RAVE-08 Abstract

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Walking Response in Virtual Reality

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Abstract

The 'rave' concept, responding to virtual reality as if real, requires a battery of tools for measurement of the extent to which this phenomenon takes place. The ultimate goal is to be able to improve virtual reality systems through understanding of what contributes to such realistic behaviour. We describe an experiment that investigates whether the manner of a person's movement, as measured by electromyogram (EMG), can be used as one technique to measure response in virtual environments.

This work is specifically concerned with examining whether EMG data can be used to differentiate human response in virtual environments. The experiment consists of having each participant experience four conditions: 1) walking on a virtual platform in a virtual room, 2) walking on the floor of the virtual room, 3) walking on a real platform in a real room, 4) walking on the floor in a real room. In each condition, the participant's feet are tracked using inertial sensors and the EMG activity in the erector spinae muscles of the lower back is recorded. There is evidence that these erector spinae muscles are activated for anticipatory balance control during locomotion. Due to non-linearities in muscle activity recorded with EMG, it is also important to record EMG when a participant performs a similar action in physical and virtual reality. Therefore, the data from the four conditions for each participant are used to compare muscle activation at the same phase of the walking cycle.

Here our goal is to show that the muscular activity of the erector spinae is greater at specific moments, such as the 'toe off' phase of walking on the platform when compared to the same phase of walking on the floor in the real world. Further, we examine whether a virtual version of the platform rendered in a Cave display will induce a similar increase in muscular activity.

This result would prove promising for using EMG to distinguish response to the real world from response to a virtual display in an objective manner. Although

some objective measures such as heart rate and galvanic skin response are currently used in presence research, they depend on a scenario that induces stress in order to be effective. This result would be one method for establishing objective measures outside of stressful scenarios.

We have had several promising results with early pilot subjects and we plan to complete this study in the spring of this year. We have already used this method to test between environments that are rendered with greater visual realism (for example, with global illumination) compared with situations where the environment is rendered with more simple illumination methods. In the first case when the participant walks along the platform they also see shadows of the platform on the ground, thus heightening the visual depth effect. In this context we found that the shadows increased muscle activation, but there was no significant difference between global illumination shadows and shadows that were baked into textures in 3DStudio Max. Although we are working in the context of walking, overall the approach is not limited to this, since it is possible to measure muscular activity and body posture and movement more generally.