Or to put in different terms, contrary to my revised interpretation of *UNCAGED*, it is not the fusion between the physical elements and the screen-based virtual elements in *UNCAGED* which is absurd, but it is the world we are living in which is absurd, where the 'real' has itself become nothing but simulation.

While I agree to a large extent and am fascinated by Baudrillard's writings, I have certain reservations towards the extremity of his assertion that, nowadays, primary reality amounts to nothing but simulation. Further, as mentioned earlier, we have to be careful to take Baudrillard's assertions too literally, because with his practice of 'radical thought' he does not attempt to provide us with an objective analysis of the issues he discusses. Rather, I believe, his theories have to be seen as provocations with the attempt to make us see more clearly the underlying nature and currents of contemporary phenomena. Generally, I feel that Baudrillard captures well the tendency of Western societies trying to objectivize and positivize the world around us and there are many indicators which, at least in principle, seem to confirm his 'prophecies'. For instance, with regards to his claim that the Other has nowadays disappeared from the sphere of sexual attraction and seduction (cf. Baudrillard, 1996, pp 115ff), one could easily think of many examples which seem to point in this direction: biological sciences try to reduce sexual attraction to a set of chemical reactions; we increasingly seem to look for and court with partners via virtual media and, in the more extreme case of 'cyber-sex', we even perform the sexual act itself via the Internet.

On the other hand, while this form of 'exchange' seems to gain ever more popularity and acceptance within our society, I do not believe that it reflects our (sexual) life exhaustively. From a very personal perspective, I certainly cannot deny that virtual media

have a strong effect on my daily life and might even, temporarily, inform my conception of reality. However, ultimately, I believe that I am well able to make a clear distinction between the hyperreal and primary reality. What is more, I would contend that my underlying apprehension of primary reality is of a rather transcendental quality, engendered by singular, personal experiences and an ultimate distrust in the objectivity of the world.

However, what seems to be the case in *UNCAGED* is that by combining the virtual world with primary reality, the latter seems to be reduced to the same ontological level as the former. Even though I have certain reservations to view the totality of primary reality as being pure simulation, in the way Baudrillard seems to suggest, certainly the portion of primary reality in *UNCAGED* corresponds rather well with the notion of simulation. To repeat again, this appears to be the case on a perceptual level - in order to make a fusion between both domains in *UNCAGED* we have to consider the physical dimension from a point of pure appearances – as well as on a ‘real’, technical level – both worlds are actually controlled from within the computer.

Seen in a larger context, I am willing to claim that the same problem applies to the whole range of so-called mixed reality artefacts and environments. In a sense, I would argue that the notion of mixed reality seems to be a very acute, ‘perfected’ form of the nexus between the hyperreal and primary reality. Or to put it differently, mixed reality environments seem to substantiate Baudrillard’s argument that the hyperreal is nowadays the model for the ‘real’ and that it has become impossible to differentiate between the two realms.

Finally, with regards to Baudrillard’s account of the ‘perfect crime’, which is largely based on the transformation of the physical universe into computational information, that is into virtual reality (VR), one could get the impression that this is pure intellectual speculation or alarmist criticism bearing no resemblance to ‘real life’ developments.

However, there actually seems to be a ‘community’, including scientists from reputable institutions where VR is considered as ‘a total resolution of the real, in which humans could escape from the world and into technology’, (Horrocks, 2000, p 44). In what Heim describes as the ‘idealist vision’:

‘[...] world-wide networks that cover the planet will form a global bee-hive where civilisation shakes off individual controls and electronic life steps out on its own. [...] Individuals give and

take freely. Compensation is automated for the heavenly, disembodied life. [...] Cooperate intelligence vanquishes private minds' (Heim, 1998, p 41).

This description resonates with Coyne's notion of 'technoromanticism'. According to Coyne, technoromantic (digital) narratives can be linked to certain historical traditions, i.e. the notion of idealism developed during different historic epochs. For instance, Plato's concept of the real is based on a division of the world, first, into a realm of (deceptive) appearances which is accessible through our senses and, second, the world of ideas. The second being the intelligible, real world of universals and forms. This idea was later taken up and developed by Neoplatonists, including Plotinus, who asserted that the soul can gain access to the real but has to liberate itself from the world of matter through frequent ecstasies. This idealism is echoed by romantic idealist philosophers by the notion that the highest aim for the individual is to free oneself from all influences of the outer world and, thus, to arrive at a perfect unity of the soul. Coyne claims that in technoromantic narratives, the notion of 'the soul is replaced with the mind, the means of ecstasies is immersion in an electronic data stream, and the realm of unity is cyberspace' (Coyne, 1999, p 10).

Maybe one of the most extreme exponents of this 'school of thought' is the Robotics and Artificial Intelligence scientist Hans Moravec. According to a comparably soft reading of his vision for the not so distant future - which is remarkably similar to Baudrillard's notion of the perfect crime - humans will disappear into cyberspace by transplanting their mind from the brain into artificial hardware. Once uploaded into cyberspace they will be able to move freely in simulated realities. 'Like programs and data that can be transferred between computers [...], our essences will become patterns that can migrate the information networks at will' (Moravec, 1998, p 93). In cyberspace we will be able to join with other human and machine intelligence to form an enormous 'bubble of Mind' (ibid., p 88). Notably, for Moravec, the essence of being human is reducible to our mind, that is our thoughts and awareness, which can be transcribed into pure computable information. In his view, physical reality, including our body, is a mere encumbrance which we should dispose of.

According to Coyne, these kinds of extreme positions are tolerated and institutionalized as an acceptable eccentricity by a more mainstream discourse within the technoscientific community (Coyne, 1999, p 106). However, this apparently more rational discourse

seems, on closer looks, to be ‘based on similar fundamental shifts in the understanding of the being of nature and humans’ (Medosch, 2005, p 23).

For instance, in his book *Being Digital* (2005) Nicholas Negroponte, leader of the MIT Media Lab, seems to account for possible negative effects of wrongly employed computer technology. Further he asks us to be cautious about fanatic claims in the Moravec fashion regarding the possibilities offered by digital technology in the not so distant future.

Despite a certain critical awareness about digital technology, on the whole, Negroponte clearly embraces our ‘becoming digital’. His short-term vision is an environment where increasingly more aspect of our lives are assisted and enhanced by computer technology and he celebrates that ‘the global nature of the digital world will increasingly erode former and smaller demarcations’ (Negroponte, 1995, p 237). Appearing more subtle and realistic in his argumentation, in the end, just like Moravec, he seems to dream of a life fully immersed in the virtual: “‘Beam me up Scotty’ is a wonderful dream, but not likely to become true for several centuries’ (ibid., pp 12+13).

As mentioned in 1.3, from the very beginning I was opposed, more or less intuitively, to the idea of immersive VR, where the physical world is more or less excluded from the participants. Maybe needless to say, after my engagement with Baudrillard my rejection of VR has, if anything, become rather more intense. I am willing to fully subscribe to Baudrillard’s illustration of how VR viewed in its ultimate consequence would put a final end to the mystery, or the Other of the world. For me, his account provides a metaphysical backbone to my intuitive rejection of VR.

