Culture Matters – A Study on Presence in an Interactive Movie

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We conducted a cross cultural study to test the influences of different cultural backgrounds on the user's presence experience in interacting with a distributed interactive movie. In addition we were interested in the effects of embodied interaction on presence. The influence of culture background is clear – Chinese participants perceived more presence than Dutch participants in all conditions. The results also show that interaction methods (direct touch against remote control) had no influence, while embodiment (robot against screen agent) had mixed effects on presence.

1 Introduction

The user's character is believed to influence the user's feeling of presence. The user's cultural background is often mentioned as such a characteristic [1, 2]. A few cross-cultural presence studies are available [3], but none investigated the relationship between the user's cultural background and presence directly. This influence is, at this point in time, more of a conjecture than a proven fact, and therefore we conducted an empirical study to investigate the relationship.

In absence of a clear definition of what cultural factors may influence presence, a good approach is to include participants from clearly different cultures. Using Dutch and Chinese participants in our study optimized cultural diversion. Hofstede [4] provides an empirical framework of culture by defining several dimensions of culture, such as power distance, individualism/collectivism, masculinity/feminity, uncertainty avoidance and long/short-term orientation. China and the Netherlands differ substantially on all dimensions except uncertainty avoidance (see table 1). Power distance, for example, refers to the extend to which less powerful members expect and accept unequal power distribution within a culture. The Netherlands rank very low on this dimension, while China ranks very high.

From an application point of view, China is currently one of the most promising economic opportunities. Its vast populace and large physical size alone mark it as a powerful global player. China's gross domestic product (GDP) growth of over seven percent indicates its steaming economic situation. Most Chinese already have access

Table 1: Hofstede's [1993] Culture Dimension Scores for Dutch and Chinese

	Dutch	Chinese
Power Distance	38L	80H
Individualism	80H	20L
Masculinity	14L	50M
Uncertainty Avoidance	53M	60M
Long Term Orientation	44M	118H

H = top third, M = medium third, L = bottom third (among 53 countries and regions for the first four dimensions; among 23 countries for the fifth.

to a TV and the local TV manufacturers satisfy the domestic market. However, technology utilizing presence is not yet produced or consumed. Awareness of cultural differences in presence may help companies to create better products for the different markets.

At the same time, we were interested in distributed interactive media and their influences on the user's feeling of presence. We have entered a new media era: passive television programs become interactive with the red button on your remote control [5]. Video games come with many different controlling interfaces such as dancing mats, EyeToy® cameras, driving wheels and boxing Gametraks™ [6]. The D-BOX® Odyssee™ motion simulation system even introduces realistic motion experiences, that were originally designer for theme parks, into our living rooms [7]. In the vision of Ambient Intelligence [8], the next generation of people's interactive media experience will not unfold only on a computer or television, or in a head set, but in the whole physical environment. The environments involve multiple devices that enable natural interactions and adapt to the users and their needs.

Formerly, distribution only revered to the distribution of data or computational processes in a network. Ambient intelligent environments build on this technology and extend it by distributing synchronized and interactive multimedia content on to multiple devices. Previous systems already employed distributed presentation to enhance the entertainment experience and thereby increasing the immersiveness of the content. Multichannel surround sound systems, for example, distribute sound all around the audience and hence provide a more realistic and natural sound experience. The ambient intelligence [8] concept goes beyond such sound distributions by distributing content through other channels in the user's environment. Displays in the room may show video clips, lamps may change its color and brightness, robots may dance and sing, and couches may vibrate. The virtual space or the content, then, is no longer yielded in traditional audio and video materials by one TV set, but now expanded into the user's surroundings covering more sensory modalities. The light color, robotic behavior and the couch vibration are parts of delivered content, conveying a virtual experience but with a direct physical embodiment. Ambient intelligence is therefore a distinct extension to classical virtual environments.

However, distributing interactive content to multiple devices would also increase

the complexity of interaction. The environment together may become difficult to understand and to control. To ease the situation, embodied characters, such as eMuu [9] or Tony [10], may be used to give such an environment a concrete face. These characters have a physical embodiment and may present content through their behavior and interact with the user through speech and body language. They can even be used as input devices.

