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Does locality make a difference? Assessing the effectiveness of location-aware narratives

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ABSTRACT

With the increasing sophistication of mobile computing, a growing interest has been paid to locative media that aim at providing immersive experiences. Location aware narratives are a particular kind of locative media that aim at “telling stories that unfold in real space”. This paper presents a study that aimed at assessing an underlying hypothesis of location-aware narratives: that the coupling between the physical space and the narrative will result in increased levels of immersion in the narrative. Forty-five individuals experienced a location-aware video narrative in three locations: (a) the original location that contains physical cues from the narrative world, (b) a different location that yet portrays a similar atmosphere, and (c) a location that contains neither physical cues nor a similar atmosphere. Significant differences were found in users' experiences with the narrative in terms of *immersion in the story* and *mental imagery*, but not with regard to feelings of *presence*, *emotional involvement* or the *memorability* of story elements. We reflect on these findings and the implications for the design of location-aware narratives and highlight questions for further research.

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1. Introduction

With the increasing sophistication of mobile computing, a growing interest has been paid to locative media that aim at providing immersive experiences. Location aware narratives are a particular kind of locative media that aim at “telling stories that unfold in real space” (Rueb, 2008). As an example, in the Media Portrait of Liberties (Nisi et al., 2008), we developed a set of historically inspired video stories, shot and experienced at particular locations in the inner city of Dublin that bear significance for each story. GPS and custom-made maps were used to guide participants through the stories.

An assumption underlying the design of location aware narratives is that the coupling between the physical space and the narrative will result in increased levels of immersion in the narrative. At these magical moments as Reid et al. (2005) call them, “the senses are heightened to the coincidence of the event and it feels almost supernatural, as if events in the virtual world have somehow moved across into the physical world”.

Researchers have eagerly opted to take advantage of this phenomenon and qualitative evidence for its existence has been repeatedly reported. Ballagas et al. (2008) in their evaluation of REXplorer, a location-based game set in the Medieval city of Regensburg, found that incorporating real world landmarks into

the game's narrative added an authenticity to the game play that increased players' immersion. Reid et al. (2005b) argued that these magic moments occur when the mapping between the virtual world, that the user is imagining in her head, matches with some artifact like a building, bench, statue or tree in the physical world. In the field trial of “Riot! 1831”, Reid et al. (2005b) found participants to report empathy with the characters of the narrative and a sense of walking in their footsteps:

“you can actually relate to this area and in some instances imagine that the people who were talking are in front of you because that was actually happening to people in 1831. You have to have that.” (Reid et al., 2005b) (p. 1735)

Yet, despite the repeated qualitative evidence for the impact of locality on immersion (Ballagas et al., 2008; Reid et al., 2005b,c), to our knowledge, no work has examined systematically if and how this phenomenon occurs. One could even argue that it is narratives' natural capacity to draw the audience into an absorbed state irrespective of situational factors, often referred to as the text hegemony hypothesis (Bloom, 1994). Others have referred to this as the “book problem”, highlighting the paradoxical empirical knowledge that individuals can experience a sense of presence with books that offer a seemingly very low immersion (Schubert and Crusius, 2002). Similarly, McMahan (2003) distinguished between *perceptual immersion*, which is accomplished by “blocking as many of the sense as possible to the outside world”, and *psychological immersion*, which “results from the user's mental absorption in

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the world". In this sense, while perceptual illusion is difficult to accomplish with text, psychological immersion can be accomplished by narratives of any media as "our brains are programmed to tune into stories" (Murray, 1997).

Green and Brock (2000) proposed the construct of *narrative transportation* in their effort to understand the phenomenological experience of being swept away by a powerful story. According to their theory of narrative transportation, individuals do experience a state of transportation while reading, watching, or listening to a narrative (Gerrig, 1993). Narrative transportation is a rather broad concept incorporating various facets of immersion into the narrative world such as emotional involvement in the story, cognitive attention to the story, feelings of suspense, lack of awareness of surroundings, and mental imagery. It goes along with a vivid mental simulation of the events described in a narrative, with the consequence that these events may be misremembered as if they were actual real-world experiences (Appel and Richter, 2010).

