

The Effect of Realism on the Virtual Hand Illusion

Lorraine Lin
lorrain@clemson.edu

Sophie Jörg
sjoerg@clemson.edu

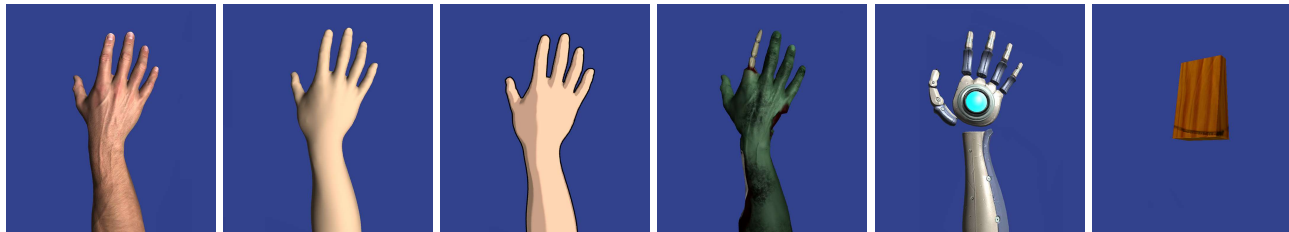


Figure 1: The six geometric models with different levels of realism used in this study. From left to right: realistic hand, toony hand, very toony hand, zombie hand, robot hand, wooden block

Introduction

The virtual arm or hand illusion [Yuan and Steed, 2010] is a body ownership illusion that can occur in a virtual environment. Previous studies compared at the most two or three models at a time, and reached different conclusions on the intensity of the perceived illusion and what influences that intensity. We investigate the influence of the realism of a controllable virtual hand model on human reaction in IVR with two studies. The motions of participants' right hands are tracked and represented with one of six virtual hands (see Figure 1).

Method

The first study was between groups: participants used one model to block spheres for three minutes in a virtual environment, then a knife as a virtual threat hit their virtual hand (see Figure 2). The second study was within groups: participants had a pre-test to see if they could experience the physical rubber hand illusion [Botvinick and Cohen, 1998], then blocked spheres for two minutes with each model generated in a random order, and finally had a knife hit the last model as a virtual threat hit. Responses towards the virtual hand being threatened were measured with a questionnaire and using galvanic skin response. We expected participants' perceived illusion to rank from highest to lowest for the six models in the order of realistic hand, toony hand, very toony hand, zombie hand, robot hand, and wooden block.

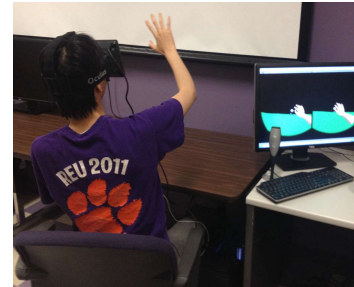


Figure 2: The experimental setup

Questionnaire

On the questionnaire for the second study, participants chose a rating on the seven-point Likert scale ranging from 1 for "strongly disagree" to 7 for "strongly agree" for statements corresponding to illusion strength, ownership, or investment in immersion or presence, such as:

- Q-B3. It sometimes seemed my own hand was located on the screen.
- Q-B5. Sometimes I felt as if the virtual hand on the screen was my own hand.
- Q-B7. During the experiment there were moments in which it seemed that my own hand was catching the ball.
- Q-B8. I thought the virtual hand on the screen looked realistic.

References

- Botvinick, M., and Cohen, J. 1998. Rubber hands 'feel' touch that eyes see. *Nature* 391 (Feb.), 756.
- Yuan, Y., and Steed, A. 2010. Is the rubber hand illusion induced by immersive virtual reality? *Virtual Reality Conference (VR)* (Mar.), 95-102.

Survey

To guarantee that our models have distinct levels of realism in appearance, we also carried out a brief online survey evaluating the perceived realism and sensitivity to pain of all six models (see Figure 4).

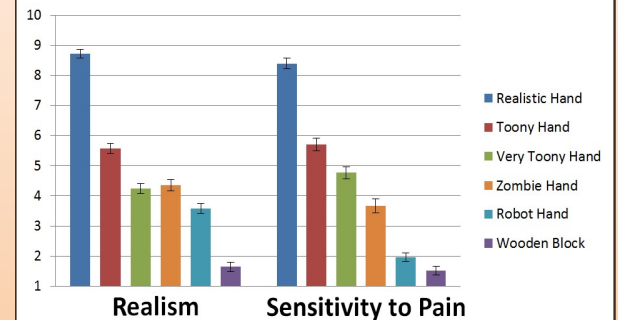


Figure 4: Perceived realism and sensitivity to pain of the hand models

Results and Conclusion

Our findings indicate that an illusion can be created for any model but that the effect is perceived weakest for a non-anthropomorphic block model and strongest for a realistic hand model in direct comparison. We furthermore find that the reactions to our experiments vary highly between participants.

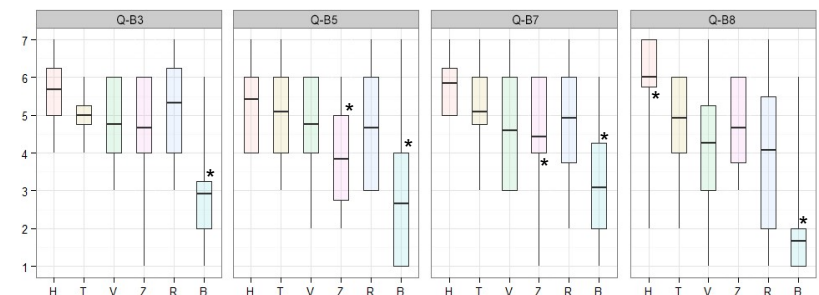


Figure 3: Boxplots of sample questionnaire results for the second study. H stands for the realistic model, T for toony, V for very toony, Z for zombie, R for robot, and B for wooden block. The boxes indicate inter-quartile ranges and the bars show the range of the ratings.