Practical Advice on How to Run Human Behavioral Studies

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(I) Objectives and scope of the tutorial

The lack of materials on the details of running human experiments can lead to a gap between theory and practice, which is particularly acute in cognitive science experiments done outside of psychology departments. The details about how to run the studies themselves, how to interact with participants and other tacit knowledge about how to run a study are often not available, or available only through apprenticeship in a psychology or HCI lab: forcing practitioners to learn through trial and error. Researchers in psychology thus often end up appalled by the lack of this common but undocumented sense when behavioral research is performed and reported by researchers outside of psychology.

This tutorial provides practical advice on how to run studies for beginning students and researchers starting to run studies. This tutorial will provide participants with an overview of how to run studies with human participants, not how to design or analyze studies. Specifically, we will focus on how to setup, debug, and run many basic studies in cognitive science. It will help people running experiments to run them more effectively, safely, and comfortably. Our purpose is to provide hands-on knowledge about experimental procedure.

The tutorial will cover the major topics noted in Figure 1. In particular, the tutorial will cover the role of identifying the research problem and reading in the general area; preparation for running a study, including piloting and IRB proposals; preparing to run a formal study, including advertising and recruiting subjects; running study sessions; and wrapping up a study.

The tutorial will be done as a half-day tutorial as it was at Cognitive Science 2012 in Japan, with around 50 participants, at the Chinese Academy of Sciences in 2012, and at TU/Chemnitz in 2013.

(II) How the tutorial will be delivered

The tutorial will cover the topics in Figure 1 using a lecture/discussion format. We will use some prerecorded material and plenty of discussion and workshop style interactions, either on the conference platform or in Zoom or Zoom-like rooms. The topics will be introduced using a presentation. Discussion will follow each section using scenarios and questions included in the book and developed for the Cognitive Science Conference.

An early draft (approximately half the current length) of the material is available in a tech. report at acs.ist.psu.edu/reports/ritterKM09.pdf, and published copies are available from Sage through SageResearchMethods' site (perhaps for free in your university library). Complimentary copies are available to instructors through Sage's web site.

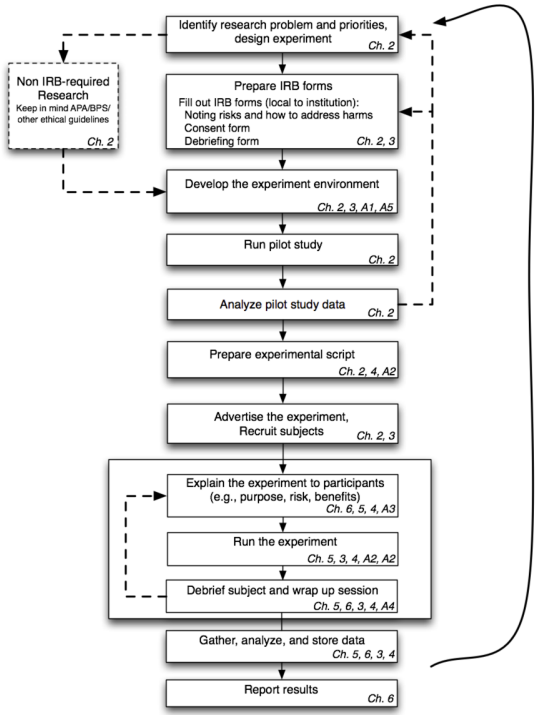

Figure 1. A pictorial summary of the research process with respect to running a human behavioral study. This is similar to, but developed separately from Bethel and Murphy's (2010) figure for human-robotic studies

(III) Why the presenter and authors are well suited to give a tutorial in the proposed area

The presenters are well qualified to prepare and present a tutorial in this area. Along with colleagues, Ritter has written a book for Sage on this topic (Ritter, Kim, Morgan, & Carlson, 2013).

Ritter has also run and directed studies with human participants (e.g., Friedrich & Ritter, 2020; Klein, Bennett, Whetzel, Granger, & Ritter, 2010; Reder & Ritter, 1992; Ritter, Freed, & Haskett, 2005; St. Amant, Horton, & Ritter, 2004). His collaborators on this tutorial and book include an industrial engineer (Kim), a research assistant who

helped run studies (Morgan, recently graduated with a PhD from Duke), and a professor of psychology who has been a member of an IRB board and director of a psychology department subject pool (Carlson). While not all co-authors will be presenting, they have helped prepare the slides. They, too, are familiar with running studies (e.g., Carlson & Cassenti, 2004; Kim, Dancy, & Sottilare, 2018; Kim & Ritter, 2015; Morgan, Cheng, Pike, & Ritter, 2013).