4.5 Conclusions

In this chapter I have provided two different critical evaluations of *UNCAGED*. My first intuitive analysis resulted in my view that due to the underlying absurdity of the exhibits - which arises from the very fusion between their physical and screen-based components - *UNCAGED* ultimately seems to highlight the difference between the virtual and the physical world, rather than bridging the gap between the two domains. By contrast, in my conclusion of a further evaluation, which was informed by Baudrillard’s conceptions of reality, I have argued that the idea to bridge the gap between the virtual world of computers and the surrounding physical environment could be regarded as being rather naïve. This is because, according to Baudrillard, our primary, physical reality and the

virtual, hyperreal world are nowadays already inextricably linked with each other. In Baudrillard's view, there is ultimately no difference between the two domains as both are simulations of an objective reality based on an ontological simplification of the world, which ignores its ultimate strangeness or otherness.

Even though I do not fully subscribe to the extremity of Baudrillard's assertion that primary reality amounts nowadays to nothing but simulation, I have argued that the problem with *UNCAGED* and, by extension, the very idea of mixed reality, is that by combining the virtual world with primary reality, the latter seems to be reduced to the same ontological level as the former.

On the other hand, maybe in a more positive light, one could claim that *UNCAGED* actually puts a very ironic slant on Baudrillard's ideas. This is because, once we consider *UNCAGED* as a reflection of our simulated universe - comprising of a nexus of virtual artefacts and physical appearances - we are confronted with a grotesque exaggeration of the matter. In my view, this irony is engendered by the extremely direct and simple approach of *UNCAGED*, or better, by reducing the rather complex technical-scientific-psychological-sociological-historical nexus between the 'real' and the hyperreal to a series of straightforward one-to-one relationships.

To sum up, I would contend that the real problem with *UNCAGED* is not related to the work itself, but rather to my motivation to make the virtual computer world a more 'humane' place to engage with, and my concern to offer new directions to overcome our difficulties to engage with computers in a satisfying way. I now hold the view that my research approach should instead have been more open. In particular, it should have been guided by a more neutral question, that is, to ask for the consequences of combining the physical domain with the virtual domain in a very direct way.

Hence, despite my extremely critical assessment, I feel that *UNCAGED* is in itself not a failure, because it raises questions regarding the very idea to integrate digital technologies in our lives in a meaningful way and interrogates the underlying nature of the 'real' and the virtual world. What is more, I would argue that *UNCAGED* offers this critical slant precisely because it seems to work on an immediate perceptual level. To put it bluntly, if the fusion between the physical and the virtual components would be less convincing, one could simply disregard *UNCAGED* as a silly idea.

Further, my critical evaluations and conclusions are, of course, very personal and therefore certainly debatable. In turn - being fully aware about the contradictoriness of my suggestion - this means that my unique formal approach taken in *UNCAGED* might

nevertheless serve as inspiration and guidance for other artists and researchers working in the broad area of mixed reality.

Finally, my discussions in this chapter have shown that it is important to continuously question an artistic approach to technology from various angles. At the very least, my theoretical reflections on *UNCAGED* have provided me with a new heightened sensitivity with regards to the role of (digital) technology in my artistic work.

Beyond *UNCAGED*: in lieu of a conclusion

As indicated in the previous chapter, my critical view on *UNCAGED*, in particular, my doubts about the idea to make the virtual world of computers a more humane domain by integrating it with the physical world, demanded a radical rethinking of my artistic practice. Initially, I had the intention to create a subsequent body of work, where the transitions between the physical and the virtual world as well as the user interaction would be more seamless. I assume it is obvious from my aforementioned concerns that a development of *UNCAGED* in this direction would have been extremely pretentious. Instead, I figured that my new artistic projects should not be concerned with perfecting the perceptual and interactive level of *UNCAGED*, i.e. through technological advancement, but with exploring further the socio-philosophical issues implied in *UNCAGED*.

As a first, very direct response to *UNCAGED* - in a kind of spontaneous abreaction of my increasingly critical view on digital technology - I have created *CCT* (2004-2005), which is a series of apparently computer controllable, networked toasters (fig. 32-34). Essentially, the work aims to parody our obsession with computerizing and automating an increasingly large part of our environment. The idea to connect a toaster to a computer network seems totally absurd to me and, as I hoped, the work has been received with a great deal of humour and amusement by various audiences. However, as I found out later, in an ironic twist, the very idea to integrate toasters within a computer based network had already been put forward by Nicholas Negroponte, a 'representative' of the aforementioned 'idealist community'. Admittedly, the following quotation contains some degree of humour, but seen in the overall context of his book *Being Digital*, I think we have to assume that he is ultimately quite serious:

'Appliances today have all too little computing. A toaster should not be able to burn toast. It should be able to talk to other appliances. It would really be quite simple to brand your toast in the morning with the closing price of your favourite stock. But first, the toaster needs to be connected to the news' (Negroponte, 1995, p 213).



Fig. 32: Ralf Nuhn, CCT - Toaster mit Schnittstelle, 2004
Electric toaster, Sub-D type computer connector



Fig. 33: Ralf Nuhn, CCT - Two Networked Toasters, 2004
Electric toasters, Sub-D type computer connectors, computer cable



Fig. 34: Ralf Nuhn, CCT - Four Networked Toasters with Hub, 2005
Electric toasters, Sub-D type computer connectors, computer cables

In a subsequent project, *Cyber-Spatialism* (2005), I have created a series of seven canvases in which computer connectors are inserted (fig. 35, 36, 38+40). *Cyber-Spatialism* refers to Luigi Fontana's *Concetto Spaziale - Attese* (1958-1968), which is a series of slashed canvases (fig. 37, 39+41). As the title suggests, Fontana's work was informed by his *concetto spaziale* (spatial concept), which, in part, can be considered as an attempt to overcome the illusionistic representation of space in painting by introducing physical space (cf. Crispolti, 1999, pp 32+37; Hapkemeyer, 1995, no pagination; Trini, 1988, p 34). By substituting Fontana's slashes with computer connectors, *Cyber-Spatialism* implies an extension of the canvas into cyberspace, and, thus, attempts to address the notion that in today's world physical space is increasingly being 'replaced' by virtual space.

With regards to colour, patterns and relative dimensions, *Cyber-Spatialism* is closely based on Fontana's 'originals' in order to make the relation between the two series more perceptible.

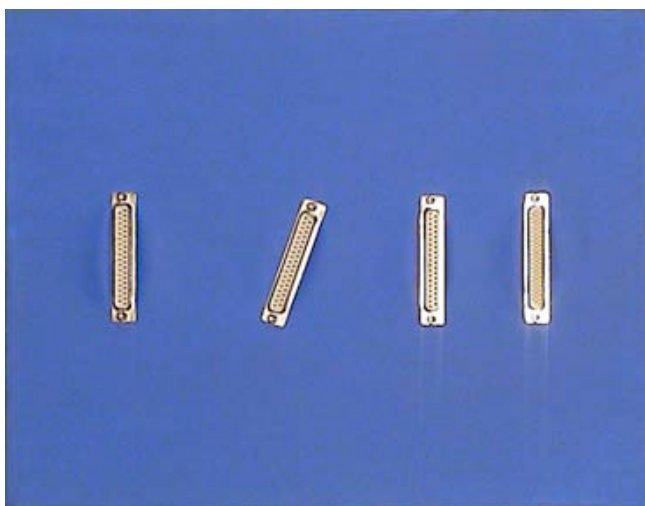


Fig. 35: Ralf Nuhn, *Cyber-Spatialism* #1, 2005
35cm (w) x 27cm (h), water-based paint and Sub-D type computer connectors on canvas



