Changing Beliefs About Correlations in Atypical Scatterplots

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CCS Concepts: • **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

Additional Key Words and Phrases: belief change, correlation perception, scatterplot, crowdsourced

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1 INTRODUCTION

2 RELATED WORK

3 PRE-STUDY: INVESTIGATING BELIEFS ABOUT RELATEDNESS STATEMENTS

3.1 Introduction

Due to previous evidence suggesting effects of prior belief strength and topic emotionality on the propensity for belief change, we first aim to build a picture of people's thoughts and feelings along these dimensions in our population of interest. With the intention of testing the potential for changes in beliefs about correlations displayed in scatterplots depicting weak and strong correlations, and those whose topics were both strong and neutral in emotional valence, we began by using ChatGPT4 [2] to generate 100 correlation statements using the following prompt:

"Generate 100 statements that describe the correlation between two variables, such as :
"X is associated with a higher level of Y" or
"As X increases, Y increases".
Try to match all the statements on emotionality."

The full list of these statements can be found in the supplementary materials. Note that we cite our use of ChatGPT according to the AI Code of Conduct developed by Iliada Eleftheriou and Ajmal Mubarik and the University of Manchester [1]. Two authors rated each statement on topic emotionality and strength of correlation using Likert scales from 1 to 7. Topic emotionality had a midpoint at 4, whereas strength of correlation varied between 1 (Not Related At All) and 7 (Strongly Related). We calculated a quadratic weighted Cohen's Kappa between the two raters, in order to penalise larger magnitude disagreements more harshly. We found agreement above chance for both topic emotionality ($\kappa = 0.49$, $p < .001$) and strength of correlation ($\kappa = 0.51$, $p < .001$), indicating moderate levels of agreement in both cases [**? ?**]. Following this, we selected strongly and weakly correlated statements with the highest level of absolute agreement, resulting in the 25 statements that can be seen in Table 1 and Table 2.

3.2 Method

3.2.1 Participants.

3.2.2 Design.

3.2.3 Procedure.

3.3 Results

3.4 Discussion

4 MAIN STUDY: POTENTIAL FOR BELIEF CHANGE USING ATYPICAL SCATTERPLOTS

4.1 Introduction

4.2 Method

4.2.1 Participants.

4.2.2 Design.

Table 1. Pre-test statements that were rated as being strongly correlated.

Statement - Strong Correlation Depicted
Increased exposure to sunlight is correlated with higher vitamin D levels.
As caffeine consumption increases, so does the average heart rate.
Greater frequency of exercise is linked to a lower risk of depression.
Greater use of helmets is associated with a lower incidence of head injuries in cyclists.
As the quality of healthcare improves, life expectancy tends to increase.
As access to clean water improves, the incidence of waterborne diseases decreases.
Higher levels of empathy are linked to stronger interpersonal relationships.
As soil quality degrades, agricultural productivity tends to decrease.
Higher levels of civic engagement are linked to a stronger sense of community.
Higher sugar consumption is associated with an increased risk of dental cavities.
Higher attendance at preventive health screenings is linked to earlier detection of diseases.
Increased use of energy-efficient appliances is associated with lower electricity bills.
As pedestrian-friendly infrastructure improves, urban walkability tends to increase.
Greater regularity in sleep patterns is associated with improved mental health.

Table 2. Pre-test statements that were rated as being of low strength correlation.

Statement - Weak Correlation Depicted
Greater water consumption is linked to improved kidney function.
As the amount of sleep decreases, the risk of obesity increases.
Greater intake of omega-3 fatty acids is associated with lower inflammation levels.
Greater exposure to music education is linked to enhanced cognitive development in children.
Higher exposure to air conditioning is associated with increased respiratory issues.
Higher frequency of family meals is linked to better eating habits in children.
As participation in community arts programs increases, local cultural engagement tends to rise.
Higher consumption of spicy foods is associated with a lower risk of certain types of cancer.
Greater adherence to a Mediterranean diet is linked to a lower risk of neurodegenerative diseases.
Higher consumption of nuts and seeds is associated with reduced risk of cardiovascular diseases.
As cultural preservation efforts increase, community identity and cohesion tend to strengthen.

4.2.3 *Procedure.*

REFERENCES

[1] Iliada Eleftheriou and Ajmal Mubarik. 2023. AI Code of Conduct. https://www.iliada-eleftheriou.com/AICodeOfConduct/#how-to-cite-and-reference-chatgpt.

[2] version 4. 2024. ChatGPT. OpenAI.