Contrary to the text hegemony hypothesis, Green and Brock (2000) assume narrative transportation to vary with regard to situational aspects as well as individual factors, such as individuals' proclivity towards becoming immersed into a story. References to physical descriptions and mental events throughout the narrative have been found to induce a higher sense of transportation (Green et al., 2004). Similarly, Busselle and Bilandzic (2008) found *external realism*, i.e. a narrative's match with external reality, and *narrative realism*, i.e. internal coherence within the story, to affect narrative engagement, a construct highly similar to Green's and Brock's narrative transportation.

It seems plausible that the coupling between the physical space and the narrative may add to the external realism of the narrative, leading to heightened feelings of being transported into the narrative world. Reid et al. (2005) proposed three levels of significance to a place and how a location-aware narrative, or mediascape as they call it, can be coupled with it. First, in *arbitrary linkage*, any place of a certain physical size can be coupled with the narrative. The place is simply used as a physical area that could be anywhere geographically. Second, *physicality* implies "a place with certain characteristics, a tree, a bench or a lamppost". The space can still contain features that are not relevant to the narrative; thus, the narrative can be remapped to any geography that contains some physical elements of significance to the narrative. Third, a *particular location*, in which "the actual location and physical artefacts in a place are significant and meaningful" to the narrative.

Reid's et al. (2005) model is useful from a design perspective as it proposes that the coupling between the physical space and the narrative can be symbolic, in that it may take any arbitrary form that the designer wishes to impose. One may, however, further extend this model by considering the varying immersive capacity of different physical elements. Some elements might be at the core of the narrative, e.g. physical artefacts that a character uses to perform an action, while others may be at the periphery, e.g. the color of walls or tiles of the pavement.

A simple dichotomy may be drawn between the original location that bears direct significance to the narrative and a location that contains some physical similarities, such as with respect to the lighting and noise conditions, the architectural style of buildings and other physical elements, and, thus, induces a sense of sharing the same atmosphere with the original location. While the original condition has the ability to lead to what Reid et al. (2005b) refer to as "magical moments" that occur when the virtual world that the user is imagining in her head, matches with some artifact of the surrounding physical environment, the latter one is less likely to lead to such effects, yet, it may induce higher sensory involvement (Laurel, 1993) and thus lead to a higher immersion in the narrative world through a suspension of disbelief (Meadows and Stephen, 2002; Ryan, 2001).

In the study that follows we employed this extended model of the coupling between the physical space and the narrative world in attempting to examine the impact of locality on users' experience of location-aware narratives.

2. Study

Motivated by Reid's et al. (2005) characterization of the three levels of significance of location and its mapping to narrative elements, we distinguished between two forms of locality, resulting to the following three conditions in the study:

- A. *Original location*: contains physical cues from the narrative. Becoming aware of these physical cues is expected to lead to increased levels of narrative transportation and feelings of presence through adding to the external realism of the narrative (i.e. the narrative's match with external reality). This heightened narrative transportation is expected to lead higher experienced affect due to increased sensory involvement as well as increased identification with the primary character of the narrative.
- B. *Same atmosphere*: a different location that yet portrays a similar atmosphere with the narrative's original location through resembling physical elements such as lighting and noise conditions as well as the architectural style of buildings and other physical elements. While we expect this to yield weaker increase in narrative transportation and feelings of presence, we expect that coupling of the atmosphere between the physical and the virtual world to induce higher sensory involvement than the control condition (Laurel, 1993) and thus lead to a higher immersion in the narrative world through a suspension of disbelief (Meadows and Stephen, 2002; Ryan, 2001).
- C. *Control condition*: a location that contains neither physical cues nor a similar atmosphere (control condition).

2.1. Participants

A total of 45 tourists visiting the city of Funchal, Madeira (24 female) participated in the study (15 per condition). The sample's median age was 35 years. Their native language was English (27), German (6), Portuguese (4), Dutch (3), Czech (1), Danish (1), Greek (1), Spanish (1) and Urdu (1). All participants were, however, pre-screened for their fluency in English. They were recruited as walking in touristic streets of Funchal. To assess participants' homogeneity in terms of their empathic ability we employed Davis' Interpersonal Reactivity Index (IRI), and specifically only one of its four constructs: the *fantasy scale*, which measures an individual's tendency to get caught up in fictional stories and imagine oneself in the same situations as fictional characters (Davis, 1983; see Table 1). Internal reliability of the scale was satisfactory (Cronbach's $\alpha = 0.63$). A principal components analysis (varimax rotation, eigenvalue > 1) revealed a two-factor structure of *imaginative empathy* (eigenvalue = 1.9, 27% explained variance) versus *emotional empathy* (eigenvalue = 1.8, 26% explained variance). Internal reliability of the scales, however, did not increase (IE: $\alpha = 0.61$, EE: $\alpha = 0.56$). No significant differences were found between the three conditions, the original location (mean = 3.55, sd = 0.83), the same atmosphere condition (mean = 3.63, sd = 0.61) and the control condition (mean = 3.89, sd = 0.56).