However, the influence of embodiment on the user's presence experience seems unclear. On the one hand, embodiment extends the distributed content from an on-screen virtual environment to a physical environment. The physical embodiment improves the content's liveness and fidelity by stimulating more sensors of the user. This might result in an increased feeling of presence [11]. On the other hand, the physical embodiment may transfer more attention from the virtual environment to the physical environment. The physical embodiment may remind the user of its existence in this world and may break down the illusion of *being there* and hence would result in less feeling of presence [2]. The division of attention itself might also have such an effect.

To control interactive content, the user requires interaction devices. A physical embodiment would invite direct manipulation. A robot could, for example, ask the use to touch its shoulder to select an option. Interaction with a virtual on-screen character may favor the use of a remote control. Embodiment in interactive media can therefore not be studied without considering the interaction method. We therefore included two interaction methods in our study.

In this framework of interactive distributed media we defined the following three research questions:

1. What influence has the user's cultural background on the users' presence experience.
2. What influence does the embodiment of a virtual characters have on the users' presence experience?
3. Would direct touching the presented content objects bring more presence than pressing buttons on remote controls?

2 Experiment

We conducted a 2 (Interaction) $\times$ 2 (Embodiment) $\times$ 2 (Culture) mixed between/within experiment (see figure 1). Interaction and culture were the between participant factors. Interaction had the conditions RemoteControl and DirectTouch, and culture had the conditions Dutch and Chinese. Embodiment was a within participant factor. Embodiment had the conditions ScreenAgent and Robot.

2.1 Measurements

The original ITC-SOPI [12] questionnaire was used and only the definition of the *Displayed Environment* in the introduction was adjusted to include the robot/screen character. The Chinese participants had a good understanding of the English language and

