

## When presence and emotion are related, and when they are not

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### Abstract

*This paper proposes a theory generating predictions for when presence and emotion are related, and when they are not. The theory explains apparently conflicting reports on the relation between presence and emotion that have appeared in the literature – some reporting a relationship, others reporting no relationship. The key assertion of the theory is that presence and emotion are related for arousing content only. For content to be arousing to a media consumer it must be perceived as personally relevant and significant – either viscerally or carrying more complex meaning. Of course, this is not to say that all content that is personally relevant and significant need be arousing – it could be personally relevant, significant and arousal reducing. In addition to explaining contradictory results previously reported in the literature on the relation between presence and emotion, the theory explains new data presented in this paper. Consistent with our own and other authors' previous reports, we present new data showing that media form manipulations (specifically screen size and participants' ability to navigate within a VE) influence presence. We did not find related influences of the same manipulations on participants' emotional responses to the media experiences. Finally, whilst we do not present our theory as evidence in favour of the evolutionary rationale for presence recently presented in the literature it is encouraging to note that the two theories are compatible.*

**Keywords---** presence, emotion, arousal, significant, meaningful, navigation, screen size, media, form, content

### 1. Introduction

Through combining Barfield, Zeltzer, Sheridan and Slater [1] and Lombard and Ditton's [2] definitions of presence, we have previously presented a unified definition of presence, as "a participant's sense of being there in a mediated environment, arising from a perceptual illusion of

non-mediation" [3]. Determinants of how present a participant feels in a mediated environment can be categorised into user and media characteristics [4]. User characteristics can include the participant's perceptual, cognitive and motor abilities and certain personality traits – which can vary with the age and sex of the user [4].

Media characteristics can be split into media form variables and media content variables. Media form refers to the physical properties of the medium e.g. the amount of sensory information presented and the extent to which the participant can control and modify the environment [4].

Media content refers to the overall theme or story represented by the medium [4] including the objects, actors and events depicted [5], and includes the inherent interest of the content, its relevance to a person, its familiarity and its naturalness.

The majority of presence research to date has focused on evaluating the effects on presence of manipulating aspects of media form e.g., Freeman et al. [6]; Freeman et al. [7]; Welch et al. [8]; Slater and Usoh [9]; Slater Usoh, and Chrysanthou, [10]; Hendrix and Barfield, [11] and IJsselsteijn, et al. [12] – such as 3D presentation, the inclusion of shadows in VEs, screen size, and interactivity. Given that the recent study of presence has its roots in advances in computing, telecommunications and broadcast technologies, it is perhaps not surprising that technical aspects related to media form were initial research foci.

As reported in [3], and previously [13] [14], several recent studies from a range of theoretical and methodological starting points – including semiotic, phenomenological, qualitative depth interviews, and quantitative factor analytic studies – converge on a definition of presence comprising three dimensions (or factors). We have labelled the three dimensions as:

- (1) Sense of Physical Space: a participant's sense of being located in a contiguous spatial environment, *determined primarily by aspects of media form*;
- (2) Ecological Validity (naturalness): a participant's sense of the believability and realism of the content – that it is real; *determined by aspects of media form and media content*; and

- (3) Engagement: a participant's sense of engagement and interest in the content of the mediated environment; *determined primarily by media content*.

Variations in both media form and media content have been shown previously to influence various dimensions of presence (e.g. [15]). Sense of Physical Space is primarily determined by aspects of media form, Engagement primarily by aspects of media content, and Ecological Validity (or the realness of the experience) by a mixture of the two.

Emotions are transient states of feeling, of relatively short duration, having a rapid onset; they are usually caused by specific events. They result from appraisals of the significance of what has happened for personal well-being: the more relevant an event, the more emotive it can be. Psychologists have found that a wide range of emotive stimuli can induce short term mood changes. These include films/stories [16], music [17] and emotive sentences [18].

That content can affect both emotion and (at least some dimensions of) presence suggested a need for research to understand the relation between the two. In previous psychological research on mood induction and emotion a prime focus has been on the effects of content on mood elicited. Previous research has also provided evidence for a relation between presence and emotion in certain contexts – through experimental research on presence and arousal [19], [20] and in a clinical context using virtual reality environments as therapeutic tools [21], [22].

