MovExp: A Versatile Visualization Tool for Human-Computer Interaction Studies with 3D Performance and Biomechanical Data

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SUPPLEMENTAL MATERIAL

Mocap-based biomechanical simulation was only recently introduced to HCI. Previously, the different aspects of an interaction such as performance and ergonomics were typically collected in separate experiments, and also analyzed separately. As a result, there was no visualization tool available to our collaboration partners which allowed seamless work with all the four aspects of their data set. The available tools typically concentrate on a specific aspect and come without support for visualizations beyond scatter plot or line chart. We performed an extensive literature review and summarize the results in Table 1. For each tool we indicate its title, the data types that are visualized and the provided visualization methods.

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Paper	Data Types	Visualizations
Physical Ergonomics		
[20]	lumbar kinematics	line plot, barplot
[21]	qualitative data	line plot, barplot, pie chart
[33]	skin conductivity	line plot, barplot
[1]	EMG	line plot, barplot
[31]	cardiovascular data	line plot
[2]	qualitative data	tasks, no data visualizations
[3]	qualitative and quantitative data	tasks, no data visualizations
[4]	image data	image data, posture annotations
[5]	image data	image data, posture annotations, 3D posture
[6]	qualitative and quantitative data	tasks, images, video, posture annot., 3D posture
[7]	qualitative and quantitative data	tasks, no data visualizations
[8]	qualitative data of self-assessment	tasks, pie chart, bar plot
[9]	qualitative and quantitative data	line plot, bar plot, exercises
[10]	EMG, force, angles	line plot, barplot, sensor placement, 3D posture
HCI Data Modeling Tools		
[29]	data distributions	scatter plot, line plot, bar plot, joint and conditional distributions
[34]	speed and accuracy	scatter plot, line plot, trajectories plot
[36]	Fitts' law models	line plot
[39]	speed and accuracy	scatter plot, line plot, trajectories
[24]	speed and accuracy	scatter plot
[11]	speed and accuracy	scatter plot, line plot, trajectory and velocity profile
[12]	speed and accuracy	line plot, targets
HCI Data Processing Tools		
[32]	video data	video play, events
[27]	video data	video play, events, line plot
[13]	video data	video play, events, direct drawing annotations
[19]	qualitative data	line plot, bar plot, pie chart, relationships scheme, tree map, tag cloud, word tree
[28]	qualitative data	line plot, bar plot, relationships map, code matrix, tag cloud, text coding chart, document portrait
[30]	qualitative data	relationships map, text coding chart
Visualization Capabilities of Motion Capture Software		
[14]	marker data	line plot, marker positions in 3D, skeleton in 3D
[15]	marker data	3D markers, human model skeleton
[16]	marker data	3D markers, human model skeleton, trajectories
Digital Human Modeling and Biomechanical Simulation		
[37]	posture data	3D human and environment visualization
[17]	posture data, external force data	3D human and environment visualization, barplot
[23]	marker kinematics, skeleton kinematics, joint moments, muscle forces and activations	line plot, 3D markers, skeleton and muscle action lines
[22]	skeleton kinematics, joint moments, muscle forces	line plot, 3D visualization of skeleton and muscles
[26]	human kinematics, external forces	3D visualization of human and environment, barplot
[38]	skeleton kinematics, joint moments, muscle forces	line plot, 3D skeleton with muscles and env., joint kinematics
[40]	posture, kinematics, external forces	3D human model, line plot
[25]	posture, kinematics, external forces, EMG, qualitative data	3D human model, line plot
[18]	posture, 3D environment	3D human model and environment, augmented reality
[35]	kinematics, joint moments, muscle forces & activations	3D human skeleton with muscles, trajectories

Table 1. Overview of the related work with the type of processed data and the used visualization methods.

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