

User evaluation of the Movement of Virtual Humans

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Virtual humans (VHs) are employed in many interactive applications, including (serious) games. The motion of these VHs should look realistic. We use the term *naturalness* for such observed realism (van Welbergen et al., 2009a). Furthermore, VH animation techniques should be flexible, to allow interaction with its surroundings and other (virtual) humans in real time. Physical controllers offer physical realism and (physical) interaction with the environment. Because they typically act on a selected set of joints, it is hard to evaluate their naturalness in isolation.

We propose to augment the motion steered by such a controller with motion capture, using a mixed paradigm animation (van Welbergen et al., 2009b) that creates coherent full body motion. A user evaluation of this resulting motion assesses the naturalness of the controller in isolation. This is done by comparing the augmented motion with full body motion capture of the same movement.

Methods from Signal Detection Theory (Macmillan and Creelman, 2004) provide us with the bias-independent sensitivity metric d' that can be compared among these different test setups, observers and motions (see Figure 1). This metric indicates how well two motions can be discriminated. We use the d' of motion captured motion compared with the model based motion as a naturalness measure for the model based motion. Additionally, a naturalness rating test is used to directly assess naturalness.

We discuss different test paradigms and assess their efficiency. An efficient test-paradigm has a d' with a low variance within each test condition and large differences between d' -s measured in different test conditions, so that it is easy to make significant observations on discrimination differences in different test conditions.

We demonstrate our approach by evaluating the naturalness of a balance controller (Wooten and Hodgins, 2000) that acts on the legs and trunk, in comparison to motion captured motion and motion in which all trunk and leg movement is omitted. We also assess the effect of several presentation factors on naturalness. Details of the test setup and a full analysis of the results can be found in (Jansen and van Welbergen, 2009).

ACKNOWLEDGMENTS

This research has been supported by the GATE project, funded by the Dutch Organization for Scientific Research (NWO) and the Dutch ICT Research and Innovation Authority (ICT Regie).

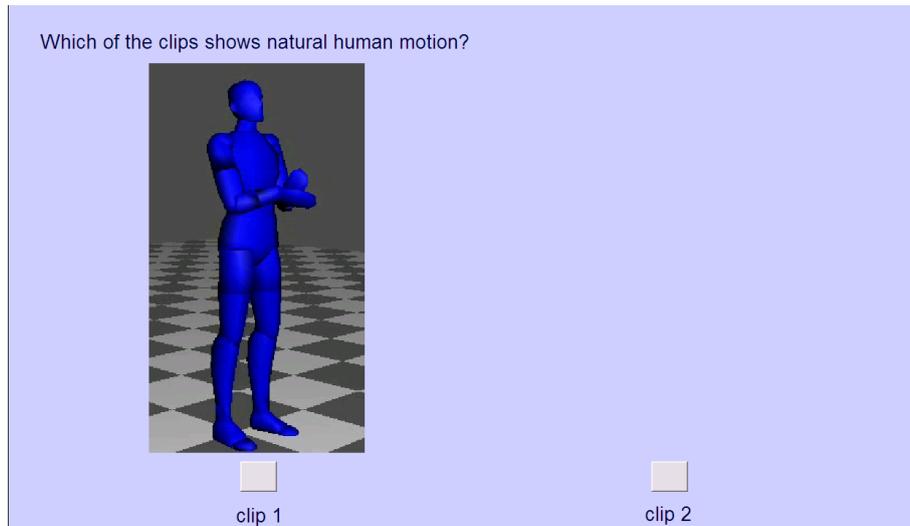
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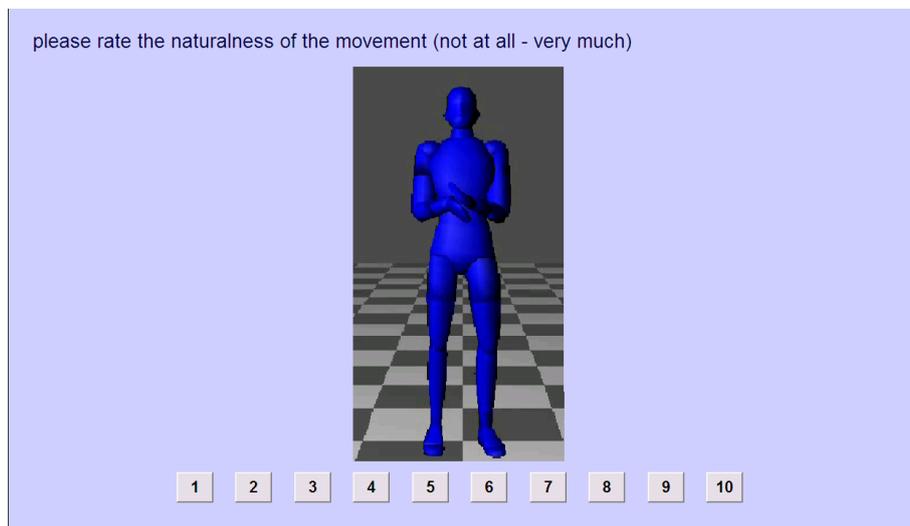
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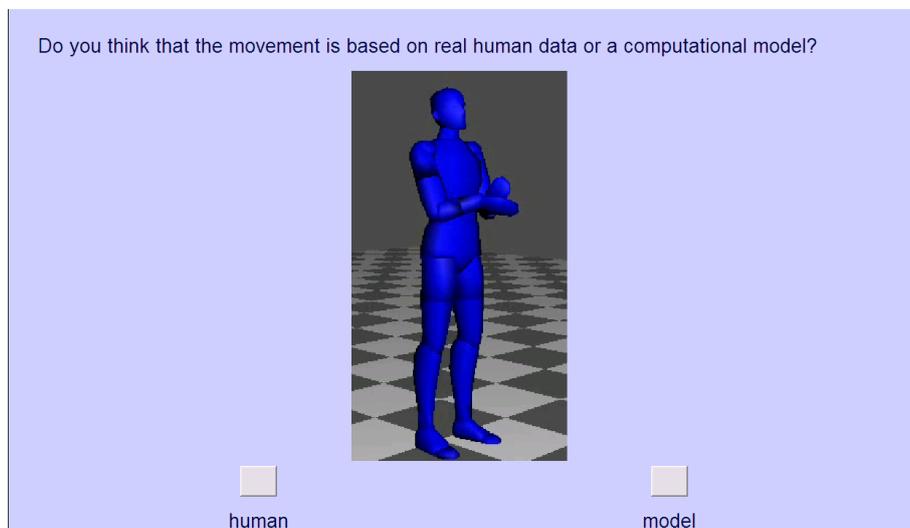
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(a) 2 Alternatives Forced Choice test



(b) Rating test



(c) Yes/No test

Figure 1: Test paradigms and viewing angles used in the evaluation study.