

## The role of content preference on thematic priming in virtual presence

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### Abstract

*We set out to test the possibility that thematically priming participants with exposure to a familiar, contemporary introductory VE (with a hip-hop theme) could increase their levels of presence in a culturally unfamiliar, historical VE (a San storytelling VE). Our findings show that the relationship between priming and presence are more complex than previously thought. Specifically, for those participants who were primed with the hip-hop introductory VE, only those who chose hip-hop music as their favorite music genre derived any benefit from the introductory VE in terms of presence scores (measured on the Igroup questionnaire). This implies that thematic priming interacts with personal preference and that introductory VEs of this sort do not necessarily improve the presence experience for all users.*

### 1. Introduction

This paper reports on an interesting theoretical finding which occurred as a side-effect of an investigation on thematic priming. This investigation involved developing a virtual environment (VE) to present the oral storytelling tradition of the San people (a nomadic hunter-gatherer group indigenous to southern Africa) in an appropriate historical and physical setting. One of our goals was to create a strong sense of presence in the users of this VE.

One possible way to improve the presence experience of a VE user is to use thematic priming [1]. This method involves cognitively preparing users for a VE experience by presenting them with materials thematically related to the VE's content (the priming manipulation) prior to their experience. For high-fidelity environments, this method has been shown to increase presence scores [1]. From a presence theory perspective, thematic priming is an interesting concept. It is argued to operate when the content of the priming manipulation interacts with the content of the VE to influence presence [1]; this implies that the content of a VE can be a predictor of presence.

If presence is a function of content factors, then it is reasonable to suggest that for different users, the same VE might lead to different presence experiences. This is because content is likely to be interpreted and understood subjectively, based on an individual's previous experiences and knowledge of the content [2]. For instance, if the content is too unfamiliar or obscure, users may fail to

extract enough meaning from the VE, thus compromising their presence experience. It might therefore be useful in such instances to introduce the content of the VE in more familiar terms, following the principles of constructionist learning [3]. Using familiar material as conceptual priming could theoretically provide a scaffolding of activated cognitive constructs upon which the unfamiliar VE can be understood, which would, hopefully, enrich the presence experience. Since familiarity will vary from individual to individual, it is important, from a methodological perspective, to control for this by obtaining some measure of a particular user's familiarity with the material used for priming.

From a practical point of view, we were interested in the possibility that providing some form of thematic priming could improve the presence experiences of our users. Most of our target audience would be young urban adults; thus, we were concerned that the historical San storytelling we wished to convey using VR would be too culturally remote for our users to understand. Also, as the story to be told in the VE is mythological, we were also concerned that the strangeness of the story might alienate users, and reduce their presence. In an attempt to maximize our target audience's presence, we constructed an introductory VE to preface the San VE and prime the users. This introductory VE provided some information on the San and their oral storytelling tradition.

### 2. Approach

To create a San storytelling VE, a traditional San fireside milieu was re-created to present the story in an appropriate historical context. This VE consisted of a large cave where a user can join a San gathering around a fire and listen to a traditional San story told by a San storyteller actor. As mentioned above, we wished to make this San VE as effective as possible and we therefore tested whether the use of a familiar introductory VE could increase presence in the San VE. Since we were aiming to convey content that was likely to be culturally unfamiliar in the San VE, we wished to investigate whether a more familiar-themed introductory VE could improve users' experience of the San VE. We hypothesized that a contemporary theme was likely to be culturally familiar to users and might thus create an effective transition to the historical San storytelling VE.

