

Affective Creative Spaces: the interactive tent and the illusion of being

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Abstract

We present descriptive models of the three dimensions of experience, and of the creative process supported by information technology through the development of *Creative Spaces*. We then focus on an example Creative Space – *the Interactive Tent* – which is an immersive environment designed to stimulate creativity and to support non-symbolic communication. We use the medium of an artistic production – *The Illusion of Being* – to exemplify our theoretical and technological approaches through the elicitation of affective responses in immersants. We suggest that the successful generation of desired emotional responses depends on a combination of art and technology and cannot be reduced to a set of design guidelines.

Keywords: creativity, communication, synaesthesia, content

1. Introduction

The main motivation for our work is the insight that current uses of information technology - in working and everyday life – often reduce the cognitive space in which people can be creative. Our main aim is to redress this situation by developing virtual and mixed-reality *Creative Spaces*, in which novel ideas can be generated, manipulated, examined, stored, recalled, and reflected upon. An important aspect of creative spaces is the stimulation of a variety of affective states.

Anecdotally, creative thought arises in three typical locations (the 3 Bs): bath, bed and bus (Boden, 1992). What is common to these three is that the thinker is isolated from usual channels of communication, work environments, and co-workers or friends. There are also patterns of sensory stimulation in creative situations that are unlike the normal office work environment. We thus tend to be least creative when we are at work with others, or whenever we have the right conditions for innovation and implementation – such as the availability of devices for communicating and critiquing new ideas. Ironically, recent portable and even wearable IT may well mean that we become as unlikely to have original ideas when out of our work environment as when we are in it.

Our approach is based on a modular, process-based approach to supporting personal creativity in a variety of settings, including the normal working office environment. It is founded on the idea that information technology can be used to provide tools for creativity, if we take seriously both individual psychological and social aspects of the processes of creative idea generation and innovation. One of the developments in IT that makes this possible is the move towards the concretisation of information, through multimedia and multimodal systems including virtual realities. These technologies permit a more affective, physical, and less abstract, style of interaction with information presented in apparently concrete forms, as compared to earlier technologies requiring essentially abstract and linguistic forms of interaction. In addition to personal creativity, we also consider the way in which recent technology can be used to support new forms of communication, which we term *Perceptually-Seductive Communication* (Waterworth and Waterworth, 2000a).

1.1 Virtuality and the Three Dimensions of Experience

Virtual and mixed reality environments can produce vivid experiences and generate powerful emotions. Our research is concerned with how this potential can be utilised in the design of *creative spaces* – environments to support human creativity, experience and reflection. Within the overall aim of supporting creativity, we are experimenting with the factors that determine the nature of subjective experiences within such environments. Our current approach is based on a three-dimensional model of experience, comprised of *locus*, *focus* and *sensus* (Waterworth and Waterworth, in press).

Locus captures the extent to which the observer is focused on the real world or a modelled model. Focus describes the nature of the user's attention, specifically whether they are attending to currently present stimuli

(from the real or virtual world) – in which case they will experience a feeling of *presence* – or are attending to information which is not currently present in the real or virtual environment. The former can be characterised as perceptual (or concrete) processing, the latter as conceptual (or abstract) processing. We refer to this latter, reflective state of mind as *absence*. Finally, the sensus dimension refers to the level of attentional arousal of the observer, and ranges from awake and alert to asleep and totally unconscious (see Figure 1). Please refer to Waterworth and Waterworth (in press) for more details of the model and its application.



Figure 1 – The 3 Dimensions of Virtual Experience

1.2 What is Creativity and How Does it Arise?

In this paper, *creativity* refers to the process by which original ideas arise in the mind of an individual. Boden (2000) differentiates between two different kinds of creativity, Pcreativity (P for psychological) and H creativity (H for historical). Pcreativity is an idea that is novel to the mind of the individual only while H-creativity is when the idea is novel in the whole of human history (as far as anybody knows). This indicates that P-creativity is more fundamental than H-creativity, and that H-creativity is a special case of P-creativity. We are primarily interested in stimulating the creativity of the individual in his or her everyday settings.

