Mel Slater
Department of Computer Science
University College London
Gower Street
London WC1E 6BT
UK

mailto:m.slater@cs.ucl.ac.uk
www.cs.ucl.ac.uk/staff/m.slater

A Note on Presence Terminology

Abstract

This note addresses the confounding of the term 'presence' with several different distinct aspects of experience. Distinctions should be made between immersion, presence, involvement, emotional response, degree of interest. An analogy with colour science is pursued, specifically the difference between wavelength distribution and perception of colour - where the former is like 'immersion' the latter is like 'presence' (a human response). On top of this colours may be experienced as interesting, emotion-producing and so on. Just as the emotional experience engendered by a colour is not the same as the perception of the colour, which is not a simple function of the wavelength distribution, so involvement, interest or emotional response in a virtual reality is not the same as presence, which is not the same as immersion.

Keywords

Presence, virtual environments, virtual reality, perception, immersion, involvement.

1 Introduction

In this note I would like to address what I think is the significant confusion surrounding the notion of 'presence in virtual environments'. (For a recent survey see IJsselsteijn et al., 2001). This confusion is hampering progress in the field. There can be no advancement simply because when people talk about *presence* they are often not talking about the same underlying concept at all. No one is 'right' or 'wrong' in this debate, they are simply not talking about the same things. I would like to propose a terminology that may clear up the confusion, and prevent arguments over essentially non-issues. If researchers are talking about different things then there is no point arguing. Let's just use different terms for these different concepts. I am writing this on the way back from the 2003 Cybertherapy conference, where there was a debate on some of these issues, which sparked the current note.

2 Immersion and Presence

I have argued before about the separation of the term 'immersion' from 'presence' (e.g, Slater, 1999). Let's reserve the term 'immersion' to stand simply for what the technology delivers from an objective point of view. The more that a system delivers displays (in all sensory modalities) and tracking that preserves fidelity in relation to their equivalent real-world sensory modalities, the more that it is 'immersive'. This is something that can be objectively assessed, and relates to different issues than how it is perceived by humans. I am making the distinction here similar to that in colour science. A colour can be described objectively in terms of a wavelength distribution. However, the perception of colour is an entirely different matter - and includes the notion, for example, of metamers, where objectively different wavelength distributions are perceived as the same colour by human observers. So immersion is analogous to 'wavelength distribution' - in principle it can be objectively assessed (though we may not always know how to do this). Following through the analogy with metamers, different immersion systems may have indistinguishable perceptual impacts on people in terms of presence.

If immersion is analogous to wavelength distribution in the description of

colour then 'presence' is analogous to the perception of colour. Presence is a human reaction to immersion. Given the same immersive system, different people may experience different levels of presence, and also different immersive systems may give rise to the same level presence in different people. Presence and immersion are logically separable, but I would contend that empirically they are probably strongly related. Part of the study of presence is to understand this relationship.

3 Form and Content

But what do I mean by presence? Let's take another analogy. Suppose you shut your eyes and try out someone's quadraphonic sound system which is playing some music. "Wow!" you say "that's just like being in the theatre where the orchestra is playing." That statement is a sign of presence. You then go on to say "But the music is really uninteresting and after a few moments my mind started to drift and I lost interest." That second statement is *nothing to do with presence*. You would not conclude, because the music is uninteresting that you did not have the illusion of being in the theatre listening to the orchestra. The first statement is about form. The second statement is about content. Presence is about form, the extent to which the unification of simulated sensory data and perceptual processing produces a coherent 'place' that you are 'in' and in which there may be the potential for you to act. The second statement is about content. A VE system can be highly presence inducing, and yet have a really uninteresting, uninvolving, content (just like many aspects of real life!). On the other hand it can be really interesting, fascinating, amazing. *This too is not a sign of presence*. Being interesting, emotionally captivating, beautiful, fantastic - these are about content, not about the form.