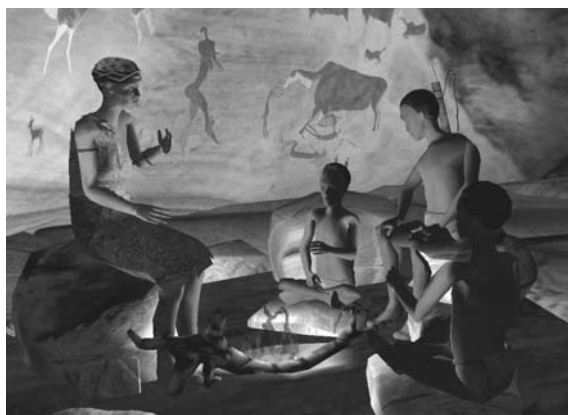
Hip-hop was chosen as the contemporary theme for the introductory VE, since it is a well-known subculture whose style is easily recognizable. We investigated the

similarities between San and hip-hop, and found that storytelling, painting, music and dance are key aspects in both. With regards to storytelling, hip-hop's mc-ing (also known as rapping) is a means of telling stories similar to the San tradition of oral storytelling performances.

### 3. Virtual Environments

In order to test the effect of using an introductory VE, two different virtual storytelling scenarios were created for comparison:

*San VE* (abbreviated as *NI*): A visual and audio desktop VE in which a San storyteller tells a San story to a gathering and the user around a fire (Figure 1). This condition had no introductory VE.



**Figure 1: The historical San storytelling environment. The storyteller (left) tells the story to the audience, which responds and reacts.**

In this VE, users are placed in a mountainous, outdoor environment; in the distance a gathering of San people can be seen sitting around an animated fire in a large cave. As the user walks toward the gathering, a San man from the gathering greets the user extends an invitation to join the group in listening to a story. The storyteller then begins to tell a traditional San story. The storyteller actor is animated throughout the narration; these animations were rotoscoped from the recorded actions of the actress who provided the storyteller's voice. The San gathering reacts during the story narration by exclaiming and gesturing to the storyteller and to each other.

The story was taken from a Bleek and Lloyd collection, one of the most comprehensive San story archives containing San stories transcribed from various San storytellers in the late 19<sup>th</sup> century [4, 5]. This collection contained two versions of a story about how Kagga'n, the praying mantis, created the eland and the moon. These versions were combined to form the story told in the San VE.

The cave was modeled after the Cederberg mountains of the Western Cape province in South Africa, once inhabited by the San [5]. The caves walls near the gathering were textured with San rock art which related to the story

[6]. Various San objects, such hanging bags, a grinding stone and quivers were also placed in the cave. Detailed sketches were made for each character using photographs of the San. The cave, San actors and story text were all reviewed and refined with the help of an archeologist, Prof. J. Parkington, to ensure as much authenticity as possible.

*San VE with Introductory VE* (abbreviated as *I*): This is the NI environment described above, but was preceded by an introductory VE with a contemporary, culturally familiar theme, in this case hip-hop (Figure 2). The introductory VE consisted of an urban environment, where the user encounters a hip-hop actor, with a radio. The actor is rapping about the San people and the story that will be told in the San VE. Again, the recorded actions of a real-life actor, in this case a hip-hop musician, were rotoscoped to animate the hip-hop actor. Behind the hip-hop actor, in the VE, there are a number of graffiti covered walls and, nearby there is a door with the word "San" in graffiti on it.

As the user walks toward the actor, he stops rapping and speaks to the user; he tells them about the San and their storytelling tradition. This monologue, along with the earlier rap, serves as preparation for the content which the users will encounter in the historical San VE. He then directs the user to the door, which opens to reveal the historical San VE. The user is then able to enter the San VE described above. Thus both VE's contain content on the San, this links the introductory and San VE's thematically.



**Figure 2: This hip-hop scene (in which the actor performs a rap and monologue about the San) precedes the historical San environment.**

### 4. Study

A study was conducted to test the effect of the introductory VE; this was done by comparing the presence experienced by users in the two virtual storytelling scenarios. 58 undergraduate university students from both Science and Humanities faculties took part in this study. 30 participants experienced the San VE without an introductory VE (*NI*), while 28 experienced the San VE with the introductory VE (*I*). The mean age of participants was 20.42 years ( $s=1.64$ ). 23 participants were female (40%), while 35 were male (60%).

