

An Investigation on the Effects of Mediation in a Storytelling Virtual Environment

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Abstract

This paper presents a study that explores the use of mediation in virtual environments (VEs) used for cultural storytelling. A VE was created in which a traditional San story was told. Two forms of mediation were used: visual mediation and audio mediation. Four versions of the VE were implemented, differentiated by the type and amount of mediation included. 77 subjects were tested, each experiencing only one of the versions. Measurements of presence, story involvement and enjoyment of each user were taken. A factorial analysis of variance, with a between-subjects design was used. Audio mediation was found to have an effect on presence ($F = 138.8, p < 0.002$). Visual mediation was found to increase story involvement ($F = 9.49, p < 0.003$). Both the interaction between the mediations, and audio mediation increased enjoyment ($F = 5.87, p < 0.02$ and $F = 4.01, p < 0.05$ respectively). Therefore, the use of subtle mediation that appears natural in the VE setting was shown to be effective. The effects of audio mediation on presence suggests that it is an important addition to any VE. And, in the context of virtual storytelling, visual mediation is valuable in conveying a narrative more successfully.

1 Introduction

Virtual Reality (VR) is an exciting, contemporary medium through which people can visualize and interact with highly complex data. This paper presents a study that, primarily, investigates the effects of mediation on user presence and enjoyment in a virtual environment (VE), and explores the use of VR as an effective cultural medium. In this research, mediation may be understood as those features of a VE whose purpose is to facilitate interaction with the user and increase user understanding of the VE.¹ The effects of adding simple visual and audio mediations to a VE, both in isolation and in combination are discussed in this paper. This is done in the context of virtual storytelling environments, more specifically San cultural storytelling². The VE that was created to tell the San story and investigate the mediations is displayed here, in Figure 1.



Figure 1: **The storytelling environment, as first seen by the user.**

Stories are an important part of human culture. Passing traditional folklore from generation to generation has preserved many cultures. Are there ways in which VEs may be designed so that they convey cultural experiences vividly? It is hoped that this study will illuminate the potential of simple, subtle mediations for enhancing presence, while increasing awareness of the San culture. The San have a rich tradition of oral storytelling that is difficult to capture with the written word. In addition, the San population is rapidly decreasing. Therefore, an accurate portrayal of the San culture and lifestyle would be highly beneficial to South Africa's cultural heritage. Usually, museums present culture as artifacts in cabinets, but cannot easily offer their visitors a dynamic, animate cultural experience.

It is also important that cultural VEs are accessible. Typically, VR has not been accessible to the general public due its expensive hardware and equipment requirements. The cost of a modern desktop PC is small in comparison with that of typical VR equipment, such as the head-mounted display and data gloves. This study has made use of a VE that is relatively inexpensive to run and create.

Therefore the main aims of this study are as follows: to investigate the effects of audio and visual mediation on user presence, enjoyment and involvement in the story; and to explore the potential of VR for conveying cultural experiences. First we present some background about previous studies in these areas. Next, our experiment and results are presented.

¹Mediation may be defined more broadly, as any experience that is created using technology[7].

²The San people are hunter-foragers indigenous to southern Africa. Their traditional nomadic culture has become increasingly difficult to preserve in the modern world[14].

2 Background

2.1 Presence

Presence is the concept around which much VR research is based. It is the term used to describe the degree to which users perceive a mediated experience to be non-mediated [7]. The goal of most virtual reality is to provide the user with the illusion that the VE is real. That is, to induce a sense of ‘being there’ in the VE.

In order to create applications that are attractive and useful to users, it is important to understand how presence may be enhanced. In light of such knowledge, applications can be developed that maintain an effective level of presence by focusing on different contributing factors. This is important for system engineering; for instance, cost-effective VEs may be created by maximising those causes that are less expensive to create. This is one of the areas of knowledge that we hope to augment by investigating mediation in VR.

