THE ZOOSYSTEM: AN OPEN-SOURCE MOVEMENT ANALYSIS MATLAB TOOLBOX

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Introduction

Movement data often contain variables recorded over time, for many subjects, groups, or conditions. Sorting, processing, statistical analysis, and visualization of data is crucial. The zoosystem provides tools to achieve these goals. Key features of the system will be shown via a sample dataset.

Sample dataset

Gait data from eleven subjects performing straight and turning trials were obtained. For this demonstration, we hypothesized that differences in maximum medio-lateral ground reaction force (GRF_Y), maximum hip adduction in stance (Hip_Y), and knee flexion at foot-off ($Knee_X$) existed between conditions.

Zoosystem processing

Data files were converted from c3d to zoo format (Fig. 1) using the *c3d2zoo* function and then partitioned over a gait cycle (*bmech_partition*).

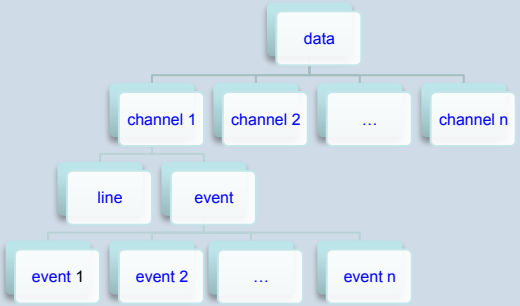


Figure 1: The zoosystem file structure.

GRF_Y, Hip_Y, and $Knee_X$ events were automatically tagged to each channel's respective event branch (*bmech_addevent*). Data were normalized to 100% of stance (*bmech_normalize*), sorted by condition and graphed (*ensembler),* and visualised in a 3D environment (*director*) (Fig. 2). Data were exported to a spread sheet (*eventval*) for statistical analysis.

Results

Statistical differences were found across conditions for GRF_Y, $Knee_X$ (Fig. 3), and Hip_Y.

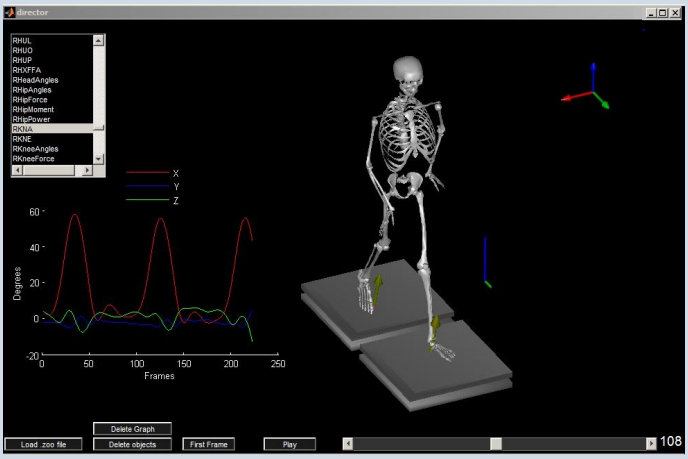
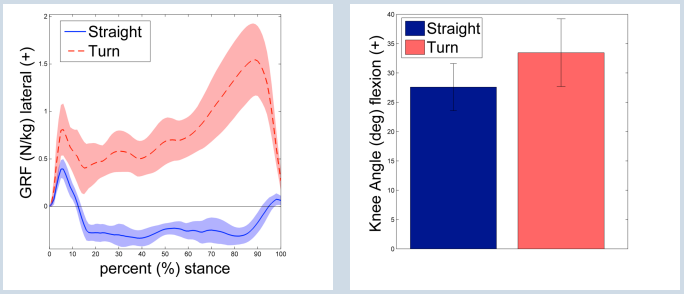


Figure 2: The director virtual 3D environment. Users can play motion files and display graphical information.



(a) **(b)**

Figure 3: a) GRF_Y curves and b) $Knee_X$ bar graphs created using the ensembler graphical user interface.

Discussion

The zoosystem provides a generic yet flexible interface to examine large time series datasets. Open-source code is provided and users are encouraged to modify or add existing functions.

Getting started

The zoosystem files and demo can be downloaded from: https://github.com/PhilD001/the-zoosystem

P.C. Dixon will be available during ESMAC to help users get started with the zoosystem. Contact: philippe.dixon@eng.ox.ac.uk