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

Benjamin Niay, Anne-Hélène Olivier, Julien Pettre, Ludovic Hoyet
Inria, Univ Rennes, CNRS, IRISA, M2S
benjamin.niay@inria.fr

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.

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.

Walk Ratio = SL / SF
Left, smaller steps, lower walk ratio.
Right, longer steps, higher walk ratio.

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].

Methods

Stimuli Generation:

• Motion capture (Xsens System)
  o 2 Female actors (1.78 and 1.65m, 26 and 22 years old).
  o 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.

Results

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.

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

References


Acknowledgements

We wish to thank all the participants in our experiments.
This work was funded by the French ANR, as part of the JCJC Per² project ANR-18-CE33-0013.