There are certain difficulties in investigating presence, such as the large number of definitions of presence. Schuemie *et al.* also found that presence seems to be a multi-dimensional concept. In other words, there are multiple possible factors that discourage or encourage presence in the user, which also depend on user characteristics [13, 9]. A third difficulty in investigating presence is the question of how to measure it. This is discussed in section 3.4.2. Definitions of presence include social richness (the extent to which an event is warm and sociable), realism, transportation (the extent to which the user is ‘transported’ into the event), immersion (the degree to which the user is encased by the experience) and social action [7]. For our purposes, we have used the definition that appears most often in the literature [12, 16, 6, 4], namely a subjective sense of being in the VE.

2.2 Mediation in Virtual Reality

A number of studies have been conducted on different ways of mediating the VR experience. Huong Dinh *et al.*[4] found that the addition of tactile, olfactory and especially auditory mediation to a VE increased the user’s sense of presence. They also found that increasing visual detail and vividness did not lead to an increase in presence. They postulated that this was because virtual reality is in essence about visual display, so that even in a low quality environment there is still visual mediation. The other sensory mediations were either present or not.

In a review of the causes and effects of presence, Lombard and Ditton [7] found that the number of sensory mediations used increased user presence. However, the mediations had to be consistent with each other and with the virtual environment in order to be effective. In fact, inconsistent mediations emphasised the artificiality of the environment and so lessened presence. Lombard and Ditton found that image quality, size and viewing distance were all important for effective visual mediations, as were motion and colour. Quality and dimensionality were found to be important aspects of audio mediation.

Murphy and Pitt [8] also found that the inclusion of sound in a VE aids the creation of a sense of immersion. They found that the use of spatial sound increased enjoyment and exploration of the VE.

2.3 Storytelling and Narrative

An important aspect of a virtual storytelling environment is that of narrative. Traditional narrative can be seen as a dialog between two individuals, a speaker and a listener [15]. There has been a large interest in investigating narrative and storytelling in a computer-based environment. Kevin Brooks [2] identifies three questions which are important to consider when storytelling and VR are merged: how can computer mediation support the development and portrayal of stories, what mediations can affect different portrayals

of a story and so deliver different experiences, and what part does the user have in this process. Our study explores possible answers to these questions.

It is important to note that narrative and narration are two distinct concepts. According to Clarke and Mitchell [3], "...narrative is to the story: 'what happened'" whereas "narration is the storytelling" (p. 82). One of the key key distinctions between VR and other storytelling media (e.g. film) is that VE users have a great deal more control over what they see and experience. This freedom poses a challenge in storytelling environments. Clarke and Mitchell suggest that the more freedom users have to determine the narrative, "the weaker the voice of the author becomes" [3] (p. 84). They also believe that interactive narratives curb the development of empathy with the characters and engagement in the plot. Thus, it might be argued that in order to present an appealing and enjoyable narration, the narrative should be told by a storyteller who is charismatic and maintains some control over it. One of the keys to creating an engaging "cultural narrative context" is the inclusion of "the undeniable power of human storytellers" [11] (p. 187). It is very important to have a storyteller who, though artificial, is both compelling and realistic. In light of the above, we decided to make use of an engaging San storyteller who fosters minimal interaction with the user. In this way, the San story would not be altered by interaction and the user would still be engaged by the storyteller.

2.4 Culture and Virtual Reality

According to Anstey, Pape & Sandin [1], VR provides a distinctive means for presenting cultural productions. VEs offer revolutionary ways to engage with cultural learning events. Jackson *et al.* [5] argue that cultures themselves are dynamic entities and should thus not be portrayed statically or rigidly. VR offers exciting possibilities for representing existing and past cultures. It has the ability to represent cultures as dynamic and vibrant, rather than merely presenting them as a collection of artifacts. But, according to Roussou, the use of VR as "an artistic, educational and cultural medium is largely overlooked and unexplored" [11] (p. 182).

