LITHUANIAN COMPUTER SOCIETY
VILNIUS UNIVERSITY INSTITUTE OF DATA SCIENCE AND DIGITAL TECHNOLOGIES
LITHUANIAN ACADEMY OF SCIENCES

14th Conference on

DATA ANALYSIS METHODS
for Software Systems

November 30 – December 2, 2023

Druskininkai, Lithuania, Hotel "Europa Royale"
https://www.mii.lt/DAMSS

VILNIUS UNIVERSITY PRESS
Vilnius, 2023

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https://doi.org/10.15388/DAMSS.14.2023
ISBN 978-609-07-0985-6 (digital PDF)

When Exponential Growth Bias Gets Worse: An Experiment With an Educational Intervention

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Exponential growth is a pervasive phenomenon found in a wide array of fields, from biology, where it underpins the proliferation of microorganisms, to economics, where it relates to compounding interests, and even physics, where it plays a role in phenomena like nuclear chain reactions. Despite this, there's a growing body of literature that highlights the challenge people face in accurately grasping this type of growth. Specifically, individuals tend to consistently underestimate exponential growth and often perceive it as linear. Recent studies have attempted to explore the origins of this bias and mitigate it by employing logarithmic and linear scales in graphical representations. However, these investigations have yielded conflicting results regarding which scale induces more perceptual errors. In the present study, we conducted an experiment involving a brief educational intervention to further investigate the factors that modulate the exponential bias in graphical representations. Our hypothesis suggests that each scale may induce misperceptions in particular contexts. We also delved into the impact of mathematical education by testing two groups of participants, one with a humanities background and the other with a background in formal sciences. A pretest-posttest design was chosen for the study.

The results of our study confirmed that when employed in an inappropriate context, both logarithmic and linear scales can negatively affect the interpretation of visualizations representing exponential growth. Specifically, the log scale leads to more errors in tasks related to describ-

ing graphs, while the linear scale misguides individuals when making predictions about the future trajectory of exponential growth. The latter part of our study reveals that these challenges with both scales can be mitigated through a brief educational intervention. Importantly, while no difference was observed between the two participant groups before the intervention, those with a stronger mathematical education displayed more significant learning effects during the posttest. We discuss the findings of this study in the theoretical framework of the dual-process model.