Fig. 36: Ralf Nuhn, *Cyber-Spatialism* #1, 2005, detail



Fig. 37: Luigi Fontana, *Concetto Spaziale - Attese*, 1967
62cm (w) x 50cm (h), water-based paint on canvass

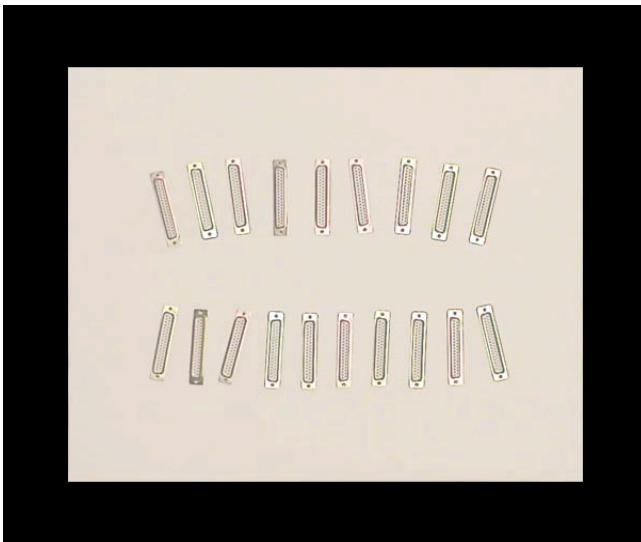


Fig. 38: Ralf Nuhn, *Cyber-Spatialism #2*, 2005
45cm (w) x 38cm (h), water-based paint and Sub-D type computer connectors on canvas

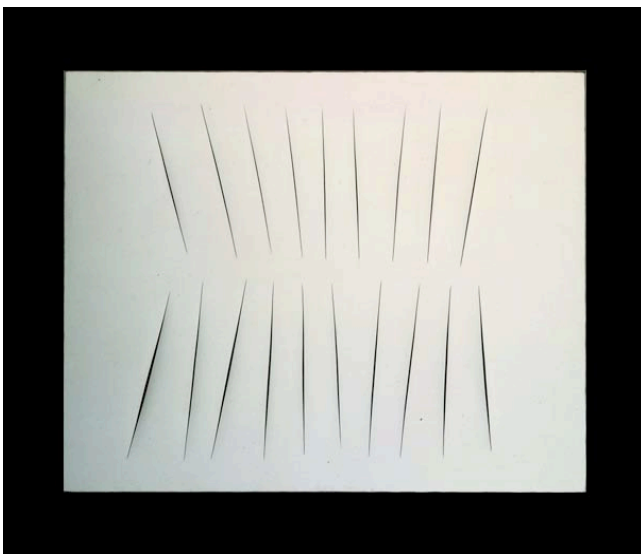


Fig. 39: Luigi Fontana, *Concetto Spaziale - Attese*, 1964
100cm (w) x 81cm (h), water-based paint on canvass



Fig. 40: Ralf Nuhn, *Cyber-Spatialism #4*, 2005
55cm (w) x 46cm (h), Sub-D type computer connectors on plain canvas

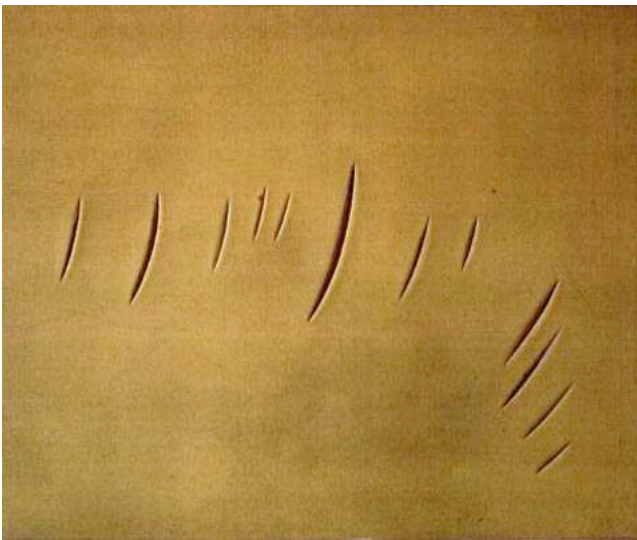


Fig. 41: Luigi Fontana, *Concetto Spaziale - Attese*, 1959
125cm (w) x 101cm (h), water-based paint on canvass

Even though I would contend that my critical attitude towards digital technology, expressed in these post-*UNCAGED* projects, has been partially influenced by my reading of Baudrillard, I do not in any way claim that they are works of art to Baudrillard's liking. He would probably reject this kind of work as being mere ironic reflections of reality (see 4.3.5). However, my own view on art does not necessarily correspond with Baudrillard. I feel it is a valuable function of art to highlight and question socio-philosophical phenomena, and I believe that irony is a useful tool in doing so.

Further, my initial reservations to use digital technology as part of my artistic practice, which is evident in the two projects above, has given way to a new appeal of using digital

technology in my latest project *Digital Communication* (2006). However, in contrast to *UNCAGED*, this interest is not motivated by the idea to offer new directions in how this technology might be improved, but instead to use, maybe subvert, digital media in order to question the way they affect our lives.

In *Digital Communication*, the user messages of a live, public Internet chat room are transcribed into a chat of mechanical fingers (digits). Symbolically, the infinite (∞) number of possible communicators in the virtual domain is converted to eight digital communicators in the physical space by means of a 90° rotation (∞ 8).

Each mechanical finger consists of a plastic fingernail attached to a servomotor. These constructions are fixed in front of 3D lenticular postcards, mounted on stands. The computer is monitoring the activity of a regular online chat room and converts the messages of the chat room users, letter by letter, into random positions of the servos. In this way, the fingers rapidly move to the left and the right in different intervals and, with their nail, scratch the textured surface of the lenticular postcards, producing a melody of their own language.

The messages of the online chatters are displayed synchronously to the fingers' movement on a computer screen at the centre of the installation. The eight mechanical fingers are assigned systematically to the eight most recent chatters. This means, that each time an additional user starts to chat he takes the place of the 'oldest' chatter, and so on. On the screen, the eight active chat positions are defined by a fixed text colour which corresponds with a specific finger in the physical domain.

For further illustration of this installation, please also refer to the video documentation 'Digital Communication' featured on the included DVD.

Notably, this project has been conceived and developed 'from beginning to end' in closest artistic collaboration with Cécile Colle and with technical support (software programming) by Martin Robinson.

I would like to stress that the following outline of the conceptual background for the project does not claim to be a sociological, psychological or linguistic analysis but is instead based on a very personal and intuitive contemplation by Cécile and myself of the issues at stake:

'With Internet chat, the computer has proposed to us its own mode of communication, a virtual communication. This communication seems to take its codes directly from "real" life. There are

meetings, groups are taking and losing shape, couples get together or split up, personalities are emerging, etc. ... but could one say the same about its stakes?

The construction of reduced identities is noticeable. The communicator is summarized by a username, a graphic icon or just a colour of her writing which become the only distinctions of her appearance. It seems, becoming a virtual communicator implies a kind of compressed identity inducing a notion of low definition of the characters engaged in this particular way of communication.