The study used an environment which, as we reported at last year's conference, was successful at eliciting its target emotion of relaxation. In the current studies we manipulated media form aspects of the presentation of Relaxation Island – a novel virtual environment (VE), conceptualised, designed and specified by i2 media research ltd and Goldsmiths College and developed by project partners at the Interactive Institute (Sweden) as part of the EC funded project, Engaging Media for Mental Health Applications (EMMA). The environment is novel in that it combines relaxing narratives with visual and auditory representations of imagery that might also facilitate relaxation (e.g. calming sea waves, sounds of a tropical island) within an interactive VE. Previously we have reported that Relaxation Island was effective in ameliorating (negative) mood states of stress and anxiety and promoting positive mood states (of happiness and relaxation) [3]. The VE, called 'Relaxation Island', is described in detail elsewhere [23]. In brief, it comprises several *zones* ('waterfall', 'beach 1', 'beach 2', and 'cloud'). Each zone has been developed to facilitate the delivery of *instructional narratives* based on one of two theoretical approaches to modifying negative thinking and anxious mood state: standard 'controlled' breathing techniques (SBT) and narratives based on acceptance and commitment therapy (ACT; which promotes the idea of 'just noticing', 'accepting' and 'experiencing' bodily sensations rather than trying to control them). Both the ACT and SBT techniques are usually 'eyes closed' (audio-only) techniques, where participants listen to an instructional narrative and have the freedom to imagine any visual (or other sensory) element

required. It has also been previously reported that when the presentation of the full VE was compared with presentation of just the ACT narrative there was a significant difference between conditions in change in relaxed mood and presence ratings, all being higher in the full VE [3].

In the current report we again focus only on conditions in which we presented participants with the ACT (and not the SBT) narrative within the VE. Our focus was on the effects on presence and emotion of allowing a participant to navigate within the full Relaxation Island environment, and of manipulating screen size within the same environment where navigation was permitted. Our key research questions were:

- What was the effect of being able to self-navigate on presence and emotion/mood?
- What was the effect of screen size on presence and emotion/mood?
- Is there a relationship between presence (a participant's sense of being there in the mediated environment) and her/ his emotional response to the content of the environment?

## 2. Method

### 2.1. Participants

Thirty participants (15 male and 15 female) aged between 18 and 43 (mean age = 25 years) took part in the study. The majority were students or staff of Goldsmiths College, University of London. All were recruited by advertising around Goldsmiths College. Participants reported to the experimenter that they satisfied the inclusion criteria that they: (a) were not taking any form of prescribed medication (except oral contraceptives), (b) were not suffering any diagnosed emotional/psychological disorder, (c) were not receiving any form of psychological therapy/counselling, (d) had normal (or corrected to normal) vision, and (e) had a good grasp of the English language. Each participant received an incentive of £10 for taking part in the study.

### 2.2. Design

Three independent groups (n=10 in each) were run in the study reported here, with the following conditions:

Group 1: small screen – no capacity for participant to navigate (navigation conducted by experimenter)

Group 2: small screen – navigation by participant

Group 3: large screen – navigation by participant

In all 3 groups participants were exposed only to the ACT (and not the SBT) narrative. In the results section below, we report on the influence of navigation on presence and emotion ratings (by comparing Group 1 with Group 2) and on the influence of screen size (by comparing Group 2 with Group 3).

### 2.3. Measures

#### Mood Measures

- Positive and Negative Affect Schedule (PANAS: Watson, Clark & Tellegen [24]: 20 items, 10 for the positive and 10 for the negative affect scale);
- Visual Analogue Scales (VAS: a variation of Gross & Levenson's [16] measure) assessing seven discrete emotions: happiness, anger, disgust, relaxation, fear, sadness, surprise

#### Presence Measures

- ITC-Sense of Presence Inventory (ITC-SOPI: Lessiter, Freeman, Keogh & Davidoff [4]: 44 items);
- UCL-Presence Questionnaire (UCL-PQ: Slater, Usoh & Steed, [25]: 3 items) - *results from the UCL PQ are not reported in this paper.*

### 2.4. Procedure

Prior to its commencement, this study received approval from Goldsmiths College Ethics Committee. Participants were randomly allocated to one of the 3 conditions.

#### Navigation (self/no self)

Participants who did not self navigate (Group 1) were simply told to keep their eyes open and that visuals were going to appear on the screen. The experimenter navigated the participant to the deckchair in the beach zone using the keyboard at the computer.

#### Screen size (large/small)

Viewing distance for both screen sizes: 210cm

Large screen size:

- projected size of 129cm by 96cm
- 37.5 \* 28.5 degrees visual angle

Small screen size:

- projected size of 38cm by 29.5cm
- 11.0 \* 8.5 degrees visual angle

The different screen sizes were created by adjusting the size of the projected image from a projector on to a large white projection screen situated 210 cm in front of the participants when they were seated in the lab. The small screen size approximates to the view of a TV screen, the larger size was defined by the limits of our equipment and laboratory. The update rate of the programme varied between 22.5 and 30 frames per second with a refresh value rate of 60 Hz, both values were the same across conditions.