2.2. Location-aware video narrative

Participants experienced a stripped-down version of iLand (see Fig. 1), a location-aware video narrative aiming at exposing the rich

Table 1

Individual items of the IRI fantasy scale along the two factors (imaginative and emotional empathy) revealed in the principal components analysis (items ordered by their loading on the respective factor). All items rated on 7-point likert scale ranging from 'does not describe me well' to 'describes me well'.

Imaginative empathy

- When I watch a good movie, I can very easily put myself in the place of a leading character
- Becoming extremely involved in a good book or movie is somewhat rare for me
- I am usually objective when I watch a movie or play, and I do not often get completely caught up in it

Emotional empathy

- After seeing a play or movie, I have felt as though I were one of the characters
- I daydream and fantasize, with some regularity, about things that might happen to me
- I really get involved with the feelings of the characters in a novel
- When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me

**Fig. 1.** Selection of frames from the iLand audiovisual narratives.

oral culture and tradition in the island of Madeira (Dionisio et al., 2010), iLand consists of five video narratives, all situated in the old town of Funchal, the capital of Madeira. To increase users' immersion in the narrative, the designers of iLand have purposely designed it so that features of the physical environment merge with the story world and narrated events. Such features may relate to local settings such as street corners, bridges and buildings, and its tangible details, such as cobbles, crumbling walls and colored balconies. In our study participants experienced only one audiovisual narrative that was deemed to be the most effective with respect to our focus on locality.

2.3. Procedure and measures

Participants were invited to “watch a video narrative about this place” as walking through touristic streets of Funchal, Madeira. Once agreeing to participate, each participant was given a Nexus S Android phone with a 2D barcode reader (notice the 2D barcode in the upper right part of Fig. 2) for starting the video narrative. Audio headsets were used to minimize interruptions due to environmental noise. We first instructed them on how to start the narrative using the 2D barcode and how to change the audio volume in the phone. Audio volume was preset at a high level. Interactions between participants and researchers were avoided during watching the narrative. The narrative lasted for 2 min and 52 s.

Once completed, participants were asked to fill out a questionnaire consisting of measures of narrative transportation, presence, affect and imaginative empathy. Finally, a subset (16 out of 45) of the participants were interviewed with the intention to uncover whether participants became aware of any physical cues and how this affected their experience. We purposefully limited interviews to a maximum of 10 min in an effort to reduce participants' fatigue as these took place outdoors and during participants' holidays.

2.3.1. Narrative transportation

Narrative transportation reflects the extend to which individuals become “lost” in a story (Green and Brock, 2000). It consists of 11 scales (see Table 2) tapping into different facets of immersion into the narrative world such as emotional involvement in the story, cognitive attention to the story, feelings of suspense, lack of awareness of surroundings, and mental imagery. Internal reliability for positive affect was satisfactory (Cronbach's alpha = 0.61). A principal components analysis (varimax rotation,

**Fig. 2.** A participant experiencing the location-aware narrative.

eigenvalue > 1) revealed a three-factor structure of *emotional involvement* (items 6, 7, 8, 11, 10, 3; eigenvalue = 3.2, 30% explained variance, internal reliability $\alpha = 0.81$), *immersion in the story* (items 9, 2, 5; eigenvalue = 1.9, 17% explained variance, internal reliability $\alpha = 0.59$ – increased to 0.62 after removing item 5), and *mental imagery* (items 1, 4; eigenvalue = 1.7, explained variance 16%, internal reliability $\alpha = 0.69$).

2.3.2. Affect

Experienced affect was measured with the PANAS scale (Watson et al., 1988). It uses 20 verbal descriptors, namely *active*,

Table 2
Individual items of the Narrative Transportation scale along the three factors (emotional involvement, immersion in the story and mental imagery) revealed in the principal components analysis (items ordered by their loading on the respective factor). All items rated on 7-point likert scale ranging from 'not at all' to 'very much'.

