



# VISUALIZATION LITERACY IN THE AGE OF BIG DATA: VITAL SKILLS FOR MODERN MEDIA CONSUMPTION

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# MOTIVATION

- Literacy: the ability to read and write
  - Limited to wealthier individuals [25]
- Access to information in general has grown
  - Visualization is becoming an increasingly common method to understand big datasets
  - With this change:
    - being able to understand visualizations has become more important
    - the idea of visualization literacy has appeared in literature
- Visualization literacy in the general public is **low** [5]
- Visualization education is limited to those with strong internet and English ability
  - Education in modern visualization techniques is only typically available to those in academia

Visualization literacy:  
The ability to interpret visualizations

# CONTRIBUTIONS & RELATED WORK

- Contributions:
  - A survey of visualization literacy literature
  - A set of themes found in the surveyed literature
  - A new, inclusive definition of visualization literacy
  - Identified gaps in participant pools of visualization literacy user studies
- There are no existing survey papers on visualization literacy
  - But some papers included helpful background or related work sections
- Significant work in the ability to interpret visualizations
- About half of the papers include the ability to construct visualizations in their definitions
- Other papers discuss visualization literacy in terms of how to critically analyze and engage with visualizations

# PROCESS

## Paper Collection

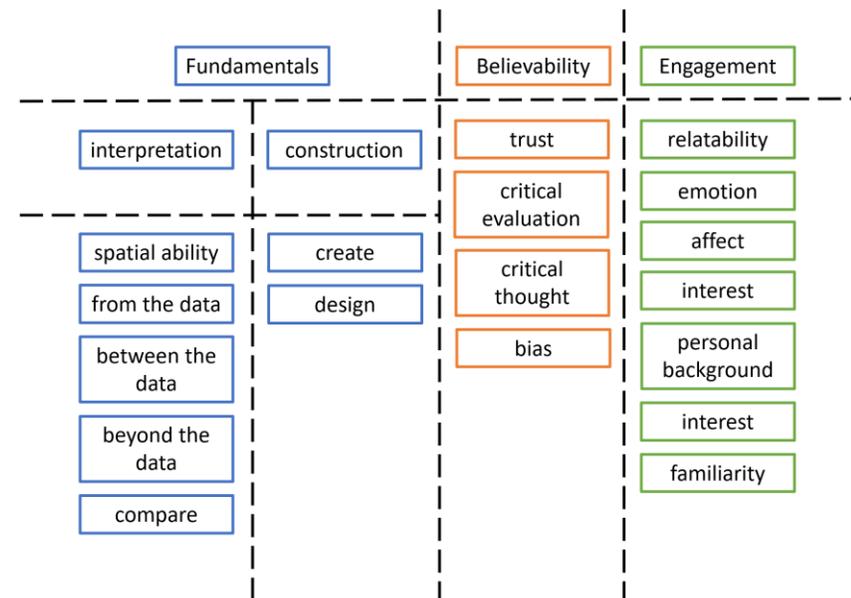
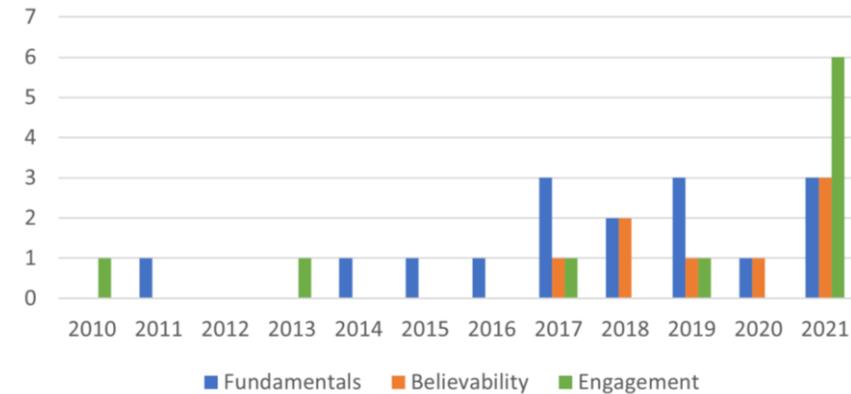
- Keyword search
  - visualization literacy, data visualization literacy, visualization comprehension, critical visualization, visualization AND engagement, etc....
- Seed papers [4, 22, 29, 34]
- Individual differences were not the focus of this paper
- 27 papers considered, 24 papers used

## Analysis

- Thematic
  - Identified themes in surveyed papers
  - First looked at definitions, then actual content of papers
- Audience
  - Analysed participant pools in the user studies
  - Identified underrepresented groups in these user studies

# THEMES

- Three themes were identified: fundamentals, believability, and engagement
  - **Fundamentals** describes how a person reads and understands visualizations and how a person designs and creates visualizations
  - **Believability** describes how a person can be critical or trusting of visualizations
  - **Engagement** describes whether a person is engaged and what makes a person more or less engaged in a visualization
- A new definition: *the ability to critically interpret and construct engaging visualizations*