For museums worldwide, there has been a growing interest in the possibility of using VE's to create meaningful and educational exhibitions of different cultures. In Athens, Greece, Maria Roussou and her colleagues [11] have completed a reconstruction of the ancient city of Miletus. Their created world is situated at the Foundation for the Hellenic World and is used to educate visitors on ancient times and lifestyles. A further example is a VR heritage project developed by Ireland's North Gate Centre. Here, VR was used to represent the North Main Street area in Cork City, Ireland as it was in the 17th century and as it is at present. This project was developed in the interests of elevating an interest in local history and exploration of local ruins [8].

Roussos *et al.* [10] note that authenticity is essential when VR is used to convey cultural or historical experiences. They also state that the content of the VE experience must be important and enhanced by the use of VR. A goal of our study was to present as authentic an experience as possible, so that the VE would be educational as well as entertaining.

3 Methodological Approach

3.1 Hypotheses and Mediation

This study aims to show that mediation is an important aid for improving user presence in a VE, despite the use of material to which users are likely to be unaccustomed, namely San narrative. Two forms of mediation were implemented: audio mediation in the form of environmental night sounds, such as a fire crackling and crickets chirping; and visual mediation in the form of San rock paintings related to the story that is told.

The paper aims to show that either mediation (audio or visual) will increase user presence in the virtual environment. It is predicted that the inclusion of both forms of mediation will be more effective in this respect than either mediation alone. Furthermore, the inclusion of visual mediation is expected to increase the user's involvement in the story. Lastly, any form of mediation is expected to increase user enjoyment in the VE.

3.2 The Virtual Environment

In order to prove our hypotheses, a VE was created in which a traditional San story is told. This VE was created using the Genesis3D engine. The scene is set in a cave at night time. Initially the user is placed outside on rough, barren terrain and is able to see the mouth of the cave. The VE was created as a convincing, highly detailed cave. Digital photographs of caves in the Cederberg mountains of the Western Cape were used to texture the rocks.³ Inside the cave there is a blazing fire, surrounded by three figures. The main interaction occurs as the user approaches the group; the storyteller stands, welcomes him or her and introduces himself and his fellow hunters. This initiates contact between the user and the agents. The user is invited to sit around the fire and listen to the story with the other San hunters. The storyteller then sits and proceeds to tell the story. Shortly after the story has finished, all of the lights in the environment fade to black. All sound in the VE was partially spatialised, as it had direction and location. Entirely ambient sound was not implemented, as it was not possible to specify multiple locations for a sound.

Within this basic framework, four different versions of the VE were created, differentiated by the type and amount of mediation included in each:

1. Paintings and Sound (P/S)
2. No Paintings and Sound (NP/S)
3. Paintings and No Sound (P/NS)
4. No Paintings and No Sound (NP/NS)

Figure 2 and Figure 3 show the storytelling environment, with the agents around the fire and the San paintings, respectively.

3.3 The Experiment

The experiments were run on two desktop computers with 19 inch monitors. Both machines had a graphics and sound card installed. The system's frame rate varied between 10 and 20 frames per second, depending on the user's perspective view (i.e. the amount of detail to be rendered for the current frame). Input to the system was effected through a mouse, for pitch and yaw, and a keyboard, for user movement and sitting or standing. Headphones were used to output the VE soundtrack.

The experiment was conducted with 77 test subjects. All participants were first and second year university students and were recruited from two university courses, Economics and Psychology. They were informed that the research was aimed at investigating storytelling in virtual reality. The subjects were randomly divided into the four experimental conditions, as evenly as possible. Each subject only experienced one of the experimental conditions. Subjects were paid R20 each for their participation.

³San people once inhabited the Cederberg mountains of South Africa, and rock paintings have been found in many caves in this area. Therefore, this seemed to be an appropriate setting for the storytelling VE.



Figure 2: **The San storyteller and companions, sitting around a fire**



Figure 3: **The San rock paintings used as visual mediation**

The experiment took place in a single room, with a partition separating the computers. Usually, two subjects were processed simultaneously. A two minute introductory talk about the format of the experiment was given by one of the experimenters. Subjects were then taken through a VE known as the 'Familiarity Room'. This VE was very simple, and served to allow subjects to become familiar and comfortable with the controls used to navigate San VE. This ensured that lack of familiarity with technology (keyboard and mouse) and frustration at being unable to move easily would be less likely to interfere with the experiment.

