

Project specification

MEi:CogSci 1st year semestral project

TOPIC OF SPECIALISATION

Bayesian videographs: experimental testing of animated visual aids in probabilistic reasoning

PHENOMENON & (PERSONAL) GOALS

Several decades of research have shown that not only laypeople but also experts (in medicine, law, or finance) have problems in solving Bayesian reasoning tasks. It is a current challenge for scientists, while many of decisions including information on statistics and probability are of a great importance. Is it possible to help people understand probability? Could we teach them how to make better decisions?

This project builds on my diploma thesis, specifically on its part dedicated to experimental testing of effectiveness of various visual aids in Bayesian reasoning (icons, Euler circles, decision trees). My plan is to extend previous research, design and examine visual aids in form of animations illustrating the sampling process (e.g., 10 out of 1000 women with cancer, 8 out of 10 women with positive mammogram).

Besides the main research goal I will learn to develop application in JavaScript and I will get an overview in web design.

The project is a combination of cognitive psychology and information technology.

LEARNING OUTCOMES

By preparing and implementing this project I would improve my skills in experimental methodology and mainly in computer programming.

PROJECT

Title: Bayesian videographs: experimental testing of animated visual aids in probabilistic reasoning

Short description: Aim of this project is to design and experimentally test animated visual aids in probabilistic reasoning. Particular visual animations will display sampling process of numerical information stated in the text of Bayesian problems. Primary research question relates to the effectiveness of visual aids in improving participants' understanding of probability and making optimal Bayesian judgments. Suggestions of participants for improvement of particular aids will be collected. Individual differences in the effect of videographs on Bayesian reasoning will be assessed, too.

PROJECT PLAN

project steps:

1. RECHERCHÉ & LITERATURE RESEARCH

26.3.2014 - 7.5.2014

aims

- search, study, making notes of relevant literature to the research topic
- search and study of documentation for JavaScript (JS) animations (videos, tutorials)

milestones

- before 16.4. materials for presentation of literature background will be prepared
- before 7.5. all materials needed for realizations of experimental method will be covered / studied

results

- 23.4. presentation of literature background and research hypotheses
- notes as a baseline for a draft of poster

references

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- Edwards, A., Elwyn, G., & Mulley, A. (2002). Explaining risks: turning data into meaningful pictures. *BMJ, 324*, 827-830.
- Galesic, M., Gigerenzer, G., & Straubinger, N. (2009). Natural frequencies help older adults and people with low numeracy to evaluate medical screening tests. *Medical Decision Making, 29*, 368-371.
- Gigerenzer, G. (1996). The psychology of good judgment: Frequency formats and single algorithms. *Journal of Medical Decision Making, 16*, 273-280.
- Gigerenzer, G., & Edwards, A. (2003). Simple tools for understanding risks: From innumeracy to insight. *British Medical Journal, 327*, 741-744.
- Hoffrage, U., Gigerenzer, G., Krauss, S., & Martignon, L. (2002). Representation facilitates reasoning: what natural frequencies are and what they are not. *Cognition, 84*, 343-352.
- Over, D. (2007). The logic of natural sampling. *Behavioral and Brain Sciences, 30*, 277-277.
- Sedlmeier, P. (1999). *Improving statistical reasoning: Theoretical models and practical implications*. Mahwah: Erlbaum.
- Sirota, M., Juanchich, M., & Haggmayer, Y. (2013). Ecological rationality or nested sets? Individual differences in cognitive processing predict Bayesian reasoning. *Psychonomic Bulletin & Review*. Advance online publication.
- Vallée-Tourangeau, F., & Krüsi Penney, A. (2005). The impact of external representation in a rule discovery task. *European Journal of Cognitive Psychology, 17*, 820-834.
- Yamagishi, K. (2003). Facilitating normative judgments of conditional probability: Frequency or nested sets? *Experimental Psychology, 50*, 97-106.
- JavaScript animation library: <http://www.greensock.com/gsap-js/>

2. FORMULATING HYPOTHESES

until 15.4.2014

aim

- defining research questions and hypotheses based on previous findings (diploma thesis, article) and studied literature

milestones

- before 15.4. the hypotheses and questions, we aim to test and answer by means of our research, will be specified

results

- list of research questions and hypotheses and their operationalization

primary questions

- Will the animated visual aids facilitate Bayesian reasoning?
- Will the animated visual aids affect the mental representations of participants?
- What suggestions will the participants report for improvement in design of the visual aids?

3. PLANNING OF EXPERIMENT

until 7.5.2014

aims

- proposal of experimental design
- familiarization with the JavaScript language basics, syntax, development environment and best practices
- study of demos, documentation and API for GreenSock Animation Platform (GSAP)

milestones

- before 23.4. method, materials and data collection procedure will be proposed
- before 7.5. specifications of the individual points of the proposal will be amended

results

- design documentation

4. REALIZATION OF THE EXPERIMENT

May 2014

aims

- functional design of animation application
- graphic design
- timeline, wireframes
- implementation of animation, testing, debugging

- data collection - realization of experiment

milestones

- before 15.5. method will be fully functional
- before 23.5. data will be collected, preliminary analysis will be conducted

results

- functional design, timeline, wireframes of animation
- implementation of animation
- collected data

5. DATA ANALYSIS & INTERPRETATION OF DATA

15.5.2014 - 5.6.2014

aims

- complete data analysis
- documentation and interpretation of results

milestones

- 21.5. preliminary results will be presented
- before 5.6. data analysis and documentation will be finalized
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results

- short paper describing theoretical and methodological background, methods, results and interpretation of the experiment

6. DOCUMENTATION OF PROJECT (according to supervisor)

13.5.2014 - 10.6.2014

aims

- poster documentation
- abstract
- poster preparation

milestones

- before 10.6. poster will be finalized

results

- documentation to the experiment, poster

NOTES AND REMINDERS

- animation will only be executable in modern web browsers (Firefox, Chrome, Safari, Opera, newer version of IE)
- do not forget to check the deadlines!