So let's reserve the term *presence* to refer to the statement about form: It is just like being in a theatre (in the example of the music). When you are present your perceptual, vestibular, proprioceptive, and autonomic nervous systems are activated in a way similar to that of real life in similar situations. Even though cognitively you know that you are not in the real life situation, you will tend to behave as if you were, and have similar thoughts (even though you may dismiss those thoughts as fantasy). Just as the perception of colour arises from the interplay of the objective wavelength distribution and the human perceptual system, so there is the same relationship between presence and immersion: the former arises from the interplay between the human sensing and motor action systems and the immersive system.

4 Presence, Involvement and Emotion

There are many other terms that are confounded with presence. These are often things said in discussions in conferences or in private meetings, but also appear in questionnaires - for example 'How much did the visual aspects of the environment involve you?' (Witmer and Singer, 1998). Let's separate *involvement* from presence, it is at a different logical level. One can be present but not involved (as in many situations in everyday life). One can be involved but not present (e.g., watching a soap opera, reading a book). "Aha!" you might say "when I read xyz book, it was as if I were really there" - that's fine, a book is at a certain low level of immersive 'technology', and maybe can induce presence for some people. This does not say that we should confuse 'involvement' with presence. In real life one can study how much different situations 'involve' people. One can also do the same in virtual reality. However, this is not the same as studying presence. *Involvement* or *interest* are to do with content, not to do with form. Listening to the music you might say "This is just like being in the theatre listening to the orchestra - but the

music - you know - it just doesn't interest me." This is high presence, low involvement (or interest).

Presence is orthogonal to emotional content. I am currently sitting at San Francisco Airport in one of the lounges. Believe me, it is not an emotional experience one way or another. Of course, by definition, I am completely present here (even though I am concentrating very much on writing this note and only peripherally aware of what is going on around me). I can hear people talking, but I don't care what they are saying. In my peripheral vision I can see various movements, and if I shift my vision and attention I could choose to see what's going on in detail if I wanted to do so. I can shift attention to various aspects of my surrounding environment, and what I perceive may be emotionally engaging or not. It doesn't change the fact of my presence. If suddenly something bad happened here (I hesitate to write an example in the current international climate) I would be more emotionally engaged, but not more present. My heart would start racing, I may start moving my body to a different location, all kinds of things would start to happen in me. In fact if in a VE and these same things happened in a simulation of a bad event inside an airport lounge, this would be a good sign of presence in the VE. Presence is separable from emotion. The first is form. The second is content. *You may choose to use an emotional content to test whether there is presence* (i.e., to check whether in the VE people have a similar emotional response as they do in similar circumstances in the real world) but the very fact that you can do this is another way to say that *presence and emotional response are logically distinct*.

It should be clear from this discussion that presence and immersion are not the same. Remember that presence is a 'response' to a system of a certain level of immersion. In order to achieve presence we could follow two different paths. The first is to construct a system that has such a high fidelity to reality that it becomes indistinguishable from reality. A more interesting approach is to use knowledge of the perceptual system to find out what is important in our representations of reality - to deliver presence even when the level of immersion is not high. People may achieve presence with wire frame computer graphics, some approximation to auditory fidelity, low resolution, and so on. How does this work? This is the real scientific question for presence. Knowing the wavelength distribution of light emitted from a surface informs us something about how it may be perceived in terms of colour, but it is far from the whole story. Understanding the human perceptual response to the wavelength distribution is critical in understanding colour. We know that, for example, that it is conceptually possible to reproduce the entire spectrum of perceivable colours (taking into account metamers) just by additively combining three primaries. This latter property (reducing the function space of wavelength distributions to the three dimensional space of perceivable colours) is only possible because of the way that human perceptual system works. Similarly, our anecdotal experience of virtual reality convinces us that presence can be achieved with systems that are extreme in their paucity compared to the incredibly rich detail available in perceptions of real life. I would hypothesise that just as a complex wavelength distribution can be 'simulated' in terms of colour perception by an appropriate additive combination of three primary colours, so the presence in a real life situation can be simulated by a virtual reality that delivers extremely poor sensory data in relation to physical reality.

