

Distributions, Trends, and Contradictions: A Case Study in Sensemaking with Interactive Data Visualizations



Tufts
UNIVERSITY

Berkeley
UNIVERSITY OF CALIFORNIA

Vasiliki Laina, Tufts University (vasiliki.laina@tufts.edu)

Michelle Wilkerson, University of California - Berkeley (mwilkers@berkeley.edu)

Motivation:

Rich, innovative and interactive representations of data are popular in social media and science. Still, students rarely have the opportunity to engage with, interpret and critique such rich displays of data in school.

Research Question:

How do students work with rich data visualizations, interpret the quantitative patterns in them, and tell stories with and about the data?

Background Literature:

Students have been found to gradually develop a blended view of statistical data, using both knowledge about the data and the context in which the data were collected from (Ben-Zvi & Arcavi, 2001). To explain patterns in data, they supplemented their own observations of the phenomenon by drawing from their contextual knowledge of the system under study (Lehrer & Schauble, 