The Exploratorium:
An Environment To Explore Your Feelings

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ABSTRACT

The Exploratorium is a virtual environment within which immersants can explore both places and feelings. The "narrative" it implements is structural/architectural rather than linear/story telling. Different areas of the Exploratorium present different experiences: scary, normally busy, or very calm. At the same time, the Exploratorium as a whole is fundamentally safe, a self-contained play area. Immersants are free explore the different areas, under their own control. Navigation is by means of the Body Joystick, using only breath and balance. Using balance for movement and turning feels natural, like riding a bike, flying, or skating. Using breath control maps naturally onto vertical navigation, as in diving and snorkelling. Physiological changes induced by breathing patterns are reinforced by mood changes induced by moving from one zone to another, creating a form of "psycho-feedback by navigation". The goal of the Exploratorium is to stimulate curiosity, leading to navigation and a consequent sense of control and empowerment, at the same time as the user experiences, explores and investigates her own feelings and emotions.

1. Introduction

Emotions are a very controversial and intriguing concept. Nobody fully understands them and yet no creature can function without them. In fact emotions are essential to the survival of all animal species. They play a very important role in the life of every human being. All people have emotions, can recognise emotions in others and sometimes try to control or suppress their own feelings or affect other people's feelings. Without emotions we would not be able to cope with everyday life, make decisions or solve problems (Damasio, 1994).

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New information technology has shown great potential in evoking both feelings and emotions in users. Many computer games are very successful in engaging the player in this way. A relatively recent and related research area within Human-Computer Interaction is to understand how and when a feeling of presence is connected to the use of new information technology, how presence relates to emotion and if it is possible to increase the level of experienced presence to abnormal levels (so called Superpresence, see Waterworth, Riva and Waterworth 2003) by the use of technology.

In this paper, we describe a virtual environment, called The Exploratorium, which is based on a novel way of interacting with a virtual world. The interaction is designed to be natural and in harmony with both the user and the contents of the environment. A basic principle behind the design is that the interaction should not need much of the user's conscious attention to control the navigation itself.

The Exploratorium was developed as part of the EU-funded EMMA project -Engaging Media for Mental Health Applications [http://www.emma.upv.es/].

The main idea behind the Exploratorium is to evoke different kinds of emotion in different areas of the virtual space, and when the user explores and experiences these areas she recognises, becomes aware of and gets in touch with her own feelings and emotions. One of our hypotheses is that the user, after practice in the Exploratorium, will learn to some degree how to control her feelings and to stay in balance with herself. The main aim is that, in that way, she will be better able to act in everyday life by getting a harmonic balance between body and soul.

An additional goal of the Exploratorium is to investigate the relation between presence and emotions. One hypothesis to be tested is whether different kinds of emotion, such as fear and calmness, evoke different degrees of presence and its opposite - which we call absence (see Waterworth E, Waterworth J. 2001). In other words, are some emotions more specific to a sense of presence, and others to a feeling of absence?

The article starts by describing the theoretical background behind the environment and the interaction style. Following that is a description of the environment (The Exploratorium) and the interaction device (The Body Joystick). The article ends with a discussion about future work with the Exploratorium.

2. Presence and emotion

Today there is a big debate about what presence is and what it is not. There exists no unifying definition of presence that everybody agrees about. Waterworth and Waterworth (2000) suggest that presence arises when we mostly attend to the currently present external environment. An implication of this is that a person has to perceive the environment that presently surrounds her, through her senses rather than in imagination, whether it is a virtual environment or physical reality. By this account, presence is primarily determined by the balance between processing internal (imaginal or conceptual) information and external (perceptual or sensory) information, and it can be experienced in response to both the physical (external real) and a virtual (externally modelled) environment. We have extended this two-dimensional model to include a third dimension in later publications (Waterworth E. L. and Waterworth J. A., 2001). In this three-dimensional model, the *Focus* dimension refers to internal (conceptual) versus external (perceptual) processing, the *Locus* dimension refers to presence in the physical versus a virtual world and the *Sensus* dimension refers to the level of conscious attention ranging from unconscious to fully alert.