Emotional involvement

- I wanted to learn how the narrative ended
- The video narrative affected me emotionally
- I found myself thinking of ways the video narrative could have turned out differently
- The events in the video narrative have changed my life
- The events in the video narrative are relevant to my everyday life
- I could picture myself in the scene of the events described in the video narrative

Immersion in the story

- I found my mind wandering while watching the video narrative
- While I was watching the video narrative, activity going on in the space around me was on my mind
- After the video narrative ended, I found it easy to put it out of my mind

Mental imagery

- While I was watching the video narrative, I could easily picture the events in it taking place
- I was mentally involved in the video narrative while watching it

alert, attentive, determined, enthusiastic, excited, inspired, proud, strong and interested for positive affect (PA), and afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, and distressed for negative affect (NA). Internal reliability was satisfactory for positive affect ($\alpha = 0.63$) and very good for negative affect ($\alpha = 0.83$). The scale's inter-correlation was substantial ($r = 0.44$, $p < 0.01$). A principal components analysis on positive affect (varimax rotation, eigenvalue > 1) revealed a two-factor structure with *inspired, enthusiastic, determined, alert, interested and strong* (PA1; eigenvalue = 4.4, 44% explained variance, internal reliability $\alpha = 0.92$) differentiating from *active, excited, proud and attentive* (PA2; eigenvalue = 2.4, 24% explained variance, internal reliability $\alpha = 0.74$). Prior work has also suggested a multidimensional structure of positive affect, though with a different structure (Egloff et al., 2003).

2.3.3. Presence

Despite recent efforts in creating a generic theory of spatial presence that is independent of the medium (e.g. Schubert, 2009), existing psychometric scales that attempt to measure presence are often specific to virtual reality applications. We thus decided to employ a single item scale: *In the video narrative I had a sense of 'being there'* (Slater et al., 1994). This item is in line with definitions of presence as an experience (Wirth et al., 2007; Lee, 2004), "a psychological state in which virtual (para-authentic or artificial) objects are experienced as actual objects in either sensory or non-sensory ways" (Lee, 2004). Presence ratings correlated with emotional involvement ($r = 0.64$, $p < 0.01$), mental imagery ($r = 0.41$, $p < 0.05$) and Positive Affect 2 ($r = 0.30$, $p = 0.05$).

2.3.4. Interviews

Once participants filled out the questionnaires, we asked a subset of them to participate in a short interview session, resulting to a total of 16 (out of 45) interviews. Interviews started by asking to "describe the story [they] just saw" with the intention to inquire into the narrative elements that participants paid attention across the three conditions. We subsequently asked them if they noticed any elements from the physical environment that surrounded them in the audio-visual narrative. When reporting at least one, we followed by asking how this made them feel. We concluded with open questions regarding experienced technical or environmental barriers, the clarity and quality of the video narrative, and whether this was their first visit to this particular location.

3. Results

In the section below we attempt to address the following three questions: (a) did participants become aware of the mapping between the physical and the narrative environment? and, if so,

did this result to (b) enhanced feelings of narrative transportation, presence and experienced affect and (c) enhanced memorability of the story elements?

3.1 Did participants become aware of the mapping between the physical and the narrative environment?

During the interview we asked participants to indicate whether they noticed any elements from the physical environment that surrounded them in the audio-visual narrative and show them to us. A total of four elements were reported: the pavement, the watercourse, the wall and one door. All participants in the original location reported at least one physical element:

"Yes... this wall... I was trying to find the door where the lady was... it had this square drawn... I could easily see [in the video narrative] this watercourse, this wall, and this small part of the street" [condition A, participant 5]

None were reported in the control condition. Interestingly, two participants mentioned becoming aware of one element – the tiles of the pavement – in the 'same atmosphere' condition, while others, as expected, mentioned the resemblance of the overall atmosphere: "Yeah, not a particular house but it looked like the surrounding here" [condition B, participant 12]. We have no way of knowing though if they became aware of this during watching the narrative or if it was based on reflection.