The one, who communicates virtually, is as anonymous as possible, or should we say unrecognizable, because the name is actually the only thing she has. Due to the absence of physical contact, she believes her vital intimacy to be protected. She is confident of being in control of her identity, managing to distribute bit by bit the information about her life, her personality.

Is this because she is convinced by the idea of a hidden “I” which cannot be touched? Or, the belief in a wholeness of personality which, once it is cut in pieces, transformed into a pixilated language and dispersed following her fancies, would doubtlessly be out of reach for the other communicators, thanks to their lack of perspective to assemble the different pieces into one single person?

Paradoxically, this controlled dispersal of information reinforces the idea that her wholeness remains indivisible and that there is always a possibility to withdraw; all the more, because of the absolute power to disappear, at any moment, by the touch of a button.

“McLuhan saw modern technologies as extensions of man. We should see them, rather, as expulsions of man” says Jean Baudrillard in *The Perfect Crime*. We noticed that it can be difficult to retain an anchor (in “physical reality”) during a connection to a chat-room; being expelled, it is not certain that this possibility to withdraw to the fortification of the self still exists. Once being swallowed up by the screen, is there still a return journey?

Considering the communicators on the Internet as autonomous entities on the other side of the screen we propose to implant a second generation of prosthesis, not McLuhan's “extensions of man” by technology, but extensions to the virtual, to force Baudrillard's “expelled” to take a body. By taking back to reality the virtual communication without ignoring its underlying nature of binary data code, we want to be faithful to a concrete understanding of digital information, and to listen, as a new language, to the translation of pure electric impulses’ (Colle and Nuhn, 2006).

I acknowledge that the above programme note is not written in an academic register and in places might be slightly obscure or ambiguous. However, I trust that our critical attitude towards digital technology, i.e. its application in Internet communication, is evident from the undertone of the programme note and, more importantly, from the nature of the installation itself. In particular, in our view, the overtly absurd idea to bring forth an embodiment of online chatters by implanting physical extensions to the computer has

to be considered as a parody of the enabling technology involved.

On the other hand, I would like to point out that this critical attitude is, at least on my part, accompanied by a sheer amazement and pleasure to watch and listen to the (melodic) chat of the fingers and its relation to the messages displayed on the computer screen. Arguably, my attraction to this 'cybernetic' dimension of the installation could be regarded as being contradictory to my critique on digital technology. However, I would like to stress that this critique is primarily directed against the, in my view, worrying 'pervasion of digital technology through our lives' (Gere, 2002, p 10), and its negative, or at least questionable, effects on an increasingly large portion of our human existence. In principle, I have no doubt about the overall appeal and potential of digital technology, and I would be hypocritical to deny it. To be more precise, in the concrete example of Internet (chat room) communication, I can appreciate the new possibilities offered by a technology which enables us to communicate in real-time with a global community. However, in my view, there is also a distressing trade-off between the benefits of this new mode of communication and its drawbacks, e.g. decrease of direct human exchange, physical isolation, loss of meaning in the information exchanged.

Due to this double-sided nature of digital technology, I think it is possible and artistically credible to question its effects on our lives, but at the same time exploit the very technology to create something perceptually enjoyable.

In this sense, then, *Digital Communication* stands for my belief that an artwork should work on several levels. That is, even if it is based on a critical idea it might nevertheless be enjoyable on a more immediate level. In my opinion, it should be ultimately up to the spectator/listener how to read the work.

Finally, to return to *UNCAGED*, surely this project was also critical towards certain mainstream employments of digital technology and intended to stimulate thought about the role of virtual media in our lives. However, as mentioned in the previous chapter, the main problem with *UNCAGED*, in my view, was its aspiration to offer new directions to make the virtual world a more humane place to engage with. By contrast, *Digital Communication* is a reflection of my present rejection of the seemingly unstoppable infiltration of digital technology in our lives. Nevertheless, I find this technology, in principle, very appealing, and this nature can be exploited 'schizophrenically' within an artistic critique of it.

Bibliography

- Baudrillard, J. (1988). *The ecstasy of communication*, NY: Semiotext(e) (original French edition published 1987).
- Baudrillard, J. (1993). *The transparency of evil*, London: Verso (original French edition published 1990).
- Baudrillard, J. (1994). *Simulacra and simulations*, Ann Arbor: University of Michigan Press (original French edition published 1981).
- Baudrillard, J. (1996). *The perfect crime*, London: Verso (original French edition published 1995).
- Baudrillard, J. (2000). *The vital illusion*, NY: Columbia University Press.
- Baudrillard, J. (2003). *Passwords*, London: Verso (original French edition published 2000).
- Baudrillard, J. (2005a). *The intelligence of evil or the lucidity pact*, Oxford: Berg (original French edition published 2004).
- Baudrillard, J. (2005b). *The conspiracy of art*, NY: Semiotext(e).
- Best, K. and Hindmarsh, J. (2004). *A report of preliminary findings from a study of visitor behaviour during the exhibition of 'UNCAGED' by Ralf Nuhn in the Museum of Childhood at Bethnal Green*, unpublished internal report, 13 pages (included in Appendix B).
- Best, S. and Kellner, D. (1999). *Debord and the postmodern turn: New stages of the spectacle*. Published online: <http://www.uta.edu/huma/illuminations/kell17.htm> (16/08/2006).
- Benford, S., Norman, S. J., Bowers, J., Adams, M., Row-Farr, J., Koleva, B., Taylor, I., Rinman, M., Martin, K., Schnädelbach, H. and Greenhalgh, C. (1999). *Pushing mixed reality boundaries*, eRENA research project deliverable, Task 7b.1, 84 pages. Published online: http://www.nada.kth.se/arena/pdf/D7b_1.pdf (27/09/2006).
- Butler, C. (2002). *Postmodernism: A very short introduction*, NY: OUP.
- Coyne, R. (1999). *Technoromanticism*, Cambridge, Massachusetts: MIT Press.
- Chion, M. (1994). *Audio-Vision*, New York: Columbia University Press.
- Colle, C. and Nuhn, R. (2006). *Digital Communication: programme note*. Published online: <http://imiteme.com/english/en-texts/en-text-dc.htm> (01/10/2006)
- Crispolti, E. (1999). 'On the creative adventure of Fontana', in Tighe, H. and Carotti, E (eds.), *Fontana*, Milan: Charta, pp 9-44.