On arrival at the lab, participants were taken into an office space. They were told that the study involved questionnaire completion and having an 'experience' which could involve looking at something presented to them on a screen. They were first asked to complete an Ethics Form, which requested them to agree that they satisfied a number of inclusion criteria.

After consent was obtained, participants were asked to complete a battery of pre-test questionnaires as detailed above (Section 2.3 Measures), and other psychological screening questionnaires. The emotion scales were

presented immediately pre-test to account for any effects on mood of completion of the other screening questionnaires, to establish an accurate pre-test mood rating.

Participants were then taken into the laboratory. They were asked to sit on a sofa located at a distance of 210 cm from a projection screen and were handed an instruction sheet that explained: "You are about to take part in a short experience. You will either be asked to sit with your eyes open or with your eyes closed. During the experience you may or may not receive verbal instructions. If you are asked to sit with your eyes closed, please try to imagine a scene consistent with any instructions you may receive". The lights were dimmed and they were then instructed that they were to keep their eyes open.

Participants in the self-navigation conditions (Groups 2 and 3) were handed a wireless keyboard and instructed that they could use the arrow keys to move around in the environment they were about to experience. They were asked to make their way to 'beach 2' which would be signposted in front of them when the environment was displayed. The experimenter then presented the environment, and participants navigated their way to the beach zone (see Figure 1).

Participants in the no-self navigation condition (Group 1) were simply told to keep their eyes open and that an environment was going to appear on the screen. The experimenter navigated the participant to the deckchair in the beach zone using the keyboard at the computer. This was positioned to the far left of the participants allowing the experimenter to navigate the participants in Group 1 to the beach zone without being in the participants' view. The view on the screen was the same as if the participant was navigating themselves. In order that participants in both conditions took part in media experiences of approximately equal duration, and to trigger elements of the narrative (built into the VR program) the experimenter navigated through the environment from the same starting point (the signpost) and followed the same path (to 'beach 2') as did participants in the self-navigation conditions.



**Figure 1 Beach Zone 2 (Relaxation Island)**

On arrival at the beach zone the participant was 'seated' in a deck chair located near the sea shore with a view of the sea and a palm tree (swaying in the breeze) positioned on the right of the display. Once in the chair, the self navigation groups' navigation capacity was restricted to panning left and right. The pre-recorded narrative then began. All participants experienced the full audio-visual VE with the ACT narrative, which included the sounds of

the waves and the sea lapping at the shore and the tropical sounds of birds and insects. During the experience, the experimenter remained in the room, silent and seated at the computer to the far left of the participants, out of their view.

There were four main sections of narrative each divided by long pauses to allow the participant to focus on the exercise. The narrative first welcomed the participant and commented on the presented environment (the ocean, waves, sun, breeze, golden shores). It was explained that the exercise would focus on a breathing technique. Participants were asked to just notice what their body and mind provided them with. In the second piece of narrative, participants were instructed to just notice their breathing. The act of taking a breath and exhaling was described and they were asked not to change their breathing but to simply notice it. The third section of narrative instructed that if their mind was drifting to other things, to gently bring it back to just noticing their breathing. And finally, the fourth narrative explained that they were coming to the end of the session. It was suggested that they could practice this breathing technique at any time and any place by visualizing the beach. The entire presentation in the beach zone lasted 7 minutes and 20 seconds. All participants were then instructed by the experimenter that the experience was over.

The participants then completed the post-test battery of measures, fixed in the following order: VAS, PANAS, ITC-SOPI, UCL-PQ. Participants finally completed the VAS and PANAS once again on reflection of their mood *during* the experience. They were then paid for their participation. The entire session lasted approximately one hour, including a short debrief. Participants completed the presence and mood questionnaires post-test to avoid disrupting their experience and having to divide their attention between the VE and the questionnaires. Because presence is a subjective experience it has been argued that using questionnaires that rely on subjective report is the most efficient way to measure it. [5]

### 3. Results

#### 3.1. Subjective Mood

*The “experience” irrespective of capacity to navigate or screen size, significantly changed discrete emotion ratings*