Ritter is also familiar with tutorials in general because he served as the first co-chair of tutorials at the Cognitive Science Conference in 1999. Since then he has severed as tutorial chair or co-chair at the Cognitive Science Conference (2001, 2002, 2004, 2005), and at the International Conference on Cognitive Modeling (2004, 2006, 2007, 2009, 2010, 2012, 2013), and was the co-chair of the 2011 HCI Consortium Workshop, which was made up exclusively of tutorials on ways of knowing in HCI.

(IV) Why it is appropriate to have a tutorial in the proposed area?

Practical skills on how to run studies are well known and well taught skills in psychology departments, but often not well known outside of psychology departments. Yet, in cognitive science, if the field believes in building computational models and gathering data to test those models then how to gather that data is an important skill for every cognitive scientist, no matter their home discipline or outlook. Or, if researchers start the other way 'round by having non-psychologists gather data to test their model, for example, work by Morita and colleagues (Morita, Miwa, Kojima, & Ritter, 2011), this background knowledge is required.

There are few teaching materials on the practical details on how to run studies, which this tutorial addresses. So, this tutorial covers an established but not well documented or often formally taught common technique. The tutorial and related book show that there are important aspects of this technique. We would argue that without training, these aspects are not well known to researchers outside of psychology, and the lack of this knowledge puts the resulting researchers and research done by those not trained at risk for failure of uninterpretable, non-reproducible, or incorrect results.

(V) The likely audience for the tutorial.

In addition to the tutorials presented at conferences as noted above, earlier versions of the material have been used in teaching graduate courses at Carleton University (cognitive science, Canada), U. of Connecticut (human factors, US), Florida Institute of Technology (HCI), U. of Texas at Houston (medical informatics), Middlesex U. (HCI, UK), Georgia Tech (industrial engineering), and at Penn State (information sciences and HCI). So, we believe that is accessible and useful to undergraduate and graduate students who are working with human participant studies, but are outside of psychology departments.

So, the likely audience for the tutorial are students and researchers outside of psychology departments who are running studies with humans in cognitive science and related disciplines, or are thinking about such studies. It will also be useful to researchers in industry related to cognitive science who are interested in running safer, more efficient, more controlled experiments.

References

Bethel, C. L., & Murphy, R. M. (2010). Review of human studies methods in HRI and recommendations. *International Journal of Social Robotics, 2*, 347–359.

Carlson, R. A., & Cassenti, D. N. (2004). Intentional control of event counting. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30*, 1235-1251.

Friedrich, M. B., & Ritter, F. E. (2020). Understanding strategy differences in a diagrammatic reasoning task. *Cognitive Systems Research, 59*, 133-150.

Kim, J. W., Dancy, C. L., & Sottilare, R. A. (2018). Towards using a physio-cognitive model in tutoring for psychomotor tasks. In *Proceedings of the AIED Workshop on Authoring and Tutoring for Psychomotor, Mobile, and Medical Domains*. London, UK.

Kim, J. W., & Ritter, F. E. (2015). Learning, forgetting, and relearning for keystroke- and mouse-driven tasks: Relearning is important. *Human-Computer Interaction, 30*(1), 1-33.

Klein, L. C., Bennett, J. M., Whetzel, C. A., Granger, D. A., & Ritter, F. E. (2010). Caffeine and stress alter salivary α-Amylase levels in young men. *Human Psychopharmacology: Clinical and Experimental, 25*, 359-367.

Morgan, J. H., Cheng, C.-Y., Pike, C., & Ritter, F. E. (2013). A design, tests, and considerations for improving keystroke and mouse loggers. *Interacting with Computers, 25*(3), 242-258.

Morita, J., Miwa, K., Kojima, K., & Ritter, F. E. (2011). Modeling decision making on the use of automation. In *Proceedings of the 33rd Annual Conference of the Cognitive Science Society*, 1971-1976. Austin, TX: Cognitive Science Society.

Reder, L. M., & Ritter, F. E. (1992). What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology : Learning, Memory & Cognition, 18*(3), 435-451.

Ritter, F. E., Freed, A. R., & Haskett, O. L. (2005). User information needs: The case of university department web sites. *ACM interactions, 12*(5), 19-27. acs.ist.psu.edu/acs-lab/reports/ritterFH02.pdf.

Ritter, F. E., Kim, J. W., Morgan, J. H., & Carlson, R. A. (2013). *Running behavioral studies with human participants: A practical guide*. Thousand Oaks, CA: Sage.

St. Amant, R., Horton, T. E., & Ritter, F. E. (2004). Model-based evaluation of cell phone menu interaction. In *Proceedings of the CHI'04 Conference on Human Factors in Computer Systems*, 343-350. New York, NY: ACM.