Where are the Weakest Links in Cybersecurity Judgment of Elementary School Students, Middle School Students, High School Students, and School Teachers

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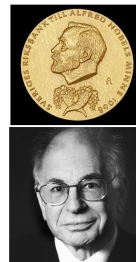
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95% of all successful cyber attacks are caused by human error

Source: IBM Cyber Security Intelligence Index

PEOPLE ARE THE WEAKEST LINK IN THE SECURITY CHAIN.

Daniel Kahneman
The Prize in Economic Sciences in Memory of Alfred Nobel 2002

"for having integrated insights from psychological research into … human judgment and decision-making under uncertainty"

We can be blind to the obvious, and we are also blind to our blindness.
— Daniel Kahneman

2 Key Challenges & 2 Research Questions

- No scientific instrument ➡ How can a valid and reliable instrument be designed to assess cybersecurity judgment? ➡ The first psychometrically sound assessment tool for research and practice.

- No baseline benchmark ➡ How well do K-12 students and teachers make cybersecurity judgment? ➡ The first baseline benchmark for K-12 cybersecurity research and education.

3 Scientific Impacts

- Empirically, findings of the weakest links in human users can be useful for designing various CPS cybersecurity solutions.

- Methodologically, focusing on the weakest links in human users can be applied to cybersecurity research and practice of various CPSs.

- Theoretically, research on the weakest links in human users can test Kahneman's human judgment theory in the cyber space.
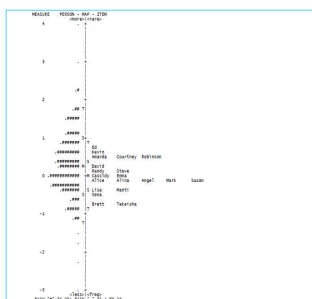

Figure 1. The Wright item-person map, demonstrating the match between the person ability hierarchy and the item difficulty hierarchy as psychometric evidence of quality of the Cybersecurity Judgment Questionnaire.
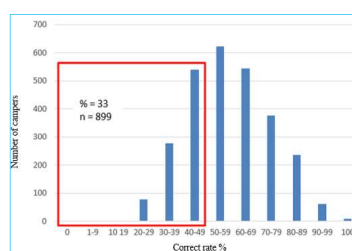

Figure 2. The number of K-12 students and teachers (Y-Axis) achieved their correct rates (X-Axis) of cybersecurity judgment on the 20 cybersecurity scenarios among 2667 participants, showing 899 (23%) participants with their correct rates blow 50% are the weakest link.
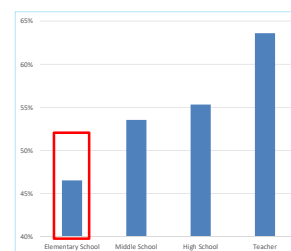

Figure 3. The mean correct rates for the four K-12 groups, elementary school students,, middle school students, high school students, and school teachers, showing the elementary school students are the weakness link.

Figure 4. The mean correct rates for two types of cybersecurity judgment, intuitive judgement and rational judgment among K-12 students and teachers, showing their rational judgement is the weakness link.

4 Societal Impacts

- Cybersecurity technologies ➡ the cybersecurity users.
- Cybersecurity professionals ➡ to ordinary cyberspace users.
- Building the strongest system in technologies ➡ tackling the weakest link in users.
- Developing users' cybersecurity awareness and cybersecurity behavior ➡ to cybersecurity judgement and decision making.

3 Educational Impacts

- Targeting the most risky individuals rather than the lease risky ones via individualized interventions.
- Targeting the youngest individuals vis appropriate and effective education.
- Targeting improvement of the rational judgement via carefully designed educational and training programs.

Quantitative Broad Impacts

- Yan, Z., Robertson, T., Yan, R., Park, S. Y., Bordoff, S., Chen, Q., & Sprissler, E. (2018). Finding the weakest links in the weakest link: How well do undergraduate students make cybersecurity judgment?. *Computers in Human Behavior*, *84*, 375-382.

- Its current 10 citations in Google Scholar within one year as of 10/2019 from 8 courntries: USA, Canada, South Africa, Malaysia (2), Ukrainian (2), Czech Republic, UK, & Turkey.