The study took place in a quiet experimental room with four desktop computers, two running the *NI* scenario and two running the *I* scenario. Each computer ran the VEs at a frame rate of 25-30 frames per second. Four participants were taken into the experimental room at a time and were randomly assigned to the *I* or *NI* condition. The use of the mouse and keyboard for navigating the VEs was described and participants were provided with a training VE in which to practice until they felt comfortable with the controls. Participants were then informed that they would be experiencing a San story in a VE where they would be free to navigate as they wished. They were asked to put on headphones, the light in room was dimmed and participants experienced the VEs under the supervision of an experimenter.

After their virtual storytelling experience, presence (P) was measured using the Igroup Presence questionnaire. [7] Each participant's personal interest in and affinity for hip-hop was also measured. This was done since the choice of hip-hop as the introductory VE's theme was essentially arbitrary; any other well-known contemporary subculture could have been selected. Therefore, as discussed in Section 1 above, we wished to control for and consider any influence participants' personal interest, or lack of interest, in hip-hop might have had on their response to the introductory VE. Two measures of hip-hop interest (HI) were used:

- A multiple choice item asking participants to choose their favourite music genre from the following options: classical, hip-hop, alternative, rhythm and blues, rock and jazz.
- 5 items (7 point Likert-type response scale with 'fully agree' and 'fully disagree' as anchors) which measured enjoyment of hip-hop and rap music as well as familiarity with hip-hop as a popular contemporary subculture.

## 5. Results

The descriptive statistics for the study are shown in Table 1. A one-way analysis of variance (ANOVA) was performed using P scores as the dependent variable and condition (*I* or *NI*) as the categorical predictor. No significant effect was found ( $F=0.038$ ,  $df=1$ ,  $p < 0.847$ ). However, when one considers only the participants in the *I* condition (i.e. those who experienced the hip-hop introduction), we see an effect on favorite music genre. A significant difference exists in favor of those who chose hip-hop as their favorite genre ( $N=6$ ) over those who chose other genres as their favorite ( $N=24$ ) (Mann-Whitney  $U=24.5$ ,  $Z=2.47$ ,  $p < 0.013$ ). As a control for the possibility that the hip-hop preference variable was simply the manifestation of some latent factor which might affect presence directly, we conducted a similar analysis on the *NI* condition. This revealed no significant difference on music genre preference (hip-hop favorite:  $N=5$ ; other favorite:  $N=23$ ; Mann Whitney  $U = 47$ ,  $Z = 0.63$ ,  $p < 0.53$ ). A summary of the comparisons performed across the entire sample and within the *NI* and *I* conditions is shown in Table 2.

From these results, one may conclude that the difference arises only from the combination of music preference and introductory VE condition.

There were no significant relationships between presence scores and the 5 Likert items measuring enjoyment and familiarity with hip-hop culture, either across introductory VE condition, or inside either condition.

Group	Valid N	Mean	Std. Dev.
<b>NI and I</b>	58	59.48	12.71
<b>NI</b>	28	55.22	11.86
<b>I</b>	30	59.17	13.65

**Table 1: Descriptive statistics presence (P) in the entire sample (NI and I), in the group with no introductory VE (NI) and the group with introductory VE (I).**

Group	Comparison	<i>p</i>
<b>NI and I</b>	NI vs. I (ANOVA)	<0.847
<b>NI</b>	Hip-Hop vs. Other (Mann-Whitney U)	<0.53
<b>I</b>	<i>Hip-Hop vs. Other (Mann-Whitney U)</i>	<i>&lt;0.013</i>

**Table 2: Summary of effects on presence (P) in the entire sample (NI and I), within the group with no introductory VE (NI) and within the group with the introductory VE (I). Significant effects ( $p < 0.05$ ) are shown in bold and italic.**

## 6. Discussion

### 6.1 Interaction of priming and preference

This study set out to test the effect of using a thematically familiar introductory VE (the hip-hop VE) to improve the sense of presence in an unfamiliar VE (the San VE). Instead, it revealed some interesting data with regards to the interaction of content preference and thematic priming on presence. We found that using an introductory VE as thematic priming does not necessarily serve to improve presence in all VE users. In this particular case, priming was only effective for users who had a pre-existing interest which overlapped with the thematic content of the introductory VE (the priming manipulation). This is evident from our result that participants who were primed with the introductory VE *and* showed a strong interest in the hip-hop exhibited higher presence scores than those who were primed and showed no particular interest in hip-hop. Conversely, for those who received no introductory VE, music preference had no effect. This clearly shows an interaction between thematic priming and individual content preference.

