Embodiment or Manipulation?

Understanding Users' Strategies for Free-Hand Character Control

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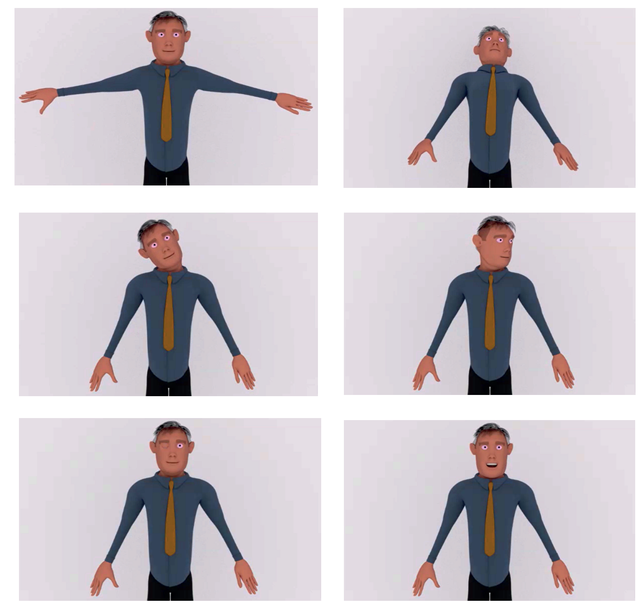


Stills of the videos for the referents "abduct both arms","lean back", "tilt head", "turn head left", "blink right eye" and "speak".

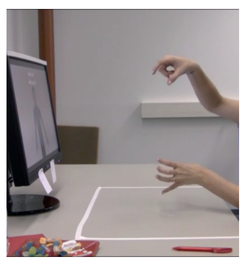
Idea

Controlling a virtual character with your free hands is a useful task for many 3D applications such as games, computer puppetry, or emerging virtual reality applications. So far, only specialist controls have been established in the animation industry. Yet little is known about novices mental models for character control, a key to designing widely usable natural and expressive interfaces.

To this end we conducted a gesture elicitation study with twelve participants performing mid-air gestures for thirteen given character motions. The mental models observed fall into two distinct categories: 1) external manipulation of an imagined physical puppet and 2) the gesturing hands embodying the motion of the virtual body part being "controlled". The employed mental model determined hand posture and the mental transformation from gesture to character motion.

We present and discuss a gesture set that can inform virtual puppetry interfaces for various application domains.

Study



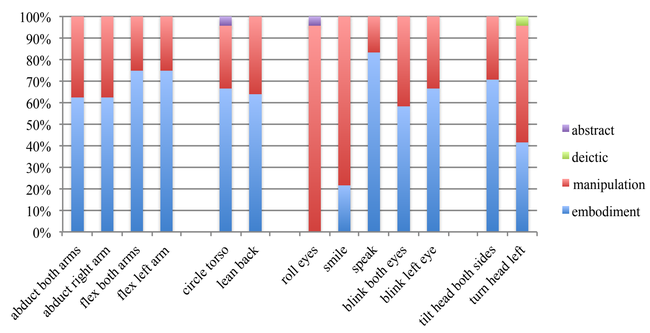
We animated face, head, arms and torso of a standing human character waist-up and determined 13 referents that represent basic character motions.

We presented the effects of commands (i.e. the referents) to participants and asked them to perform corresponding gestures. These referents were presented as short videos.

12 participants (8 female) with an average age of 25.8 years (SD = 7.8) took part in our study.

Overall, we collected 312 gestures: 12 individual user-defined one-handed and 12 two-handed suggestions for each of the 13 referents.

Classification



The suggested gestures were manually segmented and annotated regarding their nature, the hand and finger morphology, and the applied mental rotation.

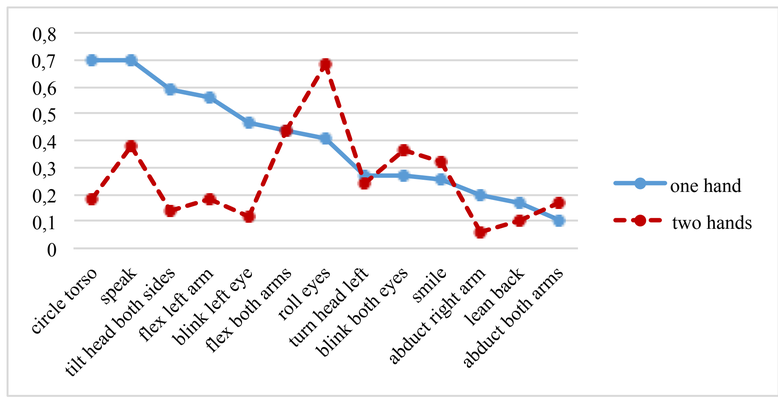
In the nature dimension, gestures fall with an overwhelming majority into the two categories embodiment (57,7%) and manipulation (41,3%).

Embodiment gestures are enacted in the tradition of physical hand puppets, where hand and fingers directly represent and animate body parts of the puppet.

For manipulation gestures the mental model is that of physical plush toys or marionettes, where the animator touches the puppet and performs movements. Free-hand gestures that fall into this category are initiated by touching a virtual target, e.g. imagining holding and moving the virtual character's arm.

Agreement

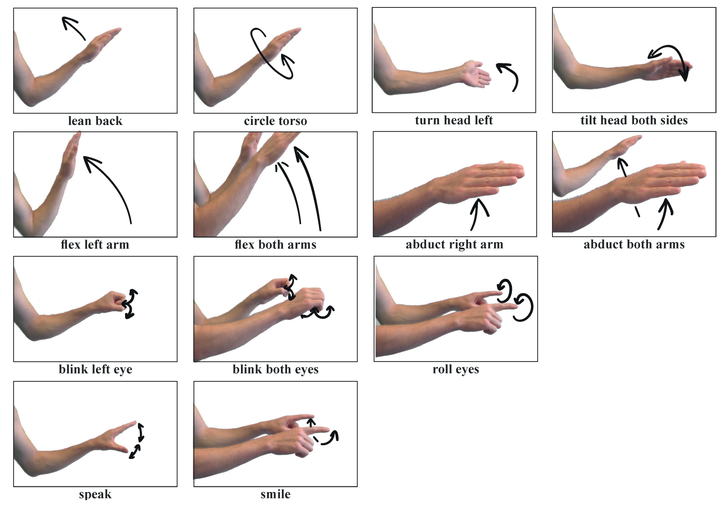
We grouped the gestures into clusters of identical gestures for each referent and calculated the agreement scores that reflect the consensus among participants.



Gesture Set

In order to derive a user-defined gesture set we first chose the most frequently performed gesture for each referent (the original set). Secondly, the resulting gesture set was refined regarding conflicts and mismatches.

it uses the two-handed version of a one-hand control for the symmetrical features (arms and eyes). The set applies mainly the same nature categories for each body region.



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