- Davies, R. C., Rydberg Mitchell, B., Hornyanzsky Dalhom, E. and Nichols, S. (2003). 'Are you with us? The role of presence in mixed reality for participatory design', in Riva, G., Davide, F. and Ijsselsteijn, W.A. (eds.), *Being There: Concepts, Effects and Measurements of User Presence in Synthetic Environments*, Amsterdam: IOS Press, pp 150-164.
- Dallet, J.-M. (2006). 'Dejà Vue: programme note', in Bailly, J.-C., v. Belliingen, S., Carvalhais, M., v. Craenenbroeck, W., Dallet, J.-M., Delamont, I., Luyckx, F. and Wiarda, A. (eds.), *Update_1: the origin (English translation)*, exhibition catalogue, Gent: Stichting Liedts-Meesen, pp 8+9.
- Edwards, E. K., Rolland, J. P. and Keller, K. P. (1993). 'Video see-through design for merging of real and virtual environments', *Proc. IEEE VRAIS'93*, pp 223-233.
- Geluck, P. (2005). *Le chat a encore frappe*, Tournai: Castermann.
- Gere, C. (2002). *Digital culture*, London: Reaktion Books.
- Gibson, J. J. (1966). *The senses considered as perceptual systems*, Boston: Houston Mifflin.
- Grimson, W. E. L., Kikinis, R., Jolesz, F. A. and Black, P. M. (1999). 'Image-guided surgery', *Scientific American*, 280(6), pp 62-69.
- Hapkemeyer, H. (1995). 'Lucio Fontana - Arnulf Rainer: Über Grenzen', in Hapkemeyer, H. and Vescovo, M. (eds.), *Lucio Fontana - Arnulf Rainer: Über das Bild hinaus*, Wien: Folio Verlag.
- Heath, C. and v. Lehm, D. (2002). 'Misconstruing interaction', *Proc. Interactive Learning in Museums of Art and Design '02*. Published online: http://www.vam.ac.uk/res_cons/research/learning/index.html (30/09/2006).
- Hegarty, P. (2004). *Jean Baudrillard: Live theory*, London: Continuum.
- Heim, M. (1998). *Virtual realism*, New York: OUP.
- Horrocks, C. (2000). *Marshall McLuhan and virtuality*, Duxford: Iconbooks.
- Ijsselsteijn, W. A. and Riva, G. (2003). 'Being there: The experience of presence in mediated environments', in Riva, G., Davide, F. and Ijsselsteijn, W. A. (eds.), *Being There: Concepts, Effects and Measurements of User Presence in Synthetic Environments*, Amsterdam: IOS Press, pp 4-14.
- Ishii, H. and Ullmer, B. (1997). 'Tangible bits: Towards seamless interfaces between people, bits and atoms', *Proc. CHI '97*, pp 234-241.
- Ishii, H., Mazalek, A. and Lee, J. (2001). 'Bottles as a minimal interface to access digital information', *Proc. CHI '01*, pp 187-188.
- Koleva, B., Taylor, I., Benford, S., Fraser, M., Greenhalgh, G., Schnädelbach, H., vom Lehn, D., Heath, C., Row-Farr, J. and Adams, M. (2001). 'Orchestrating a mixed reality performance', *Proc. CHI '01*, pp 38-45.

- Luciani, A., Urma, D., Marlière, S., Chevrier, J. (2004). 'Presence: the sense of believability of inaccessible worlds', *Computers and Graphics*, 28(4), pp 509–517.
- McEvoy, J.P. and Zarate, O. (1999). *Introducing quantum theory*, Duxford: Icon Books.
- McLuhan, M. (1994). *Understanding media*, Cambridge, Massachusetts: MIT Press (original work published 1964).
- Medosch, A. (2005). *Technological determinism in media art*, MA thesis, Brighton: Sussex University.
- Milgram, P., Kishino, F. (1994). 'A taxonomy of mixed reality visual displays', *IEICE Transactions on Networked Reality*, E77-D(12), pp 1321-1329.
- Moravec, H. (1998). 'The senses have no future', in Beckman, J. (ed.), *The virtual dimension: architecture, representation, and crash culture*, New York: Princeton Architectural Press, pp 84-95 (original work published 1997).
- Negroponte, N. (1995). *Being Digital*, London: Hodder and Stoughton.
- Nuhn, R., Eaglestone, B. M., Ford, N., Moore, A. and Brown, G. (2002). 'A qualitative analysis of composers at work', *Proc. ICMC '02*, pp 572-580.
- Rogers, Y., Scaife, M., Harris, E., Phelps, T., Price, S., Smith, H., Muller, H., Randal, C., Moss, A., Taylor, I., Stanton, D., O'Malley, C., Corke, G., and Gabrielli, S. (2002). 'Things aren't what they seem to be: innovation through technology inspiration', *Proc. DIS '02*, pp 373-379.
- Scruton, R. (2001). *Kant: A very short introduction*, NY: OUP.
- Shanken, E. (1996). 'Jeffrey Shaw's Golden Calf: Art meets Virtual Reality and religion', *Leonardo Electronic Almanac*, 4(3). Published online: http://www.leoalmanac.org/journal/Vol_4/lea_v4_n03.txt (23/09/2006).
- Syamken, F. (1997). 'Fabrizio Plessi: Liquid Time', in Klotz, H., *Contemporary art: the collection of the ZKM | Centre for Art and Media Karlsruhe*, München: Prestel.
- Tate Online Glossary. *Neo-Geo*. Published online: <http://www.tate.org.uk/collections/glossary/definition.jsp?entryId=189> (30/05/06).
- Trini, T. (1988). 'The last interview given by Fontana', in *Fontana*, exhibition catalogue, Amsterdam: Stedelijk Museum, pp 34-36 (original text published 1972).
- Turner, J. S. (2004). 'Gaia, extended organisms, and emergent homeostasis', in Schneider, S. H., Miller, J. R., Crist, E. and Boston, P. J. (eds.), *Scientists Debate Gaia: The Next Century*, Cambridge, Massachusetts: MIT Press, pp 57-71.
- Turkle, S. (1995). *Life on the screen*, NY: Simon and Schuster.
- Warnock, M. (1994). *Imagination and time*, Oxford: Blackwell.
- Weber, J. (2003). *Umkämpfte Bedeutungen: Naturkonzepte im Zeitalter der Technoscience*, Frankfurt/Main: Campus.

Wood, G. (2002). *Living dolls*, London: Faber and Faber.

Appendices

Appendix A:

Transcript of the display notes for the six *UNCAGED* exhibits, as featured in the exhibition at the V&A - National Museum of Childhood during May and June 2004.

A.1

Blow Life, 2003-2004

Ralf Nuhn with Jey Malaiperuman

Cover the hand image with your own hand to activate the fan. Keep your hand in place until the fan stops blowing. Now you will see your “lucky number” encrypted into a barcode.

Blow Life is reminiscent of a fortune telling machine often found at funfairs. The exhibit playfully addresses the threatening notion of an Orwellian world where an individual’s identity is reduced to a barcode number.

A.2

Bubblelabub, 2003-2004

Ralf Nuhn

Squeeze the tube with your hands to animate the person on the screen. The harder you squeeze the stronger the response.

Contrary to the exhibit *Blow Life*, where the airflow of a fan triggers movements on the screen, *Bubblelabub* creates the illusion that air generated within the virtual domain can transfuse into the physical world.

The title *Bubblelabub* is derived from the German expression “Pappelapap” which means to talk nonsense. To some extent this exhibit addresses our difficulties to communicate with computers in a meaningful and satisfying way.

Special thanks to Kira Aujla for (video) modelling.

A.3

Glitchy & Scratchy, 2003-2004

Ralf Nuhn

Like a DJ, use your fingers to turn the records on the screen backwards and forwards. The turntables will follow your movements and produce some scratchy sounds. Use the left or the right button in the front of the screen to repeat your most recent scratching pattern.

Rather than bridging the gap between the virtual and physical world, *Glitchy & Scratchy* seems to highlight the distance between the two. Of course, it can be a funny and interesting experience to

interact with this exhibit but at the same time it would be easier and more precise to scratch the real records in the traditional DJ way.

A.4

Square Pusher, 2003-2004

Ralf Nuhn with Jey Malaiperuman

Throw the square towards the top of the screen using your finger.
If you hit the top centre of the screen, you will earn a “100 point” bonus!
When the square bounces off the bottom of the screen you will notice its heavy weight.

