Introducing, Testing, and Evaluating a Unified JavaScript Framework for Professional Online Studies

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Abstract : Online-based research has recently gained increasing attention from various fields of research in the cognitive sciences. Technological advances in the form of online crowdsourcing (Amazon Mechanical Turk), open data repositories (Open Science Framework), and online analysis (Ipython notebook) offer rich possibilities to improve, validate, and speed up research. However, until today there is no cross-platform integration of these subsystems. Furthermore, implementation of online studies still suffers from the complex implementation (server infrastructure, database programming, security considerations etc.). Here we propose and test a new JavaScript framework that enables researchers to conduct any kind of behavioral research in the browser without the need to program a single line of code. In particular our framework offers the possibility to manipulate and combine the experimental stimuli via a graphical editor, directly in the browser. Moreover, we included an action-event system that can be used to handle user interactions, interactively change stimuli properties or store participants' responses. Besides traditional recordings such as reaction time, mouse and keyboard presses, the tool offers webcam based eye and face-tracking. On top of these features our framework also takes care about the participant recruitment, via crowdsourcing platforms such as Amazon Mechanical Turk. Furthermore, the build in functionality of google translate will ensure automatic text translations of the experimental content. Thereby, thousands of participants from different cultures and nationalities can be recruited literally within hours. Finally, the recorded data can be visualized and cleaned online, and then exported into the desired formats (csv, xls, sav, mat) for statistical analysis. Alternatively, the data can also be analyzed online within our framework using the integrated Ipython notebook. The framework was designed such that studies can be used interchangeably between researchers. This will support not only the idea of open data repositories but also constitutes the possibility to share and reuse the experimental designs and analyses such that the validity of the paradigms will be improved. Particularly, sharing and integrating the experimental designs and analysis will lead to an increased consistency of experimental paradigms. To demonstrate the functionality of the framework we present the results of a pilot study in the field of spatial navigation that was conducted using the framework. Specifically, we recruited over 2000 subjects with various cultural backgrounds and consequently analyzed performance difference in dependence on the factors culture, gender and age. Overall, our results demonstrate a strong influence of cultural factors in spatial cognition. Such an influence has not yet been reported before and would not have been possible to show without the massive amount of data collected via our framework. In fact, these findings shed new lights on cultural differences in spatial navigation. As a consequence we conclude that our new framework constitutes a wide range of advantages for online research and a methodological innovation, by which new insights can be revealed on the basis of massive data collection.

Keywords : cultural differences, crowdsourcing, JavaScript framework, methodological innovation, online data collection, online study, spatial cognition