In a later paper Waterworth, Riva and Waterworth (2003) further developed the model and explained it from an evolutionary perspective, where it is possible to view presence as originating at three evolutionary and neurological levels; Proto presence, Core presence and Extended presence. The three level model aims to capture and reinterpret several currently widespread formulations of the factors underlying presence, such as attention level (Stappers et al., 1999), shifts in attention between the real and the virtual (Slater and Steed, 2000), immersion (Slater et al, 1994), and fidelity (Bystrom et al., 1999).

2.1 Emotion and Feeling

Like presence, emotion is another concept that is very hard to define and even here there is no unifying definition that everybody agrees about. In contrast to presence, which is a relatively new concept, the concept of emotion is very ancient and has been debated for centuries, although until recently it has been relatively disregarded in modern psychology. When discussing emotions it is inevitable to include a distinction between the conscious versus the unconscious impact of events on emotions. As long ago as 500 B.C. Anaxagoras stated that both animals and plants experience pleasure

and that all sensations (sensory perceptions) are accompanied by pain (which is unconscious). The feeling of pain becomes conscious only when excessively intense. Contemporary associates of his often tried to locate different emotions in different parts of the body. For example Diogenes of Apollonia (460 BC) argued that pleasure and pain are a result of blood aeration that is mediated by the tongue. Democritus (460 B.C.) asserted that happiness, a positive emotion, is a state of mental and physical equilibrium, while thoughts (cognitions) are a distributed interaction of some localised corporeal components. For example he argued that rationality resides in the chest, the control of behaviours in the head, resentment in the heart, while appetite resides in the liver.

Damasio (1999) differentiates between emotions and feelings and argues that feelings are the private and mental experience of an emotion, while emotions are outwardly directed and publicly observable. Hillman (1962) makes a simple distinction between emotion and feeling as that between the whole and a part. Hillman claims that "*Feeling is a particular psychological function disposable to consciousness*" (Hillman 1962, page 269) and that "*Emotion is an activity of the psyche as a whole*". Moreover he states that it is possible to have feelings under one's control while "*emotion always is partly beyond ego control*". It follows from these two modern views that we can have an emotion without being aware of it, but that having a feeling always involves consciousness.

Emotion can be seen as a gatekeeper between consciousness and the unconscious. There is an ongoing debate about consciousness, what it is, whether we humans are actually conscious, and if there is a split between consciousness and the unconscious. Velmans (2000, p 3) suggests that "*Our conscious lives are the sea in which we swim, so it is not surprising that consciousness is difficult to understand*". Some people suggest that consciousness is what differentiates human beings from other species of animals. To be conscious implies a state of wakefulness, whereas being in dreamless sleep or in other states such as coma usually signifies a state of unconsciousness. Consciousness and unconsciousness can be viewed as two different states of mind, given that the mind exists even when we are unconscious. Sometimes the term consciousness is used to represent current knowledge, even though much knowledge is unconscious at any particular time, such as that stored in long-term memory (Velmans, 2000). It is obvious that the relation between unconsciousness and the unconscious is extremely complicated, but we consider both aspects of mental life to

be important, that they are related to each other and that they both play a considerable role in evoking emotions and feelings.

Emotion is a very important constituent in order to create interesting, engaging and educational virtual environments. New technology can create emotionally arousing sensations in the user in order to produce motivation and interest. But too much emotion can give rise to the opposite effect, when the door to consciousness is closed.

2.2 Perceptually-Seductive Technology

In the design of the Exploratorium (see below) we have applied the ideas behind Perceptually-Seductive Technology, PST (outlined in Waterworth E. 2001). One important constituent of PST is the evocation of emotion through design. PST could be viewed as a general class of sensory augmentation given that it appeals to multiple modalities at the same time. The information is presented in concrete forms, non-linguistic forms that are directly interpreted by the body and thus not requiring abstract thinking. This form of presentation is much faster to understand than information that has to be interpreted conceptually (i.e. in a linguistic form) and produces higher degrees of presence than more abstract forms.

Usually the information in PST is presented in a 3D space. This 3D space could either be a personal or a shared space. Furthermore it could be based on and implemented as physical, virtual or as mixed realities. One approach to use it is to present information in so-called memory theatres (see Waterworth E.L. 2001), software instantiations of the mnemonic "method of loci" (Yates, 1966).

