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Does jerk have to be considered in linear motion simulation?

F. Soyka[1], H. J. Teufel[2], K. A. Beykirch[3], P. Robuffo Giordano[4],
J. S. Butler[5], F. M. Nieuwenhuizen[6] and H.H. Bülthoff[7]
Max Planck Institute for Biological Cybernetics, Tübingen, Germany

Perceptual thresholds for the detection of the direction of linear motion are important for motion simulation. There are situations in which a subject should not perceive the motion direction as, e.g., during repositioning of a simulator, but also opposite cases where a certain motion percept must intentionally be induced in the subject. The exact dependency of the perceptual thresholds on the time evolution of the presented motion profile is still an open question. Previous studies have found evidence for a sensitivity of the thresholds on the rate of change of acceleration, called jerk. In this study we investigate three motion profiles which differ in their jerk characteristics. We want to evaluate which profile can move people furthest in the horizontal plane in a given time without them noticing the direction. Our results suggest that a profile with a minimum peak jerk value should be chosen.

Nomenclature

fixedJerk	=	profile with a fixed peak jerk value
RCB	=	raised cosine bell profile
minJerk	=	minimum peak jerk profile
A_{max}	=	peak acceleration
$A_{stimulus}$	=	peak acceleration of a stimulus
$A_{threshold}$	=	peak acceleration of the stimulus at threshold level
J_{max}	=	peak jerk value
$\dot{x}(t)$	=	linear velocity
ω	=	frequency of the motion profile
T	=	duration of the movement
Δt	=	duration of the ramp in the fixedJerk profile
μ	=	mean of the fitted cumulative Gaussian function (corresponds to the detection threshold)
σ	=	standard deviation of the fitted cumulative Gaussian function

[1] Ph.D. candidate, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; florian.soyka@tuebingen.mpg.de. Student member AIAA.
[2] Research Scientist, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; harald.teufel@tuebingen.mpg.de.
[3] Research Scientist, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; karl.beykirch@tuebingen.mpg.de.
[4] Research Scientist, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; paolo.robuffo-giordano@tuebingen.mpg.de.
[5] Research Scientist, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; john.butler@tuebingen.mpg.de.
[6] Ph.D. candidate, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; frank.nieuwenhuizen@tuebingen.mpg.de. Student member AIAA.
[7] Professor and Director, Max Planck Institute for Biological Cybernetics, P.O. Box 2169, 72012 Tübingen, Germany; heinrich.buelthoff@tuebingen.mpg.de. Member AIAA.