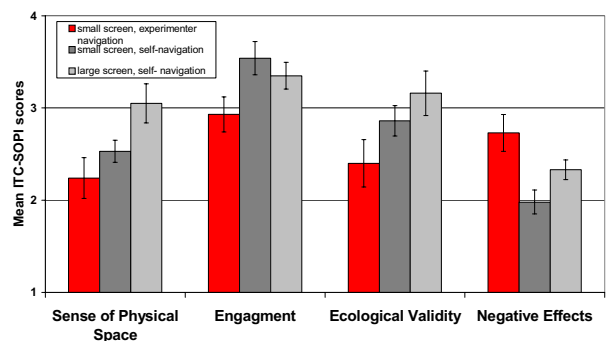
A one sample t-test was run on all 3 groups together (n=30). The results indicated that the presentation of the VE regardless of the condition significantly increased change (post-pre) in Visual Analogue Scale (VAS) rated positive discrete mood ratings of relaxation ( $t_{(29)} = 5.68, p < 0.01$ ) and significantly decreased change (post-pre) in VAS rated discrete mood ratings of anger ( $t_{(29)} = -4.37, p < 0.01$ ) and sadness ( $t_{(29)} = -3.5, p < 0.05$ ).

#### 3.2. Navigation and Presence

*Participants who self-navigated in the environment gave significantly higher ratings of Engagement, and significantly lower ratings of Negative Effects*

An independent samples t-test was run to compare presence scores of participants who self-navigated in the environment (Group 2: small screen) compared with those who did not self-navigate in this environment (Group 1: experimenter navigated on their behalf, small screen).

In terms of the ITC-Sense of Presence Inventory (ITC-SOPI) ratings, there was a significant difference between the navigation groups on Engagement ( $t_{(18)} = 2.33; p < 0.05$ ); participants who self-navigated gave significantly higher ratings than those exposed to the same experience but who did not self-navigate. There was also a significant difference in Negative Effects ratings ( $t_{(18)} = -3.14; p < 0.01$ ); participants who did not self-navigate gave higher ratings than those who self-navigated. Sense of Physical Space and Ecological Validity ratings were also higher, though not significantly, among participants in the self-navigation groups (see Figure 2 and Table 1). The authors expect this to be an issue of power – if more participants took part these effects too would be significant.



**Figure 2 The effect of navigation and screen size on ITC-SOPI scores**

#### 3.3. Navigation and Emotion

*There were no significant effects of self-navigation on emotion/mood*

There were no significant differences between the two groups' Visual Analogue Scales (VAS) or Positive and Negative Affect Schedule (PANAS) (post-pre) change scores. Navigation did not influence the emotion/ mood change elicited by the experience (see Table 1).

#### 3.4. Screen Size and Presence

*Relative to Small screen presentations, Large screen presentations resulted in significantly higher ratings of Sense of Physical Space, and higher, though not significantly, ratings of Negative Effects*

The two self-navigation conditions (Groups 2 and 3, facility to self navigate) that differed in screen size were explored to understand the effects of the screen size manipulation on presence scores.

In terms of the ITC-SOPI ratings, there was a significant difference between the screen size groups on Sense of Physical Space ( $t_{(18)} = 2.15; p < 0.05$ ); participants exposed to the large screen version of the VE gave

significantly higher ratings than those exposed to the same experience but on a small screen. The difference in Negative Effects ratings almost reached significance ( $t_{(18)} = 2.07$ ;  $p = 0.053$ ): participants presented with the large screen experience gave higher ratings than those exposed to the small screen. There was no significant difference between the screen size groups in their ratings of Engagement or Ecological Validity (see Figure 2 and Table 1).

**Table 1 Presence (ITC-SOPI) and mood/emotion (post-pre) mean scores for all groups**

	<b>Group 1</b> <b>Small screen</b> <b>No self navigation</b>	<b>Group 2</b> <b>Small screen</b> <b>Self navigation</b>	<b>Group 3</b> <b>Large screen</b> <b>Self navigation</b>
ITC-SOPI: Sense of Physical Space	2.24 (.70)	2.53 (.38)	3.05 (.67)
ITC-SOPI: Engagement	2.93 (.60)	3.54 (.57)	3.35 (.46)
ITC-SOPI: Ecological Validity	2.4 (.81)	2.86 (.52)	3.16 (.76)
ITC-SOPI: Negative Effects	2.73 (.63)	1.98 (.41)	2.33 (.34)
VAS: Happiness	-1.26 (12.19)	-.59 (22.65)	8.07 (11.23)
VAS: Anger	-6.92 (7.88)	-5.57 (6.64)	-9.98 (12.91)
VAS: Disgust	-4.47 (9.05)	-2.45 (4.37)	-6.55 (14.12)
VAS: Relaxation	17.53 (27.76)	20.38 (20.06)	25.36 (11.11)
VAS: Fear	-12.19 (19.74)	-6.83 (7.30)	-6.55 (13.08)
VAS: Sadness	-8.14 (14.16)	-6.38 (12.63)	-12.20 (15.47)
VAS: Surprise	1.12 (14.16)	5.72 (16.74)	-.048 (10.89)
PANAS: Positive Affect	-4.6 (6.9)	-6.50 (6.29)	-3.30 (4.76)
PANAS: Negative Affect	-2.7 (2.21)	-1.20 (2.70)	-2.40 (4.62)