The vibrations and sounds synchronised to the square’s animation imply a materialisation of the virtual image and create the illusion of the square being a heavy physical object.
Square Pusher could be regarded as a modern version of the familiar fun fair game *Ring-the-Bell*.

A.5

PONG (telesymbiotic version), 2002-2004

Ralf Nuhn

Press the red button to view a demo version of the game.
Press one of the white buttons to start the game.
Activate the hammers next to the screen by pressing the right or left button when the ball reaches the respective edge of the screen.
As shown in the demo version, you have to hit the ball just at the right moment to keep the ball in play.

Pong is based on the renowned early video game with the same name.

A.6

Not only Jingle Bells for two Spuikars and other Players, 2002-2004

Ralf Nuhn with Cécile Colle and Richard Thomas

Touch a button on the screen to activate the exhibit.
The top three buttons will start and automated tune.
When you press the bottom button you will see an orchestra of idle musicians.
Now you can compose your own tunes by touching the musicians with your finger.

Originally this installation consisted of only two “Spuikar” string instruments playing the tune Jingle Bells. The name “Spuikar” is composed of the words speaker and guitar and refers to the hybrid nature of the instruments made from loudspeaker and guitar components.

The set-up of silent on-screen animations, accompanied by a live orchestra, is very similar to early cinema projections and the work of folio artists where sound is created in real-time, synchronised to silent images.

Appendix B:

Unpublished internal report of preliminary findings from a study of visitor behaviour during the exhibition of *UNCAGED* at the V&A - National Museum of Childhood, by Katie Best and Jon Hindmarsh.

Please note: Page numbers inside black page frames are from the original text and are those used for referencing in the main text of this thesis.

A REPORT OF PRELIMINARY FINDINGS FROM A STUDY OF VISITOR
BEHAVIOUR DURING THE EXHIBITION OF 'UNCAGED' BY RALF NUHN
IN THE MUSEUM OF CHILDHOOD AT BETHNAL GREEN

Katie Best and Jon Hindmarsh
Work, Interaction, and Technology Research Group
King's College London



6th December, 2004.

INTRODUCTION

This report presents the preliminary findings from a study of visitor behaviour during the exhibition of **UNCAGED** in the Museum of Childhood at Bethnal Green. The findings are based on the analysis of 25 hours of video-recordings collected around three **UNCAGED** exhibits over five different days in May and June, 2004. The report focuses on how visitors' organise their collaborative exploration of exhibits; the use of textual labels by visitors to inform their exploration of exhibits; and a consideration of the ways in which visitors approach and make sense of the touch-screen elements of the exhibits. We did not undertake any interviews with visitors and therefore are not able to include visitor comments or feedback on the exhibition.

The study was undertaken as part of a programme of research on visitor behaviour within an EU-funded project called **SHAPE** (Situating Hybrid Assemblies in Public Environments; www.shape-dc.org). The project, which is now complete, included a series of studies of social interaction in museums and galleries in order to inform the design and development mixed reality, interactive installations. These studies have included research in a diverse range of museums and galleries including the V&A, Tate Britain and Tate Modern, The Horniman Museum, the Courtauld Gallery, The Science Museum, explore@Bristol, The Hunt Museum in Limerick, Nottingham Castle, The Technical Museum in Stockholm, and others. Through this research, we have identified particular concerns with how gallery visitors encounter, explore, and discuss interactive exhibits. To study the work of Ralf Nuhn was particularly appealing as his work explores the boundaries of the physical and the digital in extremely distinctive and evocative ways. We were keen to examine therefore how visitors would confront and explore his exhibits.

'UNCAGED' by Ralf Nuhn

UNCAGED constitutes a series of six "telesymbolic" installations that explore seeming transitions between computer-based digital environments and surrounding physical objects and environments. They encourage and invite visitors to playfully explore these transitions and relationships and a common feature to many of the exhibits is the use of touch-screens as a focal point for hands-on engagement. To quote the artist, the exhibition "... is motivated by the idea to 'uncage' computer based realities from the confines of their digital existence and to bring the remote computer world closer to our human experience. In particular,

UNCAGED opposes the idea of immersive virtual environments, where the physical world is excluded from the participant, but instead attempts to situate the virtual domain within the physical world. At the same time, UNCAGED aims to highlight the distance between the two domains.”

METHODS

We used contemporary qualitative research approaches in the social sciences to gather and analyse the data for this study. In particular we collected audio-visual recordings of naturally-occurring visitor conduct during a four-week period in May and June 2004. We collected the data using a camcorder, mounted on a bracket or tripod close to selected exhibits. This provided an elevated view of the interactions emerging around the work. In addition a radio microphone, placed on the exhibit itself, allowed us to collect good quality recordings of what was said about and around the work. The camera and microphones were clearly visible and notices were displayed to emphasise that we were recording visitors. The notices stressed that the recordings are only to be used for teaching and research purposes and that we were on hand to turn the camera off if a visitor did not want to participate. It should be noted that no-one objected to filming.

Around 25 hours of video footage was collected around three of the six exhibits. These data were initially reviewed in full and interesting clips were selected for further analysis. Detailed transcripts of these clips were then created, which mapped out the talk and visual conduct of visitors in interaction with each other and their orientation to surrounding artefacts (e.g. exhibit components, labels, etc.). In keeping with our broader research programme, we paid particular attention to social interaction between groups of visitors.

We selected the three exhibits on which to focus, in part due to practical matters of ease of recording, but also because in many ways they were the most complex and therefore we felt that they might be most likely to encourage extended amounts of visitor participation and engagement. The three chosen exhibits were:

- **Square Pusher:** visitors 'push' a digital square displayed on the touch-screen. They attempt to make it 'hit' the top centre of the screen and if they succeed they attain a '100 point bonus' and a bell rings (as with old-fashioned 'ring-the-bell' fairground games). After rising the square comes back to 'earth' and when it 'hits' the bottom of the screen, there is a banging sound and the table vibrates in time with the square coming to rest. It gives the illusion that the immaterial square is a heavy physical object.
- **Not Only Jingle Bells for Two Spuikars and Other Players (hereafter ...Jingle Bells...):** four buttons, displayed on the touch-screen, are available for visitors to press. The top three play an automated tune on the instruments exhibited in the case. The last one allows the audience to control an 'orchestra of idle musicians' – they can trigger different instruments and compose their own tune using a new assembly of buttons displayed on the touch-screen.

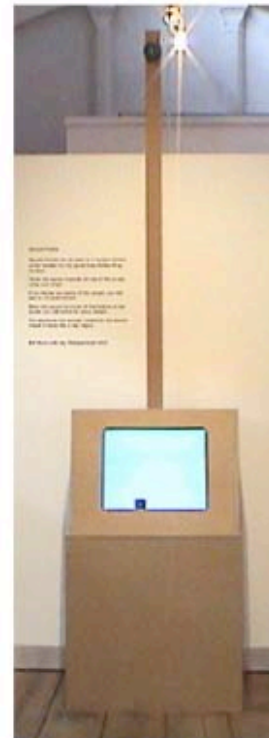


Figure 1: *Square Pusher*
(Image courtesy of the artist)

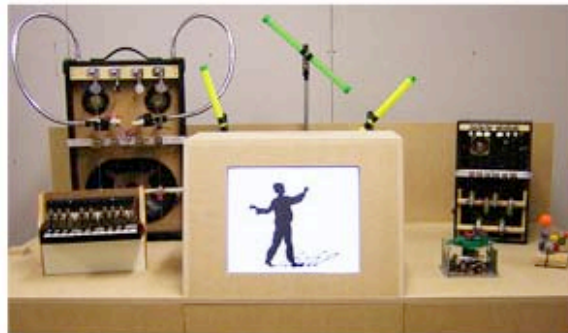


Figure 2: *...Jingle Bells...* (Image courtesy of the artist)

- **Glitchy & Scratchy:** visitors can 'scratch' two records displayed on a screen. These digital displays control real records located to either side of the touch-screen so that they begin to spin in time to the movements of the digital records created by the visitor. This creates the soundtrack that is played through speakers. Two buttons are located in front of the touch-screen which enable visitors to record and play back their own attempts at DJ-ing.