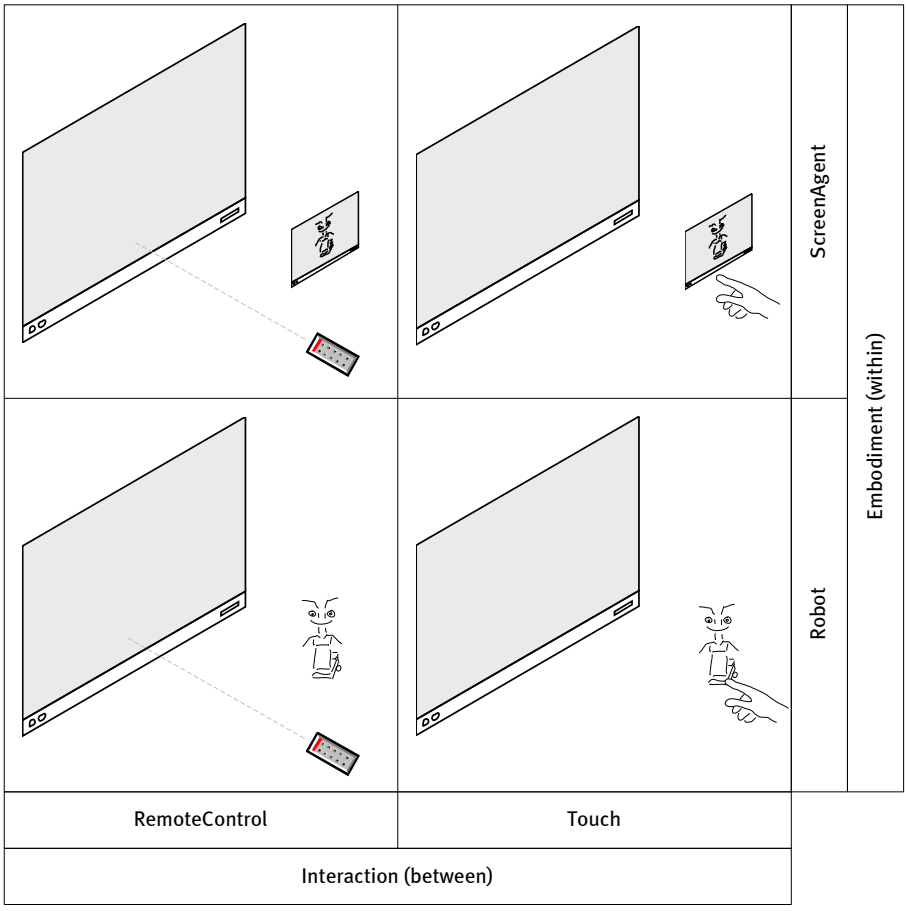


Figure 1: Conditions of the experiment with Chinese and Dutch participants

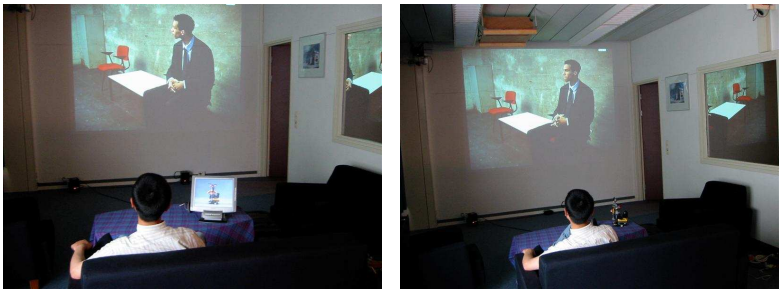
therefore no validated translation was necessary for them. The questions remained unchanged and are clustered into four groups: 1. *Spatial Presence*, a feeling of being located in the virtual space; 2. *Engagement*, a sense of involvement with narrative unfolding within virtual space; 3. Ecological validity, a sense of the *naturalness* of the mediated content; 4. *Negative effects*, a measure of the adverse effects of prolonged exposure to the immersive content.

2.2 Participants

19 Chinese and 24 Dutch between the age of 16 and 48 (14 female, 29 male) participated in the experiment. Most of them were students and teachers from Eindhoven University of Technology, with various backgrounds in computer science, industrial design, electronic engineering, chemistry, mathematics and technology management. The Chinese participants were no longer than two years in the Netherlands. All participants had good command of the English language and were frequently exposed to English speaking media, such as movies, web pages, news papers and TV shows.

2.3 Setup

The experiment took place in a living room laboratory (see figure 2). The participants were seated on a couch in front of a table. The coach was $3.5m$ away from the main screen, which was projected onto a wall in front. The projection had a size of $2.5m \times 1.88m$ with 1400×1050 pixels. The second screen was located $0.5m$ from the coach, standing on the table. The secondary screen was $30cm \times 23cm$ with 1280×1024 pixels LCD touch screen (Philips DesXcape Smart Display).



(a) ScreenRemote/ScreenTouch (b) RobotRemote/RobotTouch

Figure 2: Experiment setup

In the Robot conditions, the secondary touch screen was replaced with a Lego robot that had about the same height. In the ScreenAgent conditions, the secondary screen displayed a full screen agent of the robot.

The behavior of the screen based agent and the Lego robot were identical. They played the role of a TV companion by looking randomly at the user and the screen, but always looking at the user while speaking. Speakers were hidden under the table and were used to produce the speech, which was based on the standard Apple Speech

Synthesis software. At the start of every movie, the character introduced himself and its role.

Since a media content that is acceptable in one culture can be perceived inappropriate, rude or offensive in another [13], the movie was designed to be culturally neutral. The movie had an international cast: the applicant was played by a Moroccan, the employer by a Dutch, the secretary by an American, and the passer-by by a Chilean. The actors spoke English. This study does not investigate the influence of media content on presence and therefore the story and movie cuts were neither too exciting nor too boring for both Dutch and Chinese participants. Otherwise they might have masked the effects of embodiment and culture.