Recent technology such as virtual reality (VR) and augmented reality (AR) also makes it possible to experience the same information through several senses at the same time. This could be viewed as a simulation of the experience of synaesthesia, although the experience is through the technology, e.g. the technology is projecting the information in several different modal forms to the user. This characteristic is important in Perceptually Seductive Technology (PST) as a synaesthetic experience is assumed to be emotionally appealing.. For a non-synaesthetic person it is very hard to imagine this kind of experience, which has a life of its own and is emotionally-charged, sometimes even distressing. In Ihde's (1991) terms, there is an embodiment relation between the person and the technology; it is as if the technology were part of the user's body.

3. Rationale And Structure Of The Exploratorium

The Exploratorium consists of three "zones" arranged vertically, very loosely based on Dante's Divine Comedy: Purgatorio (central zone), Paradiso (top zone) and Inferno (lower zone). Navigation between zones is by means of the body joystick (using only breath). Navigation on the horizontally arranged plane of each zone is also by means of the body joystick (using only balance).

The Exploratorium is intended to offer a virtual environment within which immersants can explore both places and feelings. It could be viewed as an environment for the user to learn, experience and enhance her own emotions and feelings. The "narrative" it implements is structural/architectural rather than linear/story telling. What happens there depends on what the immersants do in terms of navigation; if they don't do anything, nothing will happen. Different areas of the Exploratorium present different experiences: scary, normally busy, or very calm. At the same time, the Exploratorium as a whole is fundamentally safe, a self-contained play area. Immersants can, if they wish, experience the more challenging parts or remain in the more relaxing ones. They are free to explore the different areas, under their own control.

The goal of the Exploratorium is to stimulate curiosity, leading to exploration and a consequent sense of control and empowerment, at the same time as the user experiences, explores and investigates her own feelings and emotions.

We have chosen to limit interaction to navigation. Immersants are not able to select or move objects in the space, only to move around using the "body joystick" as navigation device. We thus emphasise exploration, and it is important that the Exploratorium should evoke enough curiosity in immersants so that they become self-motivated to explore.

The space is arranged in such a way that it relates metaphorically to mood or feeling state. The idea is that immersants can navigate between different zones within the Exploratoriuim and encounter surroundings that suggest, and even provoke, particular emotional states. The Exploratorium differs from most virtual environments as in that it emphasises the vertical dimension of navigation as well as the horizontal. In addition to visual features, the Exploratorium contains sound effects and music appropriate to each part of the Exploratorium.

Upward movement suggests improving or lightening mood, whereas downward movement corresponds to deteriorating or darkening mood. This rather obvious linking can be theoretically supported by, for example, the Experiential Realism of Lakoff and Johnson (e.g. 1980, 1999). The user should be able to move between zones to

experience different states, and using the body joystick should emphasise or amplify the changes as well as the sense of control over those changes. The Exploratorium is conceived as an environment in which to learn about oneself and one's body.

3.1 Purgatorio (central zone)

Purgatorio, the middle world, consists of a park, a part of a small city and a beach. In Purgatorio the user gets the right feeling of normality and there are features such as sounds (traffic, birds, children, wind, sea) in the appropriate places. This zone was partially based on existing work by our partners at the Universidad Politécnica de Valencia and Universitat Jaume I, Castellón (see Alcaniz et al. 2003). Given that the Purgatory is an image of everyday life with a park, city and beach it is large and interesting enough for visitors to spend a reasonable amount of time exploring the zone. In certain places it is possible for the visitor to navigate up into Paradiso (the top zone) and in other places the visitor might fall down into Inferno (the lower zone).

Figure 1 - An image of the Purgatorio zone

The city, beach and sea do not actually completely encircle the Park. Rather, it is implemented as a segment beyond which the user cannot stray. Buildings, rocks, and other features provide barriers to make this seem natural. The sea extends out to a horizon where it meets the sky in the distance. No sun can be seen, but this level is well lit.