Figure 3: *Glitchy & Scratchy* (Image courtesy of the artist)

PRINCIPAL OBSERVATIONS

Galleries often request that visitors '*do not touch*' exhibits. Therefore to observe the use of interactive artworks can often be frustrating as audiences are not used to the possibilities for 'hands-on' participation and are cautious and tentative. However the interactive ethos evident throughout the Museum of Childhood provides an excellent location for a highly interactive work such as *UNCAGED*. Our analysis of the piece focuses around three principal issues: the collaborative exploration of exhibits; the use of supporting textual labels and the ways in which visitors approached the touch-screen elements of the exhibits.

Collaborative Exploration

The majority of the exhibits within *UNCAGED* are designed to be directly manipulated by one person at a time. However, those who visit in groups frequently collaboratively explore and engage with the exhibits.

- **UNCAGED Problem-Solving:** The relatively curious and unusual character of UNCAGED, coupled with the strange relationships between the digital and physical features of the exhibits routinely led to people trying to figure out the exhibits together. This led to a great deal of discussion, debate, and interaction between visitors. For example, those interacting with the *Idle Musicians* function on ..*Jingle Bells*.. frequently end up discussing amongst themselves and with strangers which instruments they are controlling by pressing particular on-screen buttons.

- **Organising a Division of Labour:**

Visitors who explore exhibits together tend to organise a division of labour at the exhibit-face. For example while one engages hands-on with the exhibit, the other advises on what to do or reads out information from the label. These roles do not remain fixed, but people switch around as they continue to explore.



Figure 4: *Glitchy & Scratchy* - Mother reading out the label as the daughter 'scratches' the digital decks

- Example: A girl of about thirteen approached *Glitchy & Scratchy* and immediately asked her mother "what's this?". It was apparent that neither had seen it before. By asking this question, the mother was set the task of determining how to operate the exhibit. She took on a facilitating role (see Figure 4) whilst the daughter started to play with the decks.

- **Creating Competition Around a Game:** Some of the UNCAGED exhibits were designed to evoke 'game-like' characteristics. For example, *Square Pusher* resonates with the traditional 'ring-the-bell' fairground game. Interestingly visitors do not treat this as simply a game for individuals, but take turns and begin competing against each whilst simultaneously sharing tips on how to improve their 'performance'. They create ad hoc competitions around the game. As only one person can play at a time, visitors create a game, where the target is for each individual in the group to ring the bell. Participants take it in turns, often giving up before they have succeeded. The way in which they step away from the exhibit or the comments that they make when doing so often suggest who might

take the next turn, if there is more than one potential candidate. For example one participant's comment 'you have a go, mum', is an obvious way of structuring who plays next. Alternatively, and less obviously, visitors would step away in a fashion that blocks one person but leaves another free to step in to play (Figure 5). People would frequently play for some time and not leave the exhibit until all participants had rung the bell.



Figure 5: Three *Square Pusher* 'players' rearrange themselves around the exhibit

- **'New Players' at *Square Pusher*:** Games at *Square Pusher* would be curtailed if other visitors approached and waited to have a turn. The presence of strangers seemed to exert a pressure to exit on the participants very quickly. We have seen from previous research, that potential participants are often attracted to an exhibit precisely because other visitors are already 'using' it and enjoying it. Interestingly therefore action at the exhibit encouraged strangers to approach, but the knock-on effect was that the existing 'players' would move off fairly soon after – thus the new players shortened the very activities which initially attracted their attention.

Labels

In the light of the emergence of hands-on exhibits and computer-based artworks, labels in museums are increasingly required to serve a wider variety of functions. Whereas in relation to 'static' exhibits (e.g. a painting or sculpture), labels are often designed to provide basic interpretive resources, labels accompanying more 'interactive' exhibits often must also provide instructions on how to 'work' the exhibit. The ways in which visitors interrelated the labels with the exhibits we found of particular interest in the study.

- **'Text Echoes' – Instruction not Interpretation:** Frequently, visitors are heard to recite passages from the label (this is termed a 'text echo' in the visitor studies literature). In our

transcripts, we see frequent examples in which passages of the label have been quoted verbatim by gallery attendees to their co-visitors, as a way of explaining how to operate the exhibit in question. This was frequently the case with *..Jingle Bells..* which does not immediately suggest how it should be operated. In a number of cases, the first line, 'Touch a button on the screen to start the exhibit.' is relayed by one visitor to another, who is interacting with the exhibit directly, and this was then used to inform the use of the piece. It is interesting to note that whilst the preliminary 'instructional' elements of the labels are routinely read out to co-visitors, the latter 'interpretive' elements are very rarely read out and almost always in the light of difficulties understanding the instructional parts. Moreover (and maybe relatedly) discussions of the broader significance of the work (e.g. with regard to the relationship between the physical and the digital) were extremely rare.

- **The Parents' Practical Problem:** In adult-child interaction the label is often consulted at very particular moments of the visits. When children approached an exhibit they would routinely ask their adult co-visitors questions like 'what's this?' or 'how does this work?'. This encourages a division of labour in which the adult is given the role of 'discovering' how to operate the exhibit, and the child engages in more hands-on exploration. In response to these sorts of questions, adults would immediately turn to the label for help and would start to read out instructions in small chunks.
- **'Text Echoes' Informing Action:** The instructions on *Square Pusher* are very frequently applied successfully to use of the exhibit. The expression '100 point bonus', lifted directly from the sign (see Figure 6), appears regularly in conversations, forming the basis for the competitions established by many groups of co-visitors. Whilst *Glitchy & Scratchy* is a more complex set-up, those who are unsure of how to operate it on first approach often read the sign and then demonstrate a higher level of understanding. One participant had the sign read to them and having heard 'Like a



Figure 6: A Woman Reads Out "100 Point Bonus" From the *Square Pusher* Label

DJ...', they began to impersonate a DJ, bobbing their head and bending their knees, perhaps demonstrating that comments contained by a sign, above and beyond instruction, can alter engagement with the piece.

- **Reading Labels 'Out Of Context' Part 1:** The context in which the label is read is very important to how successfully the information is used to interact with the exhibit itself.

For example, ...*Jingle Bells*... has a label that assumes that you will approach the machine with the first screen showing. If this is not the case, then the opening line, 'touch a button on the screen to start the exhibit', becomes the focus of much visitor confusion, because the visitors are trying to find the 'buttons' on the screen when there are none showing. Additionally, visitors who do



Figure 7: A Mother and Daughter Have Difficulty Working ...*Jingle Bells*...

approach the exhibit with the first screen on display and begin to read the sign often touch a button immediately after reading the first line, and then, upon reading further, discover that there are consequences to this choice. They often wait for the buttons to return to the screen so that they can have a turn on *Idle Musicians*. Occasionally, touching an active screen is coincidentally timed with actions from the instruments or movement on the screen. Visitors then believe that they are exerting some control over the instruments chosen to play particular notes or the images appearing on screen, leading to some confusion about how they may be controlling it and how they might continue to do so (Figure 7).