3.2 Did this mapping lead to enhanced feelings of narrative transportation, presence and experienced affect?

Fig. 3 presents the mean values and 95% confidence intervals for the three underlying factors of narrative transportation, namely *immersion in the story* – consisting of items such as "activity going on in the space around me" (inverted) and "I found my mind wandering while watching the video narrative" (inverted), *mental imagery* – consisting of items such as "I could easily picture the events in it taking place" and "I was mentally involved in the video narrative", *emotional involvement* – consisting of items such as "I wanted to learn how the narrative ended" and "the video narrative affected me emotionally", as well as for presence – users' sense of "being in" the narrative environment.

Significant differences were found between the 'original location' condition and the control condition, with participants in the original location reporting higher immersion in the story ($t(28) = 2.4$, $p < 0.05$) as well as mental imagery ($t(28) = 2.7$, $p < 0.05$). When becoming aware of the mapping between the physical and the narrative environment, some participants became amused and attempted to initiate a dialog with the researchers:

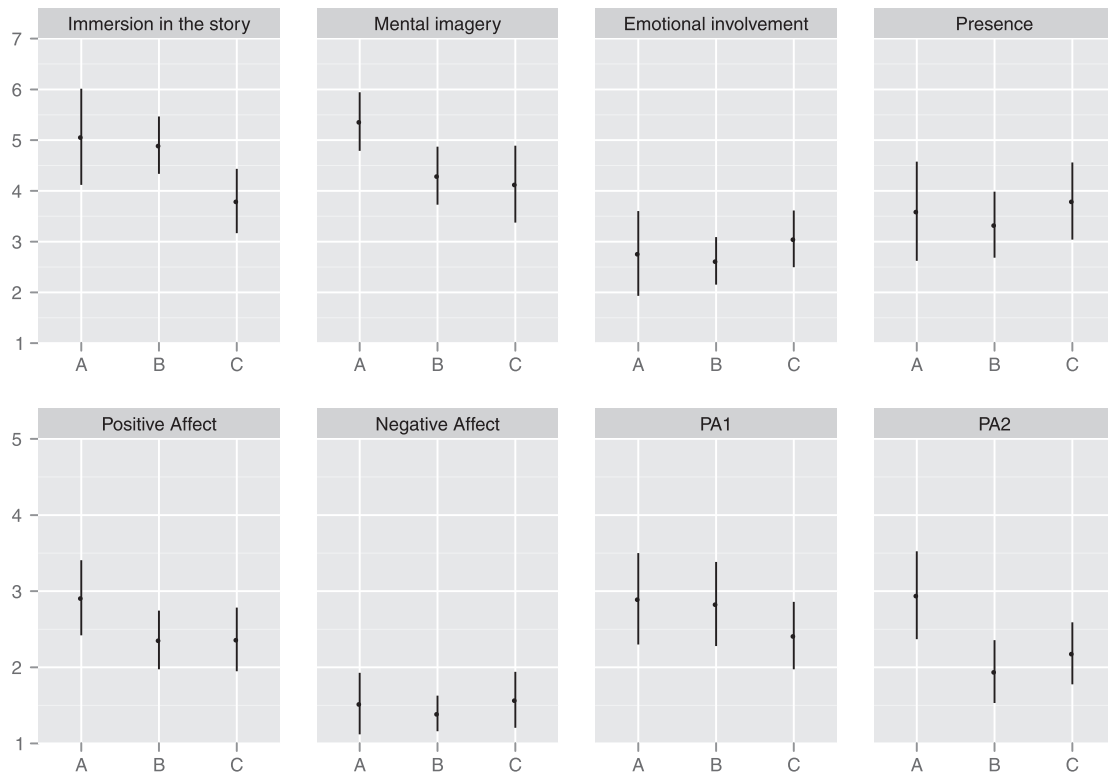


Fig. 3. Mean values and 95% confidence intervals for cognitive (upper part) and affective (lower part) feelings for the three conditions of the study (A: original location, B: same atmosphere, C: control condition). Experiencing the narrative in the original location led to significantly higher immersion in the story, mental imagery, and positive affect 2 (*active, excited, proud and attentive*).

“This is here! right?” [pointing to watercourse and smiling]. Surprisingly though, despite the higher experienced immersion and mental imagery, no significant differences were found in terms of experiencing a sense of presence that was reported to be moderate across all conditions (see Fig. 3).

Participants in the second condition, i.e. ‘same atmosphere’, appeared to experience higher immersion in the story as compared to the control condition ($t(28) = 2.8, p = 0.01$), but not necessarily higher mental imagery. Experienced mental imagery was significantly higher in the original location as compared to the ‘same atmosphere’ condition ($t(28) = 2.8, p < 0.01$).

