Male Bodily Responses towards a Virtual Woman

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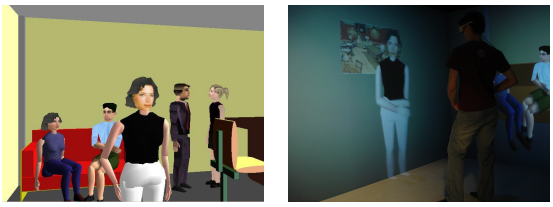
Abstract.

Current research measure participants' responses in a Virtual Environment through questionnaires, physiological responses, and post-experiment interviews. However, questionnaires and interview results are subjective. Physiological data, although objective, provide only evidence of a person's autonomic system responses rather than higher level behavioural responses. Different from the above methods, bodily movement is a gross overall indicator of a person's state, and is relatively easily observable. It therefore could offer us an additional method to assess the realism of people's responses within a virtual environment. This work presents the analysis of the bodily movement displayed by male participants, while talking with a life-size virtual woman in a virtual social encounter within a CAVE-like system. People tend to respond realistically to virtually generated data, both emotionally and physically. While interacting with a virtual character, their responses should be similar to how they would respond to a real person. Here we concentrate on their body movements as the virtual character speaks to and approaches them.

This is part of an ongoing study of whether people with social phobia react with appropriate anxiety to virtual reality depictions of social encounters. People who suffer from social phobia experience strong fear in one or more social situations, where they are afraid of acting in a way which is humiliating or embarrassing that other people would judge them in a negative way. Although they have the knowledge that the anxiety was irrational, they seek to avoid social encounters whenever possible [1]. Therefore this research studies the extent to which the participant responds towards the virtual character with appropriate affect.

We have carried out an experimental study in an immersive (Cave) system, where shy and confident males interacted with a forward virtual woman, in a virtual bar [2]. We are interested in the extend to which the participants' responses are similar to real life. We have invited both shy and confident participants, which is determined by the SPAI (Social Phobia and Anxiety Inventory) questionnaire [3]. There were 24 male participants who took part in the experiment, 12 of whom are shy, 12 confident.

The scenario was a virtual bar which is populated by 5 virtual characters, 4 of whom are talking to one another, except for one lone female, 'Christina'. Once the participant enters the scenario Christina begins to stare at him for a few seconds, then makes her way towards him (Fig. 1(a)), and then initiates a conversation (Fig. 1(b)). It is important to note (as shown in Fig. 1(b)) that from the point of view of the participant Christina is life-sized and that the projection is active stereo. The participant stood approximately in the centre of the room and head tracking was used so that Christina could look at him in the eyes, and also the other characters in the room would occasionally look towards him.



(a) (b)

Figure 1. The virtual female first looks at the participant and then (a) approaches him and (b) a conversation ensues while the other characters continue their conversations.

Christina is modelled to be an attractive female, speaking English with a slight Portuguese accent (the accent of the real actress who recorded the script). She started the conversation with the participant by introducing herself and asking the participant questions. When he spoke, she appeared to listen carefully and showed her interest by nodding and smiling. She also showed her interest by leaning forward to him, smiling, looking at him, and also by breaking the norms of social distance (of the country in which the study was conducted) by approaching within 0.5m. If the participant asked where she was from, she told him that she is an air hostess and had just arrived in London. Finally she suggested they should meet up again.

Christina's behaviour consisted of a number of multi-modal utterances, containing recorded speech, body and facial animation, which were triggered from a control panel by an experimenter, who was listening to the experiment out of view of the participant. There were around 60 utterances prepared and pre-recorded; half of these are the core of the conversation and the rest of them are backups for unexpected situations. Each utterance is a synchronised combination of speech (audio file) and movements (animation). Our animation engine distinguishes between foreground behaviour, the multi-modal utterances, and background behaviour including gaze and proxemics. We use a model of proxemics that ensures that Christina mostly orients towards the participant and maintains an appropriate conversational distance, but breaking this as time goes on as she gets closer. The following is an extract from a typical conversation: (Christina - C; Participant - P)

C: This shirt looks great on you, how much was it?
P: Thank you! It is a gift.
C: Ah, I really want to find a pair of trousers something like those for my brother [glancing down at the man's trousers]. Where did you get those?
P: Haha, I cannot remember, but there are a lot of nice shops alone the Oxford Street if you are interested.

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C: [Turns her face to the other virtual characters around] So, Do you know anyone here?
P: Well, not really anyone else, no.
C: I feel a bit shy about talking with the other people, do you mind if I talk with you for a bit longer?
P: Sure, no problem.

During the interaction, the participants' behaviour were recorded with a camera from behind. The video recording of the experiment (See Fig.2), together with a assessment form, were then passed on to a body movement expert who otherwise has no involvement with this research and had no knowledge of the purpose of our research. The Form consists of 3 questions each associated with particular events: first, when the virtual female asks about the participant's clothes; second, when the virtual female asks if the participant knows anyone there; third, some participants asked the virtual female to repeat what she has said. In real life these events would trigger the following reactions respectively: first, look down at their clothes (Fig.2(c)); second, look around at other people in the social environment(Fig.2(b)); third, lean forward in order to hear the question more clearly. Therefore the 3 questions we asked on the form were:

- When the virtual lady mentioned the participant's clothes (shirts and trousers), did he *look down* at his shirts/trousers?
- How many the participant ask the virtual lady to repeat; and when asking, how many times of these he *leaned forward* to the virtual lady?
- When the virtual lady asked if the participant knew anyone here, did he *look around* at the other virtual characters?

The answers to those questions would provide us with evidence if the participants have responded towards the virtual characters as if they were real.

(a) (b) (c)

Figure 2. (a), (b) and (c) shows a participant with normal head position, looking around, and looking down.

The body movement expert then filled in the assessment form for each participant by screening the video data from the experiment. The result is presented in Table 1, where for *looked down* and *looked around* we present the number of shy and confident participants who did the movement at the time over all participant observed; for *learned forward*, we present the number of times the participants has learned forward (when asking the virtual character to repeat) against the number of times they asked her to repeat. It can be seen that the majority of participants leaned forward when asking the avatar to repeat a question, and looked around when being asked about other "people". Note that the leaning forward made no sense from an objective point of view since the sound was not spatialised and therefore was not actually coming from the location of the virtual woman. These results suggest that the participants' bodily responses towards the female were similar to how they would respond to a real person.

Table 1. Event triggered body movement: 1, The number of participants who looked down when asked about their clothes / all participants observed. 2. The number of participants who looked around when asked about other "people" /all participants observed; 3. The times participants leaned forward when asking the virtual lady to repeat / times asked the virtual lady to repeat.

	1,Looked Down	**2,Looked Around**	**3,Leaned Forward**
Shy Participant	6/12	11/12	9/9
Confident Participant	7/12	10/12	13/15

The results support the notion that participants tend to act towards the virtual character with appropriate interpersonal behaviour. Bodily movement is a gross overall indicator of a person's state, and therefore could offer us an additional method to measure the responses of people in VEs, especially when the participant interacts with a virtual character. In our previous report [2] we have evaluated the reactions of participants and the results showed that the participants tended to respond to the situation at the subjective and physiological level as if it were real. In the previous study we have also evaluated their verbal responses to assess their behaviour, yet one can argue that verbal responses can be playfully delivered by the participants without being serious. This new evaluation of bodily responses, however, underlines the findings of our previous study, since it is unlikely that people deliberately and consciously choose their bodily responses - they are an automatic action.

REFERENCES

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