STUDENT PROJECT PROPOSAL: UNDERSTANDING THE HUMAN ASPECTS OF MATHEMATICS

Math is used as an objective language to communicate facts in science as well as in daily-life activities. Yet, there are previous evidence that shows differences between the reasoning of people with a mathematical background (math-literates) and lay-users [1,2].

A very well-known example is "**The Monty Hall**" probabilistic puzzle:

"Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?" (http://statisticshowto.com/probability-and-statistics/monty-hall-problem/)

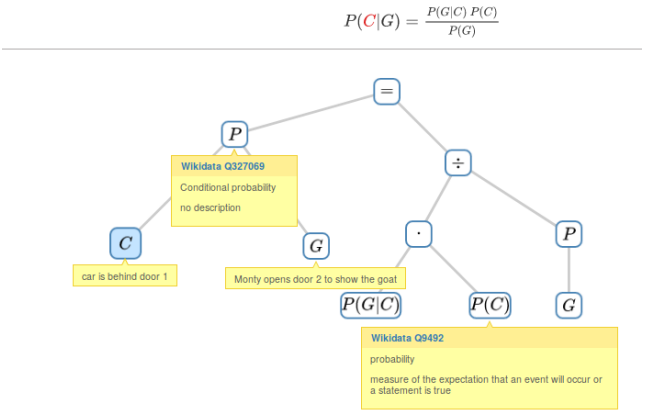

FIGURE 1 VISUAL MATHEMATICAL EXPRESSION TREE SOURCE HTTPS://VMEXT.WMFLABS.ORG

In this context, some interesting questions arise related to the "human" aspects of "Math":

- How humans perceive, process, and understand math statements and expressions?
- Is there any way to improve the communication of math by using visual interactive analysis instead of text?

Research Question

Are visual mathematical expression-trees (VMEXT, Figure 1) a good medium for math understanding? Does the VMEXT visualizations help humans to understand mathematical expressions?

Research Tasks

1. **Summarize the literature on human understanding of math expressions and**
2. **Derive hypothesis that are objectively testable in an experimental setting**
3. **Carry out the user experiment**
4. **Summarize the result**

Expected Background of the Applicant

Math Statistics Programming Gambling

Proposed Literature

[1] Moritz Schubotz, Norman Meuschke, Thomas Hepp, Howard S. Cohl, Bela Gipp: VMEXT: A Visualization Tool for Mathematical Expression Trees. CICM 2017: 340-355.

[2] Kohlhase A., Kohlhase M., Fürsich M. (2017) Visual Structure in Mathematical Expressions. In: Geuvers H., England M., Hasan O., Rabe F., Teschke O. (eds) Intelligent Computer Mathematics. CICM 2017. Lecture Notes in Computer Science, vol 10383. Springer, Cham

[3] Kuno Kurzhals, Brian Fisher, Michael Burch, and Daniel Weiskopf. 2014. Evaluating visual analytics with eye tracking. In Proceedings of the Fifth Workshop on Beyond Time and Errors: Novel Evaluation Methods for Visualization (BELIV '14), Heidi Lam, Petra Isenberg, Tobias Isenberg, and Michael Sedlmair (Eds.). ACM, New York, NY, USA, 61-69. http://dx.doi.org/10.1145/2669557.2669560

[4] Fu, Bo, Natalya F. Noy, and Margaret-Anne Storey. "Eye tracking the user experience–An evaluation of ontology visualization techniques." Semantic Web 8.1 (2017): 23-41.

Contact: Dr. Alexandra Diehl https://www.vis.uni-konstanz.de/mitglieder/diehl/