There has recently been some debate in the literature about the relative contribution of VE content to presence (see for instance [8, 9]). Our result opens up the possibility that there is an interaction at work: user preferences seem to mediate how content is processed. This interaction model, although more complex, allows for

the possibility that users' previous experience, knowledge and preferences, can play a role in their presence experiences. This possibility will need to be further examined by means of studies which carefully control for the degree of previous knowledge or preference of each participant. Since there may be more at work than the combination of content preference and priming, it would be helpful to test all possible combinations of effects in order to confidently identify the factors at work. For instance, users' level of interest in priming and VE content could be measured *before* a VE experience to test their effect on presence. In the context of the study presented in this paper, this initial testing would have allowed us to test the effect of existing interest in both hip-hop and the San on presence.

We have not categorically proven an interaction of content preference and priming. Indeed, the results of this study would be more generalisable if they were replicated with different types of content. After all, it may be that individuals preferring classical music will not be affected by classically themed priming in the same way. Bear in mind however, that no priming effects were observed where any of the other music genres, classical, alternative, rhythm and blues, rock or jazz, were selected as favorites. This suggests that it was the match between participants' content preference and priming that increased overall presence and where there was a mismatch, presence was not affected.

One potential criticism of this study is that the subjects in the introductory VE condition confused the instruction of how to complete the presence questionnaire – rather than respond about the entire experience (introductory VE and San VE), they responded with regards to the introductory VE only, as the familiarity would have grabbed their attention. If the subjects responded only about their experience in the introductory VE, it still shows that their interest in hip-hop interacted with the hip-hop content of the introductory VE to increase their presence scores for the introductory VE. Thus, although one may argue that this study does not show definitively that introductory VEs are capable of producing a priming effect, it shows quite convincingly, we believe, that VE content and user experience factors interact during a presence experience.

It must also be noted that the five Likert items measuring enjoyment and familiarity with hip-hop culture showed no effect on presence. One might have expected to see these items give a similar effect as the music preference item. However, these five items do not directly measure personal preference for hip-hop, but rather the participant's perceptions of the subculture in a more objective sense (for instance, one of the items is "Fashion inspired by hip-hop culture is cool and looks good"). In other words these items were intended to measure whether subject recognized hip-hop as a familiar subculture along with their interest in hip-hop. This effectively reduces the validity of the item as a measure of personal preference for hip-hop. It is rather a measure of a combination of preference for and knowledge of hip-hop. We believe that finding only an effect on hip-

hop as a favorite music genre indicates that preference for the theme of the introductory VE played a stronger role than just familiarity with the theme.

## 6.2 Practical implications

From a pragmatic perspective, the findings of this study are somewhat disappointing. Before conducting this study, we had hoped that a culturally familiar introductory VE would serve to improve the VE experience for all subjects. However, the fact that content preference plays a role suggests that the content of priming environments needs to be carefully chosen in order to maximize potential benefits. The data suggest that priming VEs do not necessarily increase presence for all users. If one aims the content of a VE too narrowly, one limits the potential benefits which presence may bring to the VE user. It may be that we can eliminate the role of content preference by ensuring that priming VEs are not themed too strongly; but then one may lose the potential benefit gained by appealing to users' personal interests. It may thus be preferable to examine the content interests of the user population and tailor the priming materials to match their interests. It might be possible to create several possible introductory VEs to any theme, and select one for the user based on their particular preference or experience.

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