The interactive movie, about approximately 10 minutes, was about a job interview in which the participants had to make decisions for the applicant. The storyline was discussed with several Chinese and Dutch to assure that the actions of the characters would be plausible in both cultures. The movie had two decision points, which resulted in four possible movie endings (see figure 3). The participants chose different options for decisions almost all the time. At every decision point camera would zoom in on the applicant's forehead (see figure 4). The actor then cycled through two options in his mind. He looked first to the left and thought aloud about one option, before he looked right and thought aloud about the second option. In the remote condition the screen would show one icon on the left and a different icon on the right. The icons were identical to two icons on the remote control. In the robot condition, the participant had to touch the left or the right shoulder of the robot to make the decision.

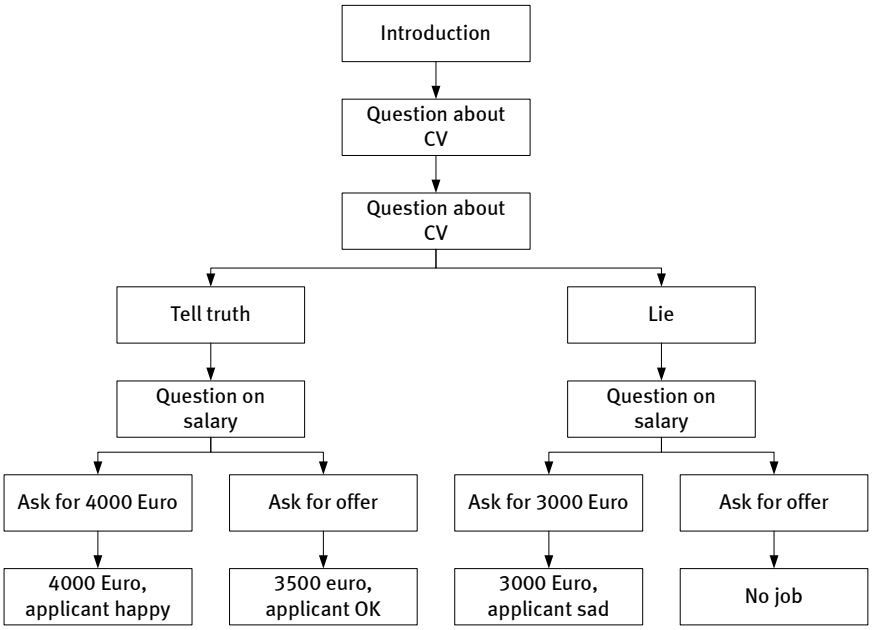


Figure 3: Storyline

Figure 4: A decision point

2.4 Procedure

After reading an introduction that explained the structure of the experiment the participants started with a training session. In this session, the participants watched an unrelated interactive movie that had only one decision point, during which the participants could make the decision using the remote control. Afterwards, they had the opportunity to ask questions about the process of the experiment. Next, the participant were randomly assigned to one of the between-participant conditions, which each consisted of two movies and a questionnaire after each movie. The participant received five Euros for their efforts.

3 Results

The mean scores for all measurements, including their standard deviations are presented in table 2 and graphically in figure 5.

3.1 Embodiment, interaction and culture effect

A 2 (embodiment) $\times$ 2 (interaction) $\times$ 2 (culture) repeated measures ANOVA was conducted. Interaction had no significant influence on any of the measurements. Embodiment and culture both had significant influence on almost all measurements (see table 3).

Interaction was removed as a factor from the further analyses since it had no effect on the measurements. The means for all remaining conditions are summarized in figure 6 and were used as the basis for the further analyses.

Paired Sample t-Tests were performed across both culture conditions. The measurements for Spatial Presence were significantly ($t(42) = 2.235$, $p = 0.031$) higher in the ScreenAgent condition than in the Robot condition. Negative Effects were significantly ($t(42) = 2.38$, $p = 0.022$) higher in the Robot condition than in the ScreenAgent condition.

Independent Samples t-Tests were performed. All measurements between the Dutch and the Chinese participants differed significantly, except for engage in the screen condition, which just missed the significance level ($t(41) = 2.007$, $p = 0.051$).