Previous research has indicated that priming experimental subjects tends to make differences in presence more explicit [9]. In order to prime the subjects, we provided them with a short description of San lifestyle and mythology. This served to create an awareness of the San culture and a context for the main VE. Thereafter, the participants were placed in the San VE. During this part of the experiment, the lights in the experimental room were dimmed, to restrict glare on the computer monitors. Following the VR experience, each subject completed the questionnaires. See section 3.4.2 for details about the questionnaires used.

3.4 Measures and Collection

3.4.1 Variables used in the experiment

The five following variables were used in the experiment:

1. Presence in the VE
2. Involvement in the story being told (SINV)
3. Enjoyment of user in the VE (ENJ)
4. Audio mediation (S/NS)
5. Visual mediation (P/NP)

The types of mediation (audio or visual) were the independent variables. Story involvement, enjoyment and presence in the VE were the dependent variables.

3.4.2 Questionnaires

There is no standard way to measure presence. Most researchers use questionnaires to allow self-report by users after an experiment. Some have tried other approaches, such as measuring physiological effects or a presence counter (where the user presses a counter whenever he or she changes presence from the VE to the external environment during a VR experience). We decided to use a questionnaire as we did not want to interfere with the storytelling experience. The Igroup Presence questionnaire (IPQ) was used to test for presence, and yielded data for the presence variable. The authors' definition of presence is that it is the user's subjective sense of being in a VE, which corresponds with our definition. The IPQ was constructed by combining previous questionnaires and some new questions. This questionnaire was thoroughly tested and statistically validated, yielding a final thirteen item scale[12].

Data for the story involvement and enjoyment variables was gathered from two additional questions, where subjects rated their involvement in the story and enjoyment on a scale from 1 to 7. These questions were as follows:

1. Characterize the extent to which you enjoyed yourself (i.e. how much fun you had) in the virtual environment by circling the appropriate number.
2. I became involved in the story being told in the virtual environment.

Subjects were also asked to give any other comments concerning the San storytelling environment, or the experiment in general.

4 Results

The data obtained from the experiment was analysed using a 2x2 factorial ANOVA. The results from this test and correlations conducted between variables are presented below.

4.1 Correlations between variables

As an initial test of the interactions between the variables (including the audio (S/NS) and visual mediation (P/NP) independent variables), correlations were performed between each variable. Positive correlations were found between all of the dependent variables, between the audio mediation variable and presence, and the visual mediation variable and story involvement. The highest correlation found was that between presence and story involvement (0.53).

	Lvl	Lvl	N	Presence Mean	Presence S.Dev.
Total			77	56.69	12.82
S/NS	S		39	61.31	13.25
S/NS	NS		38	51.95	10.57
P/NP	P		39	58.08	11.25
P/NP	NP		38	55.26	14.26
Interact	S	P	20	62.95	10.15
Interact	S	NP	19	59.58	15.98
Interact	NS	P	19	52.95	10.22
Interact	NS	NP	19	50.95	11.10

Table 1: Summary of descriptive statistics from factorial ANOVA conducted with audio and visual mediation as the independent variables, and presence as the dependent variable.

	Lvl	Lvl	N	SINV Mean	SINV S.Dev.	ENJ Mean	ENJ S.Dev.
Total			77	4.26	1.45	5.13	1.17
S/NS	S		39	4.31	1.47	5.38	1.11
S/NS	NS		38	4.21	1.45	4.87	1.19
P/NP	P		39	4.74	1.19	5.36	1.16
P/NP	NP		38	3.76	1.55	4.89	1.16
Int	S	P	20	4.90	1.07	5.90	0.97
Int	S	NP	19	3.68	1.60	4.84	1.01
Int	NS	P	19	4.58	1.30	4.79	1.08
Int	NS	NP	19	3.84	1.54	4.95	1.31

Table 2: Summary of descriptive statistics from factorial ANOVA conducted with audio and visual mediation as the independent variables, and story involvement and enjoyment as the dependent variables.