- **Reading Labels 'Out Of Context' Part 2:** It was noted earlier noted that when adults and children approach an exhibit together the adult is often placed in the role of 'explainer' whilst the child starts to physically explore the exhibit. However by the time the adults had read an appropriate section of the label the children were often very much engaged in 'playing' with the exhibit. Therefore the adults then tended to attempt to strictly structure the child's activities in order to get them to follow the instructions from the labels. Directions such as 'stop doing that for a moment' often featured heavily in these sequences.

- **Labels and Sound:** One frustration that often emerged for visitors exploring *..Jingle Bells...* was that they could not hear the sounds and the tunes particularly well (maybe due to the acoustics in the hall?). Therefore they would have difficulties relating label instructions to features of the exhibit – they simply could not hear what was happening and therefore had difficulty making sense of the instructions. This often meant that they would consider the exhibit broken or simply give up in their attempts to figure it out.

Touch-screens

Touch-screens are an increasingly prevalent feature of the modern museum experience – whether as part of an information kiosk or an interactive exhibit. Their use as part of the UNCAGED exhibition is highly innovative and they formed a core component of all three of the exhibits that featured in this study.

- **The Compulsion to Touch:** As visitors approached the exhibits, they frequently seemed to be aware that the exhibits required some form of physical manipulation to ‘work’ and in particular that this would take the form of touching the screen. This may be due to any number of reasons (they recognise them as touch-screens, they have seen others using them, have used them on other exhibits already, etc.). Whatever the case, as many visitors approach the exhibits, they immediately begin to configure one hand (or sometimes two in the case of *Glitchy & Scratchy*) to be able to touch the screen as soon as they reached it. This may involve transferring carrier bags to the other hand (*Figure 8*), or placing the hand in front of their body to ‘reach’ the exhibit first. Unfortunately with *..Jingle Bells...* the compulsion to touch the screen before reading the label would have knock-on effects, i.e. in setting the exhibit in motion, the label would be read out of context (see above) and confusion would develop.

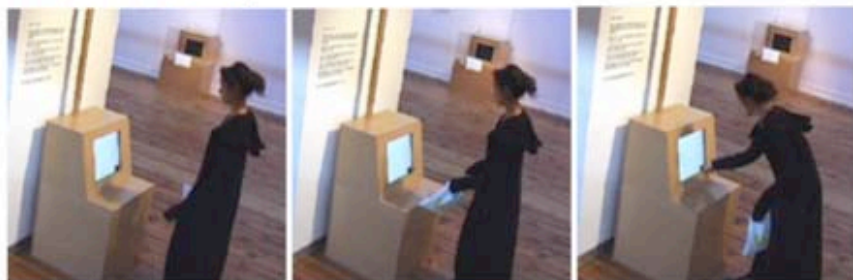


Figure 8: A Woman Moves Her Bag From Hand to Hand To Touch the *Square Pusher* Touch-Screen

- **Forms of Touch:** The ways in which on-screen material is configured alters the way in which people use their hands to manipulate the screen. *Square Pusher* uses a small square, and so participants arrange their hand in a way that fits within the square. Those using *Glitchy & Scratchy* configure their hand and arm in a way allowing them to move the record backwards and forth. In addition, this is frequently comparable to the ways in which a real DJ might use their hand; this may be due to either the similarity of the task or a tendency to 'mimic' a DJ. Problems often encourage individuals to alter the types of hand configurations they are using to achieve success. *Square Pusher* users frequently alter their configuration, seeing it as directly related to potential success at achieving the bonus. Conversely, others' success often encourages activities which copy those of others, creating 'behaviour echoes'.
- **Screen Visibility:** Frequently, when screens are placed within galleries, they are located in such a way that other participants cannot see the action occurring on screen. This can prove cumbersome for social interaction where it becomes problematic for co-visitors to show and see the action on the screen. In contrast, the positioning of UNCAGED screens was excellent. The screens used in *..Jingle Bells...* and *Square Pusher* seem particularly well-located and angled to allow a relatively high number of observers to continue see the action and to comment on that action (see Figure 9).



Figure 9: A Family Assemble Around the *Square Pusher* Touch-Screen

Issues and Implications

The data collected during the observation period at the Museum of Childhood reveals a number of very interesting features regarding interaction with and around the exhibits in the UNCAGED exhibition. Whereas many pieces of interactive art fail to engage their audience by being overly complex or badly explained, or situated in institutions which normatively seem to discourage hands-on engagement, much of the interaction we recorded in the Museum of Childhood could be deemed successful. They supported playful engagement with complex technologies – a rare feat in contemporary museum. Moreover the exhibits supported

and encouraged many forms of participation and gave rise to numerous forms of innovative engagement (e.g. the development of multi-party games around *Square Pusher*; the imitation of DJ-ing in *Glitchy & Scratchy*, etc.).

Whilst this report focuses mainly on describing aspects of visitor engagement with three of the UNCAGED exhibits, the research does seem to suggest some potential and general design implications:

- **Designing for Collaboration:** A key feature of the museum visit is that visitors often come with others. Therefore it is critical for design work to take into account the fact that visitors *will* discuss, explore and use exhibits together. With traditional art this is relatively unproblematic as the role of the visitor is only as 'spectator' and all members of a group can take on this role together. With more interactive exhibits, the visitors adopt different activities (hands-on engagement, explainer, spectator, etc.). The design should take into account how visitors might organise a division of labour around the exhibit and consider how to make use of this aspect of co-visiting.
- **Designing Labels to be Read Out to Others:** Often labels are produced on the assumption that one person will read the label and then engage with the piece. However we have seen here how visitors: i. routinely read out the label to inform someone else how to act; ii. therefore often read the label out in small chunks and get their co-visitor to act at the end of each chunk; iii. rarely read out the later interpretive elements of the label. The design of labels might well consider how to exploit these aspects of reading behaviour.
- **Designing Labels for Dynamic Displays:** It is important to design labels in a way that recognises the dynamic nature of an interactive exhibit and which allows for an intelligible reading at all the temporal stages of an exhibit. The label should not require the screen to be displaying one particular set of screen information. Indeed it might be worth exploring the potential of dynamic labels in these cases.
- **Recognising and Designing for the Compulsion to Touch:** Given that individuals (especially children) frequently (if not routinely) touch touch-screens as they first approach an exhibit and before reading the labels, there is the need to design instructional labels with this in mind. Or alternatively to collapse the instructional elements of the label somehow into the touch-screen itself.
- **Positioning Screens for Multiple Participants:** Many museums and galleries have much to learn from UNCAGED about the successful placement and positioning of touch-

screens both to afford visibility of action for a number of co-visitors and to facilitate the involvement of children.

End Note

In terms of the research reported here, it may be worth noting that we are currently working up an academic paper concerned with the use of labels alongside exhibits. The paper will draw on these data, as well as recordings collected in one other museum, and will include more in-depth discussion of various issues raised here. We will distribute this piece in the New Year.