Table 2: Mean and standard deviation for all measurements

Embodiment	Culture	Interaction	Measurement	Mean	Std.Dev.
ScreenAgent	Chinese	RemoteControl	Spatial Presence	3.08	0.18
			Engagement	3.35	0.37
			Naturalness	3.17	0.32
			Negative Effects	1.96	0.55
		DirectTouch	Spatial Presence	2.79	0.37
			Engagement	3.28	0.41
			Naturalness	2.92	0.61
			Negative Effects	1.83	0.52
	Dutch	RemoteControl	Spatial Presence	2.56	0.29
			Engagement	3.17	0.51
			Naturalness	2.75	0.50
			Negative Effects	1.46	0.43
		DirectTouch	Spatial Presence	2.44	0.45
			Engagement	2.84	0.58
			Naturalness	2.58	0.74
			Negative Effects	1.5	0.36
Robot	Chinese	RemoteControl	Spatial Presence	2.99	0.2
			Engagement	3.33	0.24
			Naturalness	2.73	0.17
			Negative Effects	3.28	0.42
		DirectTouch	Spatial Presence	2.72	0.59
			Engagement	3.22	0.43
			Naturalness	3.08	0.32
			Negative Effects	3.35	0.52
	Dutch	RemoteControl	Spatial Presence	2.51	0.25
			Engagement	3.07	0.61
			Naturalness	2.55	0.66
			Negative Effects	2.9	0.4
		DirectTouch	Spatial Presence	2.26	0.41
			Engagement	2.86	0.56
			Naturalness	2.42	0.59
			Negative Effects	2.52	0.82

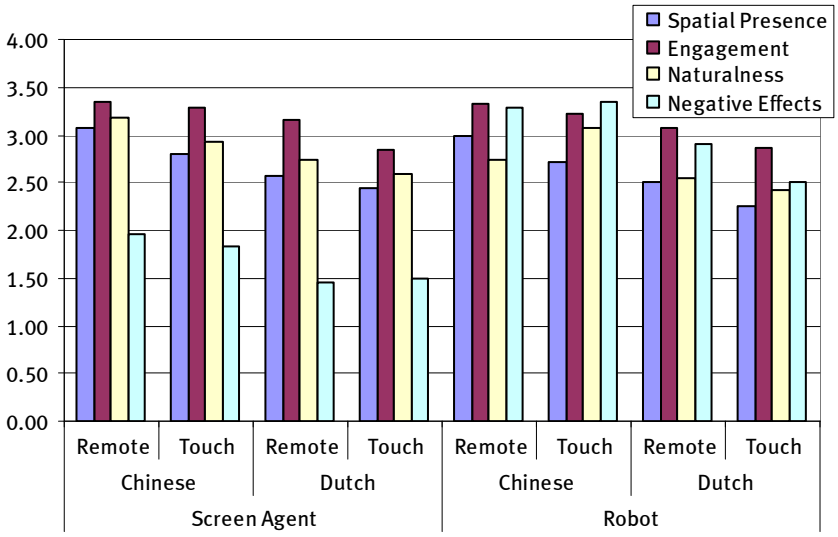


Figure 5: Means of all measurements in all conditions

Table 3: F and p values for culture and embodiment

Factor	Measurement	F (1,39)	p
Embodiment	Spatial Presence	4.789	**0.035**
	Engagement	0.515	0.477
	Naturalness	4.335	**0.044**
	Negative Effects	119.973	**0.001**
Culture	Spatial Presence	19.49	**0.001**
	Engagement	4.962	**0.032**
	Naturalness	7.494	**0.009**
	Negative Effects	24.491	**0.001**