# THEME #1: FUNDAMENTALS

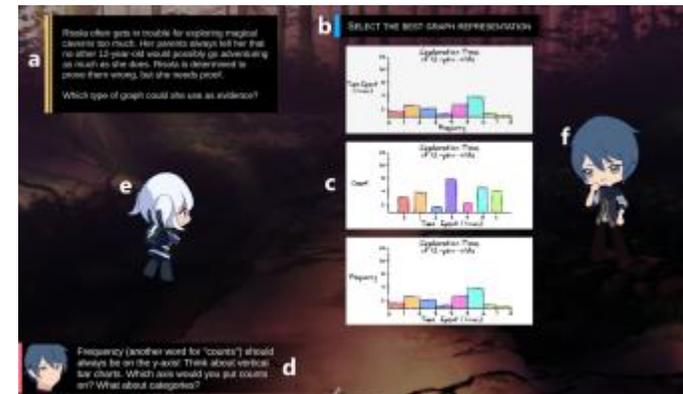
“how a person reads and understands visualizations and how a person designs and creates visualizations”

- The most common theme
  - Likely due to the similarity to literacy (to read and write)
- Existing: frameworks, assessment methods, implemented assessments, educational tools for children
- Why is construction lacking in the literature?
  - Multiple papers noted this
  - Chevalier et al [7] make two relevant suggestions based on their observations in elementary school classrooms
    - Future work needs to take visualization construction into account (supports learning and reproducibility)
    - Visualization construction should be a part of the definition

# THEME #2: BELIEVABILITY

“how a person can be critical or trusting of visualizations”

- The newest theme
- Existing: assessing source reliability, including prior knowledge, clarifying misconceptions using visualization, ways in which the general public are critical
- Adding believability to the definition
  - Knowing when to trust a visualization is key
    - Unreliable sources
    - Misleading visualizations
  - Visualizations should be reproducible (which supports construction)

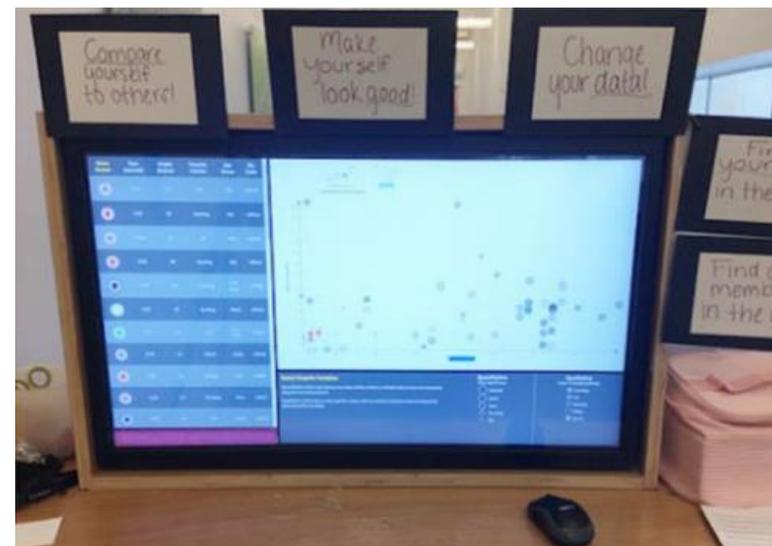


A screenshot from the narrative educational game designed by Huynh et al. showing dialog and charts [17]

## THEME #3: ENGAGEMENT

“whether a person is engaged and what makes a person more or less engaged in a visualization”

- An old theme that has recently exploded
- Existing: why people do or do not engage, personalized visualization, emotion affecting perception, perception affecting emotion
- Consider engagement as a factor in future research
  - Engaging is not necessarily a skill on its own
  - Engagement is an important factor in how people perceive visualizations
    - Future use of visualization literacy assessments should consider how participant engagement affects performance



The station used for constructing and interacting with visualizations based on previously entered data, designed by Pepler et al. [30]

# AUDIENCE ANALYSIS

- 16 of the surveyed papers had user studies
  - 8 of them explicitly discuss visualization literacy in their contributions
- Overall:
  - Men are overrepresented
  - Children and young adults are overrepresented
  - Participants from Western countries are massively overrepresented
  - Many of the user studies completely lack participant demographics
    - Those that have demographics are inconsistent

# DISCUSSION & FUTURE WORK

- The three themes should at least be discussed in future visualization literacy work
- Future work in visualization literacy:
  - How do skills in visualization construction interact with skills in visualization interpretation?
  - Which visualizations are good at changing people's opinions? Are there any?
  - How can we build stronger narratives and personability into visualizations?
  - Do the skills of interpretation, construction, and critical evaluation go hand in hand or must they be learnt separately?
  - Are people actually illiterate in visualization or do they just use different chart types?
- Future work in general visualization:
  - Make sure we are really assessing novices when we design visualization systems for them

# CONCLUSION

- 24 papers were surveyed
- 3 themes were identified
- A new definition was proposed
- Gaps in participant pools of visualization literacy user studies were identified