5 Presence and Simulations of the Non-Real

A sign of presence is when people behave in a VE in a way that is similar to what their behaviour would have been in a similar real life situation. 'Behave' includes all aspects - acts of perception, volitional, conscious as well as

unconscious responses of the autonomic nervous system. Now, researchers may object: "But virtual reality can represent situations that are not real, fantasy worlds, nothing compared to normal human experience. Are you saying that the concept of presence cannot be applied to such fantasy worlds?" Well, first, we can change the properties of the world but we cannot change the physiology of humans. We can transfer between sensory experience - e.g., we can show visual images of sounds, and auditory images of smells, and transform touch into smell and smell into touch and so on. We can have x-ray vision, and walk through walls. But the responding entity is still that of the total human physiology. What we are able to do is to explore what presence would be like if such worlds existed. Of course in this situation we do not have any comparative data from real world experiences to know whether these responses are similar to those of the real world. We would only have comparative evaluations between different people. If we are confident that our immersive systems tend to result in the presence response for 'real life' scenarios then we have a way of exploring of what the presence response would be in these non-real life situations. We can explore aspects of being on the planet Pluto without ever going there.

6 Summary

Presence is the response to a given level of immersion (and it only really makes sense when there are two competing systems - one typically the real world, and the other the technology delivering a given immersive system). There are many signs of presence - behaviours (in the widest sense) that match being in a similar situation in reality. "Wow, it is just like being there" is a sign (not a definition!) of presence. Presence arises from an appropriate conjunction of the human perceptual and motor system and immersion. Presence is a response. Separate from presence are aspects of an experience such as involvement, interest and emotion. These are to do with the content of the experience. Presence is the form.

There are several interesting scientific problems:

- The relation between presence and immersion;
- The transfer from a presence response in a virtual reality to behaviour in the real world (e.g., in skill acquisition);
- Characteristics of an experience that will make it involving;
- How to measure presence (independently of involvement etc).
- What has to be put into a VE in order to induce presence. One way to induce presence is to increase realism; another way is to match the displays and interactive capabilities to the requirements of the human perceptual and motor systems.

There is a huge task to accomplish in quantifying immersion. It consists of:-

- Visual, auditory, haptic, olfactory fidelity - including fields of view, resolution, stereo, panorama, etc..
- Behavioural fidelity of what is being simulated (e.g., does the virtual human behave, talk, move like a real human?);
- Display lag and system latency;
- Tracking coverage;
- Temperature, air flow, gravity, sensory isolation from the surrounding real world;
- Many others

Each of these needs to be thoroughly studied and quantified. For each of them

there would be a corresponding 'presence response curve' that showed for an 'average participant' how presence was ideally thought to vary as these system parameters varied. This is again analogous with colour science.

In the example of the orchestra, it was assumed that you shut your eyes when listening to the sound system. But suppose your eyes stay open? Then there would be contradictory signals in the visual and auditory modalities - where is your presence? There may be different presence in different modalities - i.e., the simultaneous maintenance of auditory presence in one situation, visual presence in another, and kinaesthetic presence in yet another. Or it may be a question of field dominance - your preferred sensory modality gives you overall presence according to the situation of that modality. (We considered these issues in Slater, Usoh, Steed, 1994 and references therein). Or there may just be confusion. It is likely that in order to achieve presence there needs to be consistency in sensory input across as well as within modalities, but to what extent remains an open and empirical question.

Finally, confusing immersion, presence, involvement, emotional response, is equivalent to confusing the emotional response to a colour with the perception of a colour, with the wavelength distribution that is the underlying physical basis of the perception. Let's agree on a set of terms, and study the relationships between the various concepts represented by these terms.

References

IJsselsteijn, W.A., Freeman, J. and Huib de Ridder (2001) Editorial: Presence: Where Are We? Cyberpsychology and Behavior, 4(2) 179-182.

Slater, M. (1999) Measuring Presence: A Response to the Witmer and Singer Questionnaire, Presence: Teleoperators and Virtual Environments, 8(5), 560-566.

Slater, M., Usoh, M. and Steed, A. (1994) Depth of Presence in Virtual Environments, Presence: Teleoperators and Virtual Environments, 3.2, 1994, 130- 144.

Witmer, B.G and Singer, M.J. (1998) Measuring Presence in Virtual Environments: A Presence Questionnaire, Presence: Teleoperators and Virtual Environments, 7(3), 225-240.