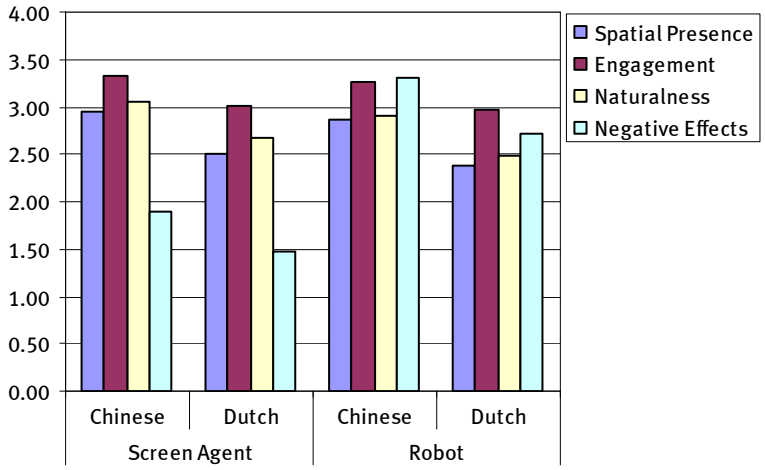


Figure 6: Means in the culture and embodiment conditions

4 Discussion

4.1 Culture effects

The participants' cultural background clearly influenced the measurements. Chinese participants perceived more presence than Dutch participants in all conditions. One might suspect that the Chinese participants might simply be more polite in answering questions, because being polite and maintaining one's and the other's "face" are important in Chinese culture [14]. Our measurements show that they also gave higher scores to Negative Effects and therefore did not simply respond politely. The next question will be what aspects of the cultural background have the greatest influence on presence. Hofstede [15, 4] suggested several categories through which cultures and organizations may be characterized, but none of them appear relevant to presence at first sight. One might speculate that the long-term orientation in Chinese culture would result in more patience towards imperfections. They might have more easily tolerated the noise emitted by the robot and the occasional visibility of a microphone in the movie. Further studies are necessary to investigate this issue.

4.2 Embodiment effects

The influence of embodiment on all measurements does not conform to the expected results defined in the construct of presence. According to Lessiter et al. [12],

> Whilst in the current study Negative Effects was not strongly correlated (positively or negatively) with Engagement or Ecological Validity, it was significantly but modestly (and positively) related to Sense of Physical Space.

However, in our results Spatial Presence and Naturalness are higher in the ScreenAgent condition, while Negative Effects was higher in the Robot condition. Negative Effects appear to have been affected by something else than presence.

During the experiment, the robot's motor emitted noise, which caused the participants to look at it. A moving physical object is potentially dangerous and hence attracts attention. Clearly, the robot emphasized the participants feeling of being in the room and not in the movie and thereby reducing the presence experience. The screen character did not emit noise and is unable to pose physical danger to the user. It therefore did not attract as much attention as the robot.

The participants were frequently switching between looking at the movie and the robot and hence divide their attention. This switching made it hard for the users to stay focused and might cause the high negative experience. Eggen, Feijs, Graaf, and Peters [16] showed that a divided attention space reduced the users immersion. Further research is necessary to determine if divided attention increases the negative effects of multiple displays. The extra costs necessary to build and maintain a robot for an interactive movie appear unjustified in relation to its benefit.

The different interaction methods (using a remote control or touching directly) had no influence on the measurements. The participants did not experience more or less presence when they interacted with a remote control or with the screen/robot directly. This is to some degree surprising, since the participants had to lean forward to touch the screen/robot directly, while they could remain leaned back using the remote. The necessity to make a choice might have overshadowed the difference in physical movement. To create compelling sense of presence it might be useful to pay more attention to the physical output than to the input.

4.3 Future Research

In this study, several factors were investigated besides the cultural background of the participants. It might be beneficial to conduct a dedicated study on the influence of culture on presence. Such a study could then also cover more than the two cultures investigated in this study. In addition, it appears necessary to further connect the results of such a study to existing results in other research areas, such as cross-cultural communication studies. Qualitative interview might help to gain better insights into to social and cultural viewpoints of the participants in relation to presence.

Ambient Intelligence is currently a major research theme in the European academic and commercial world, but the results of this study show that cultural aspects do play a role in the design of future technology. Given China's rapid grow and potential, it might be valuable to include an "Eastern Perspective" into the European research, in particular since more and more consumer electronics are produced and consumed in Asia.

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