When an original idea is modified or developed in a group setting, which often involves a judgment against shared norms or constraints, this is referred to here as *innovation*. And when an idea is carried forward and put into actual practice, this is referred to as *implementation*. So, as the terms are used here, creativity is usually a personal matter, innovation is often a group matter, and implementation is generally a group or organisational matter. Most studies of the field can be understood in these terms.

Clearly, if a creative idea is going to have any real effect in the world it needs to be moved to the stage of implementation. To produce that overall effect we need to support the individual in the generation of new ideas, and appropriate groups in their implementation. Here, we focus mostly on supporting the individual in generating and reflecting on creative ideas. This is done in terms of a process model, parts of which are also relevant to the innovative development of creative ideas by teams.

Boden (1995) makes the point that human (and machine) creativity arises from the paradoxical blending of freedom and the application of constraints. Freedom to generate alternative possibilities, unhindered by practical considerations, must be combined with later reflection on how well the possibilities match practical constraints. These two phases must be kept separate. Boden's view echoes evolutionary ideas in biology, such as Monod's (1971) characterisation of evolution as the result of chance alternating with necessity in a given environment. More recently, evolutionary ideas on creativity have been extended into the realm of culture and the creation of novel artefacts.

West (2000) provides a useful summary of what is known about creativity and innovation at work. In line with the definition of creativity above, he sees the generation of a new idea as a cognitive process located within an individual. In general, people are at their most creative when alone, free from pressure, and feeling safe and positive. On the other hand, innovation often involves groups, and implementation is best done in teams. Innovation and its implementation often arise as a result of pressure or even threats from outside the group. We can see from this that very different conditions are needed to promote creativity versus the innovative implementation of new ideas.

Individual creativity is inhibited when others question a new idea too closely or too soon, when they make fun of an idea, or when they ignore a new idea. An individual raising a new idea is socially vulnerable and can be easily deterred from following through to the innovation stage. Implementation of innovative ideas, on the other hand, generally requires diversity of knowledge and professional background. But there should also be a high level of social integration within the group. An innovative group that does not inhibit individual creativity will be one where individuals feel safe, with little competition between members.

Dawkins (1976) first proposed the idea of memes, the cultural equivalent of genes, and others have developed the idea further (e.g. Blackmore, 1999; Dennett, 1995). Meme theory applies the genetic operations of copying, duplicating, resequencing, and mutating to ideas, tunes, objects, and other artefactual elements of differing complexity. Evolutionary creativity depends on variation, selection and inheritance (retention). Variation maps onto non-judgmental openness, while selection corresponds to the application of constraints. Retention is what remains after unsuccessful candidates have been eliminated (in standard evolutionary terms, what is retained are genetic features of organisms that survive to have offspring with the same features).

In line with the idea that freedom from normal constraints is important to creativity, Arthur Koestler (1964, reprinted 1989) points to the importance of the suspension of rational thought, and the role of the unconscious in being creative:

"The moment of truth, the sudden emergence of a new insight, is an act of intuition. Such intuitions give the appearance of miraculous flashes, or short-circuits of reasoning. In fact they may be likened to an immersed chain, or which only the beginning and end are visible above the surface of consciousness. The diver vanishes at one end of the chain and comes up at the other end, guided by invisible links."

Much earlier, Poincaré (1905) had suggested that novel combinations in the unconscious have a role in the creative process. Inspired by him, Hadamard (1945, reprinted 1996) distinguished four distinct phases: Preparation, Incubation, Illumination, and Verification (to which a fifth Revision stage is often added). These are developed further in the next section.

Shneiderman (2000) describes work to provide "user interfaces for supporting innovation", based on a four part process consisting of Collecting (learning from published work in libraries and on the Web), Relating (consulting with peers and mentors), Creating (exploring, composing and evaluating possible solutions), and Donating (disseminating results). This is a very general framework for all kinds of "creative work", but the focus is on rather mundane activities such as searching for relevant information, composing documents and other intellectual products, consulting with others, and visualising information. There is also a useful review of a few "creativity-enhancing" software tools, such as the Axon Idea Processor for producing "Mind Maps".