3.2 Paradiso (heavenly zone)

"The only perfect view is of the sky over our heads"

Paradiso is designed so that the user will have an experience that reflects a relaxed, even transcendent state of mind – where things happen as if internally. Paradiso is located above the clouds, so the sun always shines. The sun remains fixed in one place. The view from Paradiso shows infinite sky above (and to the sides) and cloud layer below. As the visitor moves around Paradiso, she hears various Heavenly sounds in different places. The sounds are modulated according to how high the visitor flies. In the sky are mandalas with floating fairy castles in the background.
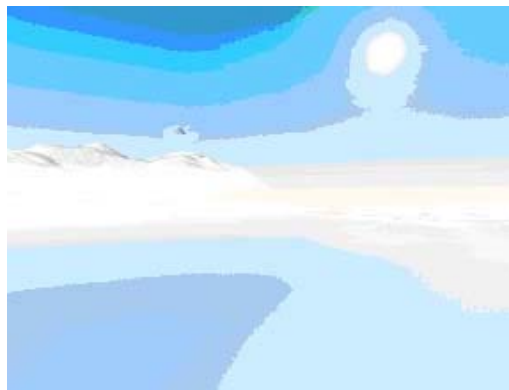

Figure 2 - Image from Paradiso

The visitor can sink down into the cloud, but only to neck level, i.e. the lowest viewpoint is the level of the top of the clouds. Collision detection prevents the visitor from going down through the clouds. If the user navigates into some specific areas she "falls" down to inferno (the hellish zone).

3.3 The Inferno (hellish zone)

The Inferno is large and complex enough to evoke feelings of getting lost and/trapped, of a bounded maze-like set of interlinked places, with no obvious way out. Outside the maze is a dead, dark garden. The entrance of the maze area provides access to "The Gates of Hell". The entrance is dark and wooded, with tense expectant music. Inside the Inferno, the visitor must navigate around the maze to get anywhere. This implies that collision detection is used to make the walls impenetrable. He cannot fly while in the inferno, but navigates around the floor.

This is an unpleasant place, with discordant sounds, sudden loud noises in unpredictable places, screams, noises of machinery, low frequencies, and explosions. Fog pervades the whole zone, with both distance and particle-based elements. Ghosts, or other unpleasant-looking things, sometimes emerge out of the fog. The centre of the

Inferno is a lively, large and noisy fire. Here there are also some of the most off-putting noises: screams, things smashing and breaking. It is unpleasant to be close to the fire.
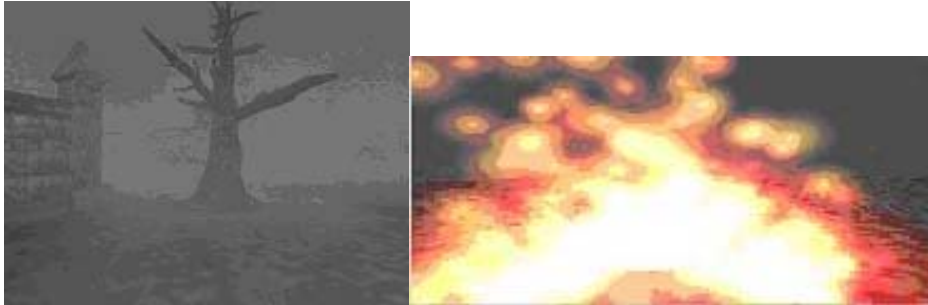

Figure 3 - Two images from the Inferno zone

The Inferno is bounded by the floor and roof, both impenetrable, and is circled by mountains forming a bowl. The mountains extend beyond Paradiso (above) and form a cusp into which the visitor falling from above will land. The visitor can climb a little way up the mountains but as they become more vertical no progress is possible – the falling visitor lands within this barrier.

There are a few places that can take the visitor out of the Inferno, via correct breathing (see 3.3 below) or "right" actions. Depending on the place the visitor is transferred to Purgatorio or to Paradiso.

3.3 Navigation in the Exploratorium – The body joystick

It is possible to navigate in the Exploratorium using a variety of devices, such as joysticks, wands, and so on, but the design is more specifically intended for use with the Body Joystick. The Body Joystick concept uses a vest, worn by the immersant, which includes sensors for both body orientation and chest expansion in breathing. It was inspired by the powerful immersive artwork Osmose of Char Davies (Davies, 1998). We have adapted the navigation idea by making the vest lightweight and wireless, and we do not use a Head Mounted Display but rather passive stereo using polarising lenses – which are extremely light to wear.