4.2 Factorial ANOVA results

A 2x2 factorial ANOVA was conducted in order to test the effect of audio and visual mediations on presence, story involvement and enjoyment in the VE. A summary of some descriptive statistics from the factorial ANOVA is displayed in Table 1 and Table 2. Figure 4 and Figure 5 display the means from these tables graphically.

This test yielded several significant results. A significant main effect was found for audio mediation on presence ($F = 138.8, p < 0.002$), and for visual mediation on story involvement ($F = 9.49, p < 0.003$). For the enjoyment dependent variable, two significant effects occurred. A significant interaction between audio and visual mediation ($F = 5.87, p < 0.02$) and a significant main effect for audio mediation ($F = 4.01, p < 0.05$) were found.

4.3 Post-hoc analysis of the significant interaction effect between audio and visual mediation on enjoyment

In order to fully understand the interaction effect on enjoyment, a series of one-way ANOVA tests were conducted to examine the effects of each of the independent variables at one level of the other. These were conducted with only enjoyment as a dependent variable. These showed that the effect of visual mediation on enjoyment was significant when only those users who experienced audio mediation were considered (F

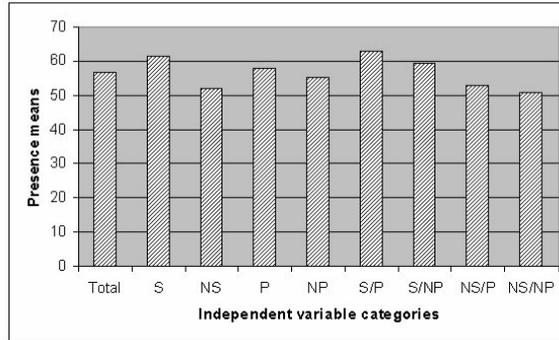


Figure 4: Histogram of presence means across Audio Mediation and Visual Mediation categories

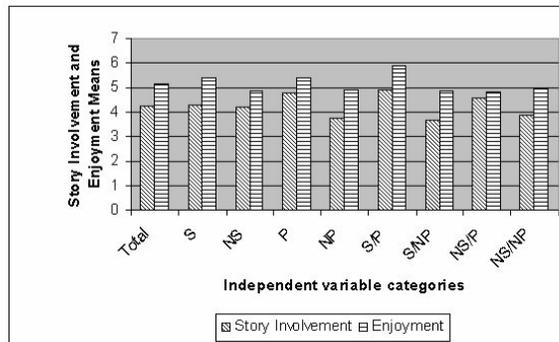


Figure 5: Histogram of story involvement and enjoyment means across Audio Mediation and Visual Mediation categories

= 11.11, $p < 0.002$), but not when users who did not experience audio mediation were considered ($F = 0.16$, $p > 0.6$). They also showed that the effect of audio mediation on enjoyment was significant when only those users who experienced visual mediation were considered ($F = 11.41$, $p < 0.002$), but not when users who did not experience visual mediation were considered ($F = 0.08$, $p > 0.7$).

These results are displayed graphically in Figure 6.

5 Discussion of Results

5.1 Presence effects

The results indicate that audio mediation in the form of environmental sounds is important for increased presence in a virtual environment. These sounds create ambient, spatialised sound that creates a 3D auditory effect. This acts to place the user more firmly in the virtual world. Adding San paintings to the environment does not appear to have any effect on presence, however. The virtual environment that was created was already visually compelling. Adding additional visual items has no effect on presence. This corresponds with results reported in previous experiments [7]. This suggests that perhaps there is some threshold in visual mediation. Good visual effects are a starting point to engender presence in a virtual environment, but to add to presence, other forms of mediation should be included.

