PERCEIVING AND DECEIVING ANATOMICAL DIMENSIONS

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INTRODUCTION

Simulation, assessment or retargeting of motion requires an understanding of inter-subject variability and our ability to control or perceive it. Researchers have hypothesised a strong linkage between perception and production of an action [1]. When a motor act is observed, certain motor areas in the brain are activated; the same motor areas and motor plans that the observer would activate himself during the execution of the same movement. Because of our daily experience with other individuals' motions, we can say that we all have an extensive database of motion plans. Several experiments have investigated human capabilities during deceiving [2, 3]; underlying the fine accuracy that characterises our perceptual system in recognizing unnatural movements and also our inability to reproduce completely certain motor patterns. This paper investigates the ability to perceive and deceive anatomical dimensions in human motion acts. Subjects were asked to use their own motor experiences in order to create movements with different properties in terms of musculo-skeletal dimensions.

METHODS

A system of 8 infrared motion capture cameras (Vicon, Ltd. U.K.) was used to capture the motion of six unimpaired subjects (mean age: 26 ± 2.4 years, mean femur length 42 ± 3 cm), using markers applied directly to the skin. All subjects, none of them professional actors, were asked to perform a walking motion at a self selected speed with three different affectations: walking normally (N), walking as they had a larger musculo-skeletal system (L) and walking as if they had a smaller musculo-skeletal system (S). All subjects voluntarily agreed in participating in the study; no suggestion about how they should perform the task "correctly" was given to any of the subjects analysed. A Bodybuilder model (Vicon Ltd., U.K.) was created and applied to recorded markers' trajectories. Our interest was focused on the lower limb kinematics, with the acquisition of hip and knee flexion/ extension in the sagittal plane, gait frequency and pelvis trajectory. A one way ANOVA test was performed in order to establish if the three populations (*large, normal*, *small*) were significantly different.

RESULTS AND DISCUSSION

Subjects tended to increase their hip and knee range of motion (Hip mean range of motion L: 48.5 deg; N: 41.5 deg; S: 37.15 deg; ANOVA p=0.016; Knee mean range of motion L: 51 deg; N: 35.7 deg; S: 32.7 deg; ANOVA p=0.052) when performing as *larger* individuals, and vice versa when performing as *smaller* individuals. The ranges of motions for the modified walks were outside the normal walk ranges of motions. It is likely that the six subjects decided to perform as if they had a much *larger* and a much *smaller* musculo-skeletal system.

Considering the timing properties of the walking motion; as expected, subjects tended to increase and decrease their gait frequencies when performing as smaller and larger individuals respectively (Gait frequency mean: L: 39.6, N: 50.7; S: 56.8; ANOVA, p=0.004). Only one subject did not change his gait frequency at all.

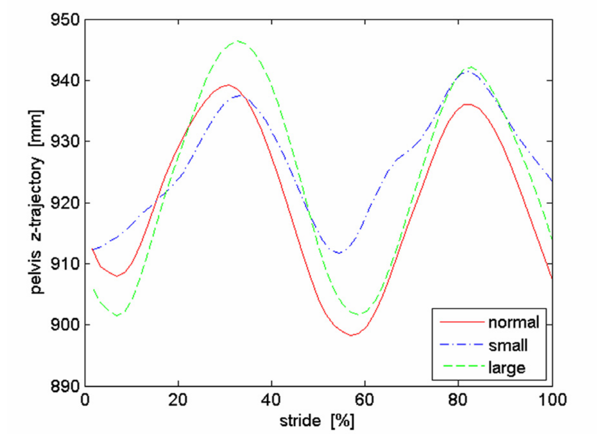

Figure 1, Pelvis vertical trajectory for subject 1

Considering the vertical trajectory of the pelvis (Figure 1) the highest values of range of motion were recorded for the "as *larger"* walks, while range of pelvis vertical trajectory decreased for the *normal* and the "as *smaller"* musculo-skeletal systems (Pelvis vertical trajectory mean range of motion: L: 57.1 mm; N: 46 mm; S: 29.9 mm; ANOVA, p=0.00). These pattern modifications are not the same modifications that the subjects would have if they could effectively modify their anatomical dimensions. However, these attempts give us an indication about our sensitivity to size discrimination and perception, and what we would expect to see from an individual moving with certain musculo-skeletal properties.

CONCLUSIONS

The investigation performed has highlighted certain characteristics and properties of our ability in perceiving and deceiving size information of the human body. Subjects were able to modify their kinematic parameters using their existing information and motor experiences. The joint ranges of motion were increased and the stride frequencies were decreased when performing as individuals with *larger* skeletal systems. These findings, which are being further examined in a visual perception study, can have interesting applications in process of retargeting or simulating motion for the entertainment industry, clinical training, or helping explaining inter-subject motion variability.

REFERENCES

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