The immersant slips on the vest, and it is fastened across the chest. A small sensor and wire across the front detects expansion and contraction of the chest during intake and expulsion of air while breathing. Breathing in and holding the breath will result in the immersant moving up in the virtual space of the Exploratorium. Breathing out and

holding will cause the immersant to move down. Normal breathing will maintain the immersant at a steady vertical position. Movement on the horizontal plane is controlled by balance. If the immersant leans forward she will move forward in virtual space; leaning backwards results in backward movement. The immersant can turn right by leaning to the right, and left by leaning to the left.

Figure 4 - The body joystick

4. The Technical Set-Up

The Exploratorium set-up consist of two parts, the main part, the Aide Sensorielle, that is a practicing and experiencing component, and the Aide Memoire that can transfer the person back to the emotional state the feelings experienced in a certain part of the Exploratorium via memory evocation.

4.1 The Aide Sensorielle

The Aide Sensorielle consists of a one-wall CAVE made up of a standard PC with a decent graphics card. It runs under Windows and the VR software we use is called Brainstorm. For the immersive experience we use a Luxus™ Deluxe Screenwall Filmscreen 150 which is a 150 inch back projected screen with high contrast. The graphics card has two outputs and connecting them to two separate projectors we achieve passive stereo. We use two DLP™ projectors with a minimum of 2500 ANSI lumen. Each projector projects a picture for one eye. The light is filtered with circular polarized filters. This means the user has to wear special glasses, where each glass is also a special filter, but these are light and unobtrusive. For the user to be able to use her body movement via the Body Joystick (see below), there is a tracking system

involved. We use a wireless system from Intersense™ called IS-900VET. It is a 6-DOF tracking system giving instant feedback, and since it is wireless the user does not need to bother about cables.

4.2 The Aide Memoire

The Aide Memoire comprises a PDA and will be used as a reminder of the actual immersive environment (the Aide Sensorielle) and that can be used in an emotional situation in real life. For example when one has a panic attack on a bus, one could use the Aide Memoire to recapture the memory and mood of the Paradiso zone in the Exploratorium. The main goal of the PDA application is to enable users of the more comprehensive VR-applications to re-experience feelings from the 3D environment independent of time and place. The main idea is to bring to mind the feelings that the user experienced in the 3D environments in order to handle the emotional situation at hand.

The pocket-pc-application primarily uses a combination of small films, sound effects and images to achieve these goals. The films consist of short films from the 3D environment, and the sound effects are selected pieces from the VR-application. These small films and sound effects are in other words the same that are experienced in the 3D environment. The user is also able to choose audio-only presentation, and in this way can recapture, for example, a relaxing experience in an unobtrusive way while looking at other things (while walking around town, for example). In this way, the user will simply appear to others as if listening to music on a Walkman.

The small films enable a direct link between the two different applications and thus render possible a coherent experience for the user. The user will be able to select which part of the 3D environment he or she wants to be exposed to and that is most appropriate for the actual situation. Thus the pocket-pc application can elicit and arouse several different types of moods and in such a way act as a multiple mood device.

5. Conclusions

This article outlines the Exploratorium, an environment for getting in touch with one's own feelings. The environment encourages its user to explore, experience and develop her inner being. The main idea behind the implementation is to investigate the extent to which it is possible design environments and styles of interaction that maximise this

effect. Another main idea is to investigate the relation between presence and emotion. The environment supports and evokes different emotions and a future aim is to test whether different kinds of emotions produce different degrees of presence and absence.

Initial trials confirm that the Body Joystick is simple and intuitive to use to navigate around the Exploratorium. Using balance for movement and turning feels natural, like riding a bike, flying, or skating. Using breath control maps naturally onto vertical navigation, as in diving and snorkelling. Physiological changes induced by breathing patterns are reinforced by mood changes induced by moving from one zone to another, creating a form of "psycho-feedback by navigation".

The Exploratorium can be viewed as a form of sensory stimulation that helps its user to get closer to her true emotions and associated feelings, and in this manner get to know herself and her reactions better. This should support learning about how to stay in balance with herself in a way that extends to her everyday life.

Current information about the Exploratorium is available here: http://www.interactiveinstitute.se/tools/projects/emma/exploratorium.htm

6. Acknowledgements

7. References

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