No significant differences were found across the three conditions in terms of emotional involvement and experienced affect, except from positive affect 2 consisting of verbal descriptors such as *active, excited, proud and attentive* which was rated higher in the ‘original location’ condition as compared to the control condition ($t(28) = 2.4, p < 0.05$) and the ‘same atmosphere’ condition ($t(28) = 3.1, p < 0.01$). Emotional involvement and experienced affect was overall rated low. Some participants resonated with the idea of seeing how life used to be in the past, e.g. “*I was really interested because it was giving the history of how the people actually live*” [condition B, participant 15], “*I felt sorry for the chap but I mean its life really, I gathered it’s from the late 1800’s. Back then I think things were different, weren’t they?*” [Condition B, participant 2], gaining new information, e.g. “*interesting to see how people used to deliver milk in the past*” [condition C, participant 1], or reminding them of their own past, e.g. “*It was emotional because when I was younger I used to work in the farm and worked hard*” [condition A, participant 2]. Others felt a lack of connection to the cultural context, e.g. “*I was looking for a moral lesson at the end. It felt like the old days but neutral*” [condition B, participant 10], or the location, e.g. “*I wanted to know more about this place. I would like to have more content*” [condition B, participant 12].

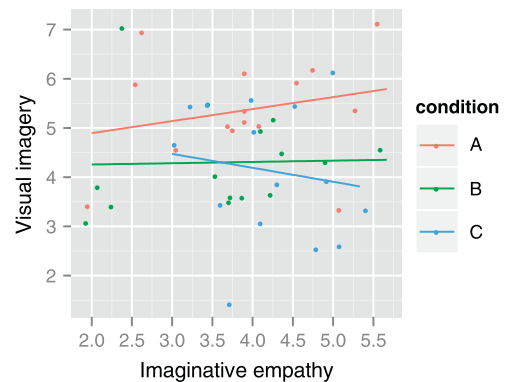


Fig. 4. Scatterplot of experienced mental imagery against participants’ disposition towards imaginative empathy for the three conditions of the study (A: original location, B: same atmosphere, C: control condition). X, Y coordinates have been jittered by 0.1.

No significant correlations were found between participants’ disposition towards imaginative and emotional empathy and experienced cognitive and affective feelings while watching the narrative. Some interesting tendencies were observed though on the relation between the experienced mental imagery and participants’ disposition towards imaginative empathy (all interaction effects were not significant though). Individuals in the ‘original location’ condition with higher disposition towards imaginative empathy tended to experience higher mental imagery (see Fig. 4). The reverse seemed to happen in the control condition. One plausible interpretation of this tendency could be that individuals with higher disposition towards imaginative empathy may have higher expectations from a narrative experience as well as

more, or more recent, experience with immersive narratives to which they can contrast their ongoing experience.

3.3 Did this mapping lead to enhanced memorability of the story elements?

We transcribed participants' recollections of the narrative word-by-word and divided these recollections into narrative units. Each unit consisted of an actor-action-object phrase such as "boy sells milk", "group of boys invite him to play football", "boy poured the milk down the stream". We found seven different recollected units of the narrative. In the 'original location' condition participants recalled an average of four narrative units. Surprisingly, participants in the same atmosphere condition recalled less narrative units (mean = 1.3) as opposed to the control condition (mean = 4.3). One possible explanation for this is that participants became distracted from the narrative as looking for cues in the physical space. As one participant mentioned:

"I was looking... I could see some of the surface elements, but I couldn't see the doors ... I was looking because I saw the sign and thought it must be connected to the place ... it might be that the building has changed or it might be in the next street" [condition B, participant 5]

Next, it appears that there is no evidence suggesting that experiencing narratives at their original location results to better memorability of the narrative. One has to be cautious, however, in that these insights can be treated only as indicative as they are based on a small sample (16 participants).