For an extensive survey of software (59 products at the time of writing) for "creativity and idea generation", see <http://www.ozemail.com.au/~caveman/Creative/Software/swindex.htm>. Our work is based on the conclusion that, although useful for some purposes, such software packages provide only very limited support for restricted parts of the creative process, or are concerned with general production tasks such as preparing a book manuscript for publication.

Other recent authors have suggested that too much rational thought can stifle creativity and even intelligence (Caxton, 1997). De Bono (e.g. 1990) is famous for the idea of "lateral thinking" amongst other techniques that help suspend rational judgments. Part of the idea is to leave time and mental space for novel insights to develop. It is also necessary to engage and capitalise on unconscious processing capacity – to try out multiple combinations for example – because conscious capacity is so severely limited.

Another strand in understanding how creative sparks arise is the catalogue of evidence suggesting that this depends more on sensory perception and affect than on conceptual cognition. While conceptual analysis is a necessary part of developing new ideas, original insights may depend more on sensory exploration and associated emotional experience than on conceptual analysis.

1.3 Technology and the Creative Process

Waterworth (1997) pointed to the way in which new technologies, by allowing information to be experienced in a variety of vivid media and forms, expand the possibilities for creative inspiration. In other words, experiencing the same underlying information in different representations, and through a variety of sensory channels increases the range of concrete perceptions through which information is experienced. These richer perceptions may then lead to more original concepts. Some people have the natural ability to experience information through several senses at the same time, a phenomenon known as synaesthesia. Synaesthetic individuals are often associated with a high degree of creativity (Cytowic, 1989, 1995). Recent results (Kovordanyi, 1999) show that too much early conceptual interpretation by observers limits the number of alternatives that can be perceived in ambiguous stimulus forms. In other words, prior conception inhibits the variety of possible perceptions.

Systems that provide experiences of the same material in different modalities have been dubbed "synaesthetic media" (Waterworth, 1997). The idea of multiple, filtered views of an information collection (such as the WWW) was explored earlier (Waterworth, 1996; 1999). Such views may also be shared as a basis for group involvement in innovation.

A “wheel of creative learning”, including both sensory stimulation and conceptual reflection, is developed in Waterworth and Waterworth (2000b), where the importance of both perceptual presence, and conceptual absence-of-mind, is outlined.

The creative spaces we are developing correspond to one or more of the stages of a hypothesised cyclical process, which carries the individual through changes along the three dimensions of experience outlined above. The creative process is as follows:

1. Sensory stimulation (varying modal form for the same content). Here the idea of *synaesthetic media* (Waterworth, 1997) is applicable – emphasising perception rather than conception, thus inducing a strong sense of presence and emotional engagement. This will often involve a close relation to the real world (though likely to be transmogrified into different sensory channels) rather than to a modelled VR.
2. Inactivity (or HCI; but in this case, it is human-computer *inactivity*). Here the participant is encouraged, with technological assistance, *not* to focus consciously on the issues or problems under consideration. This can be done in various ways, but all involve the inducement of a calm, free-floating sense of low-level awareness. Seclusion in a personal creative space, safely open to emotions, will often support this phase.
3. Conceptual exploration (ideas in action, manipulating memetic elements). Here the strong emphasis on pure perception of 1., and the relative unconsciousness of 2., give way to more conceptual activities, such as the synthesis and evaluation of new combinations of memetic elements. The participant alternates between mild presence and mild absence as he or she explores information models in a detached way.
4. Recollection and Reflection (assessment of results against goals). Conceptual faculties are now fully engaged in a more analytic stage of the process. The participant is highly conscious but no longer feels present in the current (real and/or virtual) environment. Rather, he or she is fully engaged with concepts generated during the creative process. However, earlier phases may need to be re-experienced, through the replaying of earlier situations. This will tend temporarily to recreate the conditions of those particular phases.
5. Selection, and deletion of unwanted materials. In this stage (recall that the process is cyclical) the participant is engaged in critiquing and editing the results of earlier stages, and so feels strong absence, but is reconnected to the real world through reflecting on the feasibility of the ideas generated earlier in the process. The result of this phase may be to re-enter the process at an earlier phase.