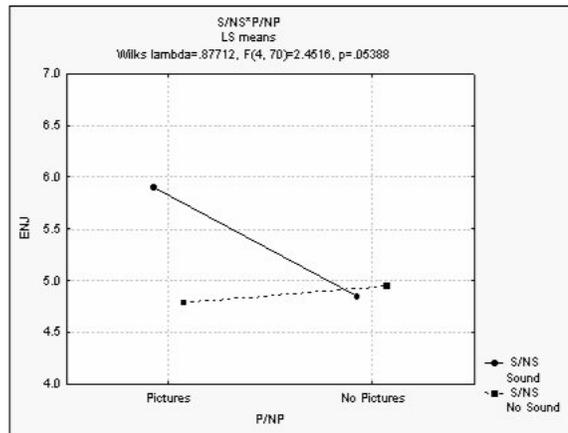


Figure 6: Means plot of the interaction between audio mediation and visual mediation on enjoyment

5.2 Story involvement effects

While the visual mediation had no significant effect on presence, it did have a significant effect on involvement in the story being told, while the audio mediation had no significant effect here. This could partly be because the San paintings related directly to the story, while the environmental sounds did not. These related to the environment and, as was seen in the previous section, caused a significant effect on presence in the environment. The paintings would have given users the opportunity to look at objects in the cave, while listening to the story. Therefore, they could remain closer to the storyteller and explore at the same time. Without the paintings, users were more likely to wander away from the storyteller (perhaps far enough away so that they could not hear the story clearly) in order to explore the cave.

5.3 Enjoyment effects

Audio mediation had a weak significant effect on enjoyment. This suggests that overall, adding general environmental sounds increases user enjoyment slightly. The interaction effect is more interesting. The results indicate that, if the VE contains environmental sound, adding San paintings increases enjoyment by a large amount. In addition, if the VE contains San paintings, adding environmental sound also increases enjoyment by a large amount. However, if there are no environmental sounds and no San paintings, adding either sounds or paintings does not increase enjoyment. In fact, as can be seen from Figures 6 and 5, adding one mediation without the other tends to decrease enjoyment slightly. The virtual environment which contains both visual and audio mediation has a very positive effect on enjoyment. The enjoyment experienced in the other three environments (only one mediation or neither) is almost equal. Because audio mediation alone is significant, a possible interpretation is that most of the enjoyment effect stems from the audio mediation, but that visual mediation must be present to act as a catalyst for this effect. So, the effect of audio mediation depends on the presence of visual mediation. This result also suggests that enjoyment does not depend on any single mediation (except slightly on environmental sounds), but is affected by the number of mediations added.

5.4 Correlations between presence, story involvement and enjoyment

As seen in the results section, all of the dependent variables correlated positively with each other. Therefore, presence, story involvement and enjoyment are all related. As one variable increases or decreases, the other variables are likely to do the same. This correlation also shows that the single questions asked for the enjoyment and story involvement variables correlate with the presence questionnaire. This suggests that the questions are measuring similar and related phenomena, which is what was expected.

5.5 Comments from experimental subjects

As part of the questionnaires, the subjects were asked to give further comments on the San VE. These comments are useful in that they can qualitatively explain the subject's opinions. Criticisms are important as they point the way for future work in the VE.

Numerous users responded well to the sound and look of the fire. In fact, many mentioned the actual warmth of the fire. This warm feeling was partly induced by the sound of the fire getting louder as the user approached it. The fire cast random shadows around the cave and many users enjoyed this flickering fire light. It added to the realism of the environment. The use of spatialised 3D sound was very successful. Users enjoyed the way in which the sound (fire and storyteller's voice) increased or decreased depending on the proximity of the user to the storytelling area.

Some users felt that more characterisation and lip synching was necessary in the VE. One user suggested that the San men should have more expression (e.g. by having them say "ooh" and "aah") especially as the story reaches the climax "to show the excitement of it all". However, there were users who enjoyed the "random motion" of the hunters. For example, one user mentioned that the "small motions and nodding (of the 2 hunters) was good". One user noticed that it was unusual for the story to continue when he got up and left the storytelling area. Social norms were contravened in this respect.