### 3.5. Screen Size and Emotion

*There were no significant effects of screen size on emotion/mood*

An independent samples t-test was run to compare mood/emotion scores of participants exposed to the large screen compared with those presented with the small screen version of the VE. There were no significant differences between the large and small screen size groups on VAS or PANAS (post-pre) change scores (see Table 1).

### 3.6. Relation between presence and emotion

Pearson's r correlations were run to explore the relationship between ITC-SOPI presence and VAS/PANAS emotion/mood across groups in which the presence manipulation was effective in producing significant results in the expected direction. The screen size manipulation produced significant differences in Sense of Physical Space ratings, with participants who experienced the large screen presentation reporting higher presence ratings along this dimension than participants in the small screen (self navigation) group. Correlations were run between ITC-SOPI presence and the subjective emotion ratings from participants in these two conditions.

Just one significant correlation emerged between ITC-SOPI Engagement and VAS (post-pre) Happiness ( $r = .56$ ;  $p < 0.05$ ;  $n = 20$ ): as participants' engagement in the experience increased, so did their happiness ratings. This correlation is likely to be an artefact of the similarity in scale content; the Engagement scale of the ITC-SOPI includes items relating to participants' enjoyment of their media experience.

## 4. Discussion and Conclusions

The study described here was designed to explore the relationship between presence and emotion, in conditions where presence was manipulated through variations in media form. Participants from fully independent groups who had the capacity to navigate in an environment and who experienced the environment on a larger display - Sheridan's (1992, [26]) ability to position sensors, and extent of sensory information, respectively - gave higher presence ratings than participants who experienced the environment on a smaller display and than those who were not given the capacity to navigate within the environment. More specifically, participants who self-navigated in the VE gave higher Engagement ratings on the ITC - Sense of Presence Inventory and participants who experienced the environment on a larger display gave higher Sense of Physical Space ratings. These findings support previous research by Welch et al. [8]; Hendrix and Barfield [11] and IJsselstein et al. [12] who have also found that screen size and the navigation within a VE can increase presence ratings. An important point to note here is the power and usefulness of carefully designed and validated presence questionnaires in independent groups designs.

Related changes in emotion were not observed. This finding stands in contrast to previously published results in

the literature showing that presence and emotion are related. Comparison of the design of the studies raised an interesting explanation, supported by other data from our laboratory. Previously we have reported no relation between presence and emotion for neutral (non-emotive) stimuli [15]. In the current study, we have reported no relation between presence and emotion for arousal reducing stimuli. In all studies where a relation between presence and emotion has been reported, arousing stimuli have been used (such as Meehan's experiments using Slater and colleagues virtual pit [20]). The theory we propose is therefore that *presence and emotion are related only for arousing stimuli*.

For content to be arousing to a media consumer it must be perceived as personally relevant and significant – either viscerally or carrying more complex meaning. Of course, this is not to say that all content that is personally relevant and significant need be arousing – it could be personally relevant, significant and arousal reducing.

We propose that there is an intuitive theoretical basis to explain why presence may enhance users' emotional responses to arousing media experiences, relating to the nature of arousal. For highly arousing stimuli a user's typical response is to be on alert, ready to respond to positive or negative events that would require an action (flight/flight or approach behaviour), and attention becomes heightened to that environment. In essence a user's ability to act, or perceived ability to act, in response to a stimulus is relevant for arousing stimuli. As presence is a user's sense of "being there" in a mediated experience – and hence their perceived ability to act within the experience - there is a rationale to expect it to be related to the extent of arousal elicited by an arousing stimulus. For non-arousing or arousal reducing stimuli there is no call to action on the user. As such, a user's perceived ability to interact with an environment, their attentional allocation to and sense of presence in relation to an environment may be expected to be less relevant for non-arousing stimuli. Of course, as per the initial expectations of the project, emotional responses to non-arousing stimuli may still be stronger in higher presence environments (as per the direction of the results presented here) but less so than are emotional responses to arousing stimuli.

The theory we propose is directly testable and falsifiable and we plan to investigate the topic further in our future research. One encouraging point to note is that it is consistent with the evolutionary rationale for presence recently presented by Riva, Waterworth and Waterworth (2004)[27].

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