2. In-tent: the interactive tent

In a tent we are secluded but also in touch, with nature and with ourselves. An ordinary tent can provide a meditative, relaxing environment, but also an emotionally or intellectually stimulating one. We can refresh ourselves and explore new thoughts. A tent can be a very personal and emotionally-engaging place. These characteristics guided our choice of using a tent-like structure as one environment in which to implement creative spaces embodying one or more stages of our hypothesised creative process.

The Interactive Tent (Figure 2) is an environment within which several of the stages of our hypothesised creative process can be realised. It is also a test-bed for experimenting with the nature and possibilities of experience in virtual environments. The tent has a simple and inexpensive material structure - rather like a normal tent. Video images are projected onto the outside of the tent, which is constructed from back projection material, and viewed from inside as an enveloping visual display. There is also a 3D sound system and an inlet for smells. The tent can also detect behaviour by the user, such as restless shifting of position, or movements of the chest (in breathing, for example) or of the arms (waving a flashlight around, perhaps), to control information displayed on the tent walls. We have already been using the tent to support the relaxation and sensory stimulation components of the creative process (1. and 2., above). We anticipate further applications in empathetic communication and psychosomatic control of body states (see below).

We can also manipulate, and/or allow the occupant to control, the nature of displays: to stimulate presence or absence (focus), and vary the degree of realism, effectively moving the occupant along the real-modelled dimension (locus). Exactly how the occupant interacts with the tent is also of great importance – this can be more or less conscious and deliberate. For example, if we use depth of breathing or general posture to control the display in some particular way, this has quite a different effect on the level of consciousness needed to interact than if we use arm gestures or spoken commands (in other words, these vary on the sensus dimension). The effect of varying the means of interaction is a main focus of our current research.

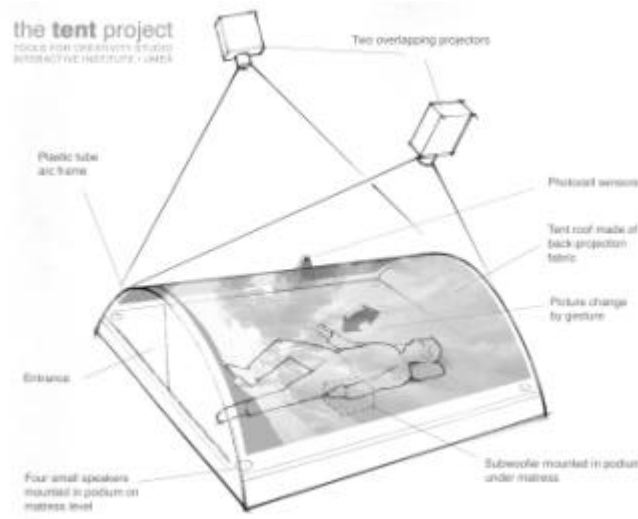


Figure 2 – the Interactive Tent

3. Con-tent: the illusion of being

When considering affective human factors, content is at least as important as the form of the interface in the evocation of emotion and a sense of presence or absence, and in our view cannot be reduced to a set of designer’s guidelines. In this section, a “production” for the Tent is described. *The Illusion of Being* is designed to allow participants to experience the three-dimensional model of experience outlined earlier, in a vivid and moving way – a way that is both experientially poignant and thought provoking. We do this by transporting the tent occupant between states of excitement and calmness, and between modes of presentation which elicit thought or direct sensory experiences.

3.1 A Cycle of Elements

In the *Illusion of Being*, the tent occupant is carried through a relentless cycle of four “elements”: snow, fire, earth, and water, as shown in Figure 3. The light (snow) – dark (earth) opposition symbolises the poles of the sensus dimension of conscious-unconscious. Both extremes of white (pure consciousness) and black (pure unconsciousness) are silent and still, whereas the other poles, fire and water, are both extremely noisy and visually lively.