Due to the minimal interaction of the VE, some users felt ignored by the San men in the cave. However there were other interpretations of this. This can be best seen in the following comment from a user who experienced both sound and visual mediations.

"I really felt as if I was the fourth member in the room, that I was one of the Khoi-San. Another feeling I felt was that I was accepted by the Khoi-San, in that by them not watching or paying attention to me, they did not judge who I was and in this manner, I felt accepted by the group."

Our use of a VE to tell a story seemed to be highly effective overall, as can be seen in the following comment:

"...the story and the environment reminded me of stories that I was told when I was growing up by my elders. When I was young such stories took my breath away and they captured by attention so well."

However, there were differing opinions from the users, such as

"It was easy to get involved in the virtual world, but not the story. The story alone was too passive a medium ..."

6 Conclusions and Future Work

This paper has presented a study which explores the effects of audio and visual mediation on user presence, story involvement and enjoyment in a VE. The VE used was a virtual storytelling environment, in which a San story was told.

We aimed to prove that either visual or audio mediation increases the presence of users in a VE. We found that audio mediation increased presence significantly, while visual mediation did not. It was also expected that combined mediations would increase user presence more so than any one mediation on its own. While

the presence mean for the scenario with combined mediations was higher than any of the others, this result was not significant.

Our expectation that visual mediation would increase story involvement was confirmed by the significant result attained.

Our hypothesis that any mediation would increase user enjoyment was partly confirmed. We found that the interaction of audio and visual mediation yielded a strong significant effect. Furthermore, it was found that adding audio mediation alone yielded a small significant increase in enjoyment, although adding visual mediation alone had no significant effect.

The knowledge gained from this study has valuable potential in the area of virtual storytelling. The importance of sound for enhancing user presence was highlighted. Two aspects of the sound used in this VE proved to be important for increasing presence. The first of these is the spacialized and directional nature of the sound, which users found very effective. This aspect was implemented even when audio mediation was not included, as the storyteller's voice had direction and distance effects. The second aspect of the sound only concerns the audio mediations. Users found that the fire and night sounds were realistic. These increased their enjoyment and helped them to feel present in the VE (to the extent of feeling the warmth of the fire, in some cases). This suggests that audio mediation is a valuable, yet inexpensive, addition to a VE, even though its effects are subtle. Its absence is often more noticeable than its presence.

Visual mediation is also valuable, as it increases user involvement and interest in the story. It draws attention to the narrative, thus making listening a less passive experience. However, additional visual material is not particularly valuable for presence in a VE. This is because the VE is already a visually mediated experience.

The VE developed for this project was successful in conveying a low-cost San cultural experience and was further improved by the addition of mediation (as mentioned above). Storytelling VEs, such as the one developed for this study, may be used to preserve cultural heritage in a dynamic and animate way. Furthermore, the use of subtle mediation that appears natural in the VE setting was shown to be effective. The effects of audio mediation on presence suggests that it is an important addition to any VE. And, in the context of virtual storytelling, visual mediation is valuable in conveying a narrative more successfully.

The following possibilities for future work were identified during the course of this study:

- **Use of fully spacialised sound:** The sound system for the VE could be improved by allowing completely ambient sound to be implemented. This would involve being able to specify multiple locations for one sound. This would increase the realism and, possibly, the effectiveness of audio mediation in the VE.
- **Increased visual effects relating to the story:** Additional visual effects could be added to the VE, to further increase involvement in the story. These could include animation of pictures (in our case, the rock paintings) or creating 3D visual mediation.
- **Increased characterization of agents:** The agents who tell the story could be given more realistic and substantial characters. This would allow the user to identify more with the agents.
- **Increased interaction in the VE:** More interaction within the VE could be added, in order to increase user engagement in the storytelling environment. This could take the form of interaction with the agents and/or interaction with the environment.
- **Inclusion of avatar representations for users:** Users could be represented by avatars in the VE, in order to facilitate more embodiment.
- **Collaborative storytelling:** The ability to add multiple users across a network would allow a group to listen to a story and discuss it in the VE.

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