4. Discussion

Overall, some positive evidence was found for the impact of locality on users' experiences with location-aware narratives, with participants in the original location reporting to be significantly more immersed into story as well experience heightened mental imagery as compared to control condition. This became evident also during observing participants' behavioural responses while watching the narrative as well as during the interview session. The 'same atmosphere' condition produced mixed results; while participants reported increasingly a higher immersion into the story, or loss of awareness of activities going on in the nearby physical, they did not report significantly higher mental imagery. This might imply that such an arbitrary mapping may be sufficient for setting the conditions for an immersive experience but not necessarily result to Reid's et al. (2005b) "magical moments" that occur when the virtual world that the user is imagining in her head, matches with some artifact of the surrounding physical environment. Important to note, however, is that we observed that location mattered in more than just what we initially imagined. As these settings were in different parts of the town, participants came with a different mind-set. The original location, being located in the old town of Funchal may have afforded a more open positive attitude towards engaging in new experiences, which may have contributed to the current findings.

Next, it is rather puzzling that, despite these findings, participants reported moderate experienced spatial presence across all conditions. One could simply attribute this to the use of a non-standardized scale, or to the use of a single-item to measure presence. Note, however, that single-item constructs has been a common practice in the measurement of even more evasive constructs (Abdel-Khalek, 2006), and that the item that was used in this study is at the core of many definitions, or measures of presence as a quality of experience. Another possible interpretation could be the limited exposure to the narrative, lasting for less than

3 min. A last possible interpretation of these conflicting results may be found in the dual-process model that Schubert and Crusius (2002) propose in trying to differentiate the experience of presence in virtual reality, film and textual stimuli. They assume two processes underlying the psychological phenomenon of presence: (1) constructing a spatial mental model in which own (bodily) interactions with the environment are coded – they call this spatial presence, and (2) devoting attention to this construction – they call this involvement. They argue that while virtual reality is marked by a high potential for both involvement and spatial presence, text and film seem strong on the involvement but weaker on the spatial presence side. In this sense, to experience a feeling of presence, i.e. a feeling of "being there", requires strong sensory cues that are typically acquired through a bodily interaction with the environment (e.g. turning one's head resulting to a different perspective), that location-aware narratives, like traditional narratives, fail to deliver.

While participants engaged with the narrative world, this did not necessarily result to higher emotional involvement with the characters of the narrative. This may well be attributed to the content of the story, as some participants reported it being emotionally neutral and to lack cultural context. While prior work has shown narrative transportation to correlate with affect (Escalas, 2004), this study revealed that immersion into the story and mental imagery do not necessarily lead to strong affective reactions.

5. Conclusion

This study attempted to test the significance of location to location-aware narratives. In doing so, we distinguished between two forms of locality: the original location that bears direct significance to the narrative and a location that contains some physical similarities and, thus, induces a sense of sharing the same atmosphere with the original location. Overall, results showed that experiencing a narrative in the original location may lead to a significantly increased immersion into story as well heightened mental imagery as compared to control condition.

Contrary, experiencing the narrative in a location that bears a similar atmosphere to the original location may lead to increased immersion but not mental imagery, suggesting that such an arbitrary mapping may be sufficient for setting the conditions for an immersive experience but not necessarily result to Reid's et al. (2005b) "magical moments" that occur when the virtual world that the user is imagining in her head, matches with some artifact of the surrounding physical environment. Worth-pointing however is the potential confusion that may be induced through such an arbitrary linkage, when some but not all cues match between the physical and the virtual environment. This may lead to cognitive overload, distraction and eventually disengagement from the narrative as attention needs to be shifted to the physical environment. Designers could opt for narration styles that enhance this connection (e.g. guiding the viewer to attend certain aspects of the physical environment), providing feedback (e.g. haptic) throughout the experience.

One has to note a number of limitations of the current study. Firstly, the study reported in the current paper, despite being in the actual field, it had a number of controlled elements, i.e. all participants experience a single narrative, in a confined space while involving no transit between different locations. On the one hand, this minimized risks of interruptions during the narrative experience, which is often mentioned as a threat to immersion (Diamantaki et al., 2010). On the other hand, one has to note that location-aware narratives entail more than a coupling between the narrative and the physical world. Next to this coupling, a second assumption underlying the design of location-aware narratives is

that the free, voluntary, exploration of the space and the order in which one may encounter different location-aware narratives increases the chance of serendipitous encounters. This creates a second kind of ‘magical moments’ that this study has not assessed.

Secondly, participants experienced a single story and of limited length (3 min) which may have contributed to the current findings such as moderate feeling of presence.

Last, the narrative employed in the current study was of audio-visual form. One could question the extent to which these results carry over to textual or audio narratives, especially with regard to mental imagery.

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