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The Influence of Step Length to Step Frequency Ratio on the Perception of Virtual Walking Motions

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Motivations
• More realistic virtual motions are needed in entertaining applications.
• Walk Ratio (WR) = natural and invariant ratio between step length (SL) and step frequency (SF) of an individual.

Conclusions
• Viewers are able to identify self-selected step length to step frequency ratio of actors.
• Differences regarding actors’ gender seem to exist.
• New insights in the creation of personalized and more realistic walking motions.

Objectives
• Investigate the ability of viewers to recognize this natural ratio on virtual characters.
• Main Hypothesis: Viewers are able to identify the natural walk ratio of an individual.

Methods
Stimuli Generation:
• Motion capture (Xsens System)
  ○ 2 Female actors (1.78 and 1.65m, 26 and 22 years old).
  ○ 2 Male actors (1.80 and 1.78m, 24 and 20 years old).
• 5 free walks at different speeds captured to compute natural walk ratio.
• 5 walking speeds at 5 different cadences captured (from 80Hz to 120Hz, by 10Hz steps). We blended these motions to generate walking motions at different given speeds and step frequencies.

Perceptual Study:
• 15 Participants (11 Male 4 Female between 18 and 30 years old).
• Task: Participants adjusted the step frequency of virtual humans (using the keyboard) until they considered the motion to be the most natural.
• Factors: 4 Actors, 3 Speeds (0.8, 1.0, 1.2 m/s), 2 Initializations (min 80, max 120), 4 repetitions. Step frequency was bounded between 80 and 120 steps per min.
• Data Collected: Step frequency and Walk Ratio responses.

Background
• Humans walk with different speeds and styles [1].
• Biomechanical parameters such as the Walk Ratio [2] associated with walking seldom taken into account in walking animations.
• Walk ratio: constant at different walking speeds, but inter-individual differences exist (e.g. gender differences) [2].

Results
Walk ratios estimated by the participants are not significantly different from the captured walk ratios except for Female 2.

Stimuli Generation

Validation of the stimuli presented to the participant in the perceptual experiment.

For male actors, walk ratios computed from the motion capture (red and blue lines) are in agreement with Zarrugh’s findings [3].

References

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