Figure 3 – Cycle of Elements in *The Illusion of Being*

The other two dimensions are exercised dynamically through the behaviour of the tent occupant. In its current implementation, we use pressure and motion sensors to detect head position and degree of body movement. Moving the head up or down determines whether the elemental cycle is experienced in a concrete, perceptual way or in a more abstract version requiring conceptual processing. Moving the head to the left or right determines whether what is experienced is captured from reality or is entirely synthetic (see Figure 4).

To make this possible, we have produced four versions of the elemental “story”, which run in synchrony and continuously, although the occupant experiences only one at any one time. A shift in head position causes the presentation to change to the appropriate parallel track – real/concrete, real/abstract, virtual/concrete or virtual/abstract, which are characterised as follows:

- Real/Concrete – filmed events with natural soundtrack
- Real/Abstract – text, sketches and spoken words describing events in the cycle
- Virtual/Concrete – detailed virtual reality version, with synthesised sound effects
- Virtual/Abstract – wireframe VR with text labels and stylised synthetic sound effects

These four tracks are designed to instantiate alternative ways of being – different ways of experiencing the same underlying reality of the relentless cycle of the elements – as characterised by the focus and locus dimensions of experience. We want participants to feel emotion or engage in reflective thought, to merely relax or be highly alert, depending on the stream they are sampling. Changes in the occupant’s bodily attitude determine which stream is experienced at any given time. Additionally, if the occupant does not change position within the tent for a criterion duration, he or she slips into “the void”, where nothing is seen or heard until another significant postural move is made.

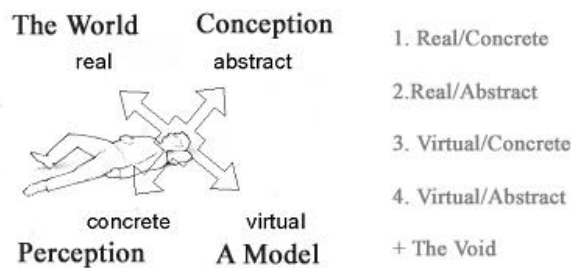


Figure 4 – Four Streams of Consciousness in *The Illusion of Being*

Preliminary trials of *the Illusion of Being* suggest that it meets the goal of providing an emotionally compelling and thought provoking experience. An interesting outcome has been that several tent occupants report psychological changes depending on which “stream of consciousness” they follow. Sometimes occupants seem to feel extraordinarily present in the environment – more so, in fact, than in the real world. We hypothesise that this is because of the combination of bodily interaction with a sense of physical and social safety, in a personal, protected world. In the Tent we can safely afford to be more present than we normally are in the world, because in the outside world we must almost always reserve some conscious capacity for reasoning about our own safety – both physical and social. Detailed results of these evaluations will be available shortly.

4. Further Applications

We are currently addressing other possible productions and applications for one or more Interactive Tents. One of our most promising current research directions is to provide what we call Perceptually-Seductive Communication (PSC). We might, for example, link two remotely located tents to provide inter-personal PSC. But we can also use the same basic technology used for the solitary tent environment to provide intra-personal PSC – to put the individual in better contact with his or her own emotions or other bodily states. Although artificial synaesthesia (providing the same information in multimodal ways) was not implemented within the *Illusion of Being*, it is an important aspect of PSC.

PSC (Waterworth and Waterworth, 2000a) is primarily concerned with intrinsic, non-symbolic forms of information exchange. These include the environmental situation in which a communicator is located (noise, change, temperature, smell, etc.), aspects of the communicator – such as restlessness, rate and depth of breathing, position of parts of the body, eye gaze, etc., and also paralinguistic features such as rate of speech, dynamics and articulation (whether loud or soft, smooth or jerky, etc.), pitch contours and other prosodic features.

PSC is not concerned with the symbolic content of any speech or gesture; there is no attempt made to understand the meaning of the communication. Any interpretation is left to the communicators; the technology *mediates* but does not attempt to *understand*. Shifting the modality of information allows us to *convey* intrinsic

information without having to *simulate* it, and thus to use relatively low bandwidth. We take intrinsic features, transform them and display them – either locally or at any distance.

In this way, we not only experience and experiment with particular affective virtual spaces; we also share the experience of being there. We effectively create a shared space for two or more participants. Our intention is to use such extended creative spaces to explore interpersonal aspects of the creative process. Applications of PSC include any situation where it is desirable to convey the state and situation of another person even though they are not present, and situations where it is desirable to broaden a person's awareness of their own bodily states or behaviours. We list some current directions for research on PSC below.

4.1 Intimacy while Apart

Two lovers, separated by an ocean but each in a Tent, can share an intimate experience while apart. A scared child alone in a distant bedroom can be comforted by an ambient display that includes the smell of his mother. Conversely, anxious parents can have a dynamic ambient display of baby's state projected on the ceiling of the living room, so that they would be peripherally aware of any disturbance to normal sleeping patterns. We can also use PSC to put back cues, in modified form, to low-bandwidth media such as e-mail and telephone calls.

Affective e-mail, for example, would allow context to be added without trying to duplicate reality, and so the data transfer demands could be kept realistically low. Imagine affective e-mail, where the sender records a PSC file while composing a mail, attaches it to the message, and then the receiver can (in some senses!) experience the sender's state and situation as an ambient display while reading the mail.

The idea of communicating non-symbolic "intrinsic" information (sometimes alongside symbolic information like speech and images) is fun because it is common across different people (even across different mammals!) and, when people interact in this way, the non-symbolic will soon become symbolic, in interestingly unpredictable ways.

Our initial trials of PSC are with two Tents, one in Northern Sweden and the other in Southern Africa. Our occupants are thus separated by huge geographical and cultural distances, but are conveniently within the same time zone. When the Tents are empty, they display the reality at the other end, in altered form. But when occupied, the immersants affect the process in a distant-biofeedback sort of way - my situation is projected to you, but this changes your experience which is projected back to me, which changes my experience, and so on. This plays with the idea of "being" - being here, being there, being in both places at once, or "being in transit" – the original meaning of "psyche".

4.2 Special Needs

Particularly useful applications of PSC are in supporting people with special needs. The most obvious are in facilitating interpersonal communication, in person or over the telecommunications network. Imagine a wheelchair-bound person who can only speak via a synthesiser controlled from an adapted keyboard by means of a head-mounted pointer. Existing approaches have used physiological indicators to control modulation of the output speech, but this may already be too late for a viable conversation to be established. Producing the desired utterance is at all times a difficult and fairly slow process, but especially so when the user becomes emotionally agitated.

A PSC system used in such a situation might detect and convey the following information:

- this is a dark, hot, noisy place (a difficult context to produce a message) – conveyed perhaps as a busy visual pattern with a deep rhythmic sound beat.
- I am agitated, and I am doing something (this is important to me) – conveyed perhaps with rapidly pulsating, multiplying stars.

The receiver might then infer (not necessarily consciously) that he should wait for a message.

Adding visual displays, related non-linguistically to the sender's affective state, to existing assistive technology could establish PSC between the participants from the outset of their interaction.

PSC can also be used intra-personally, to make people more aware of their own body states and actions, and increase the potential for self control. Suitable applications include recovery from heart attacks, stress management, and anxiety disorders of various kinds.

5. Conclusions

The Tent provides a novel environment for seclusion and to experiment with perceptually-seductive communication. Within the Tent, non-symbolic interaction and information exchange can be used both to stimulate personal creativity and to provide the possibility for a rare intimacy in electronic communication. Our research method includes the creation of artistic productions that combine theoretical ideas with technological innovation to elicit affective responses in those who experience them. We suggest that the successful generation

of desired emotional responses depends on such a combination of art and technology and cannot be reduced to a set of guidelines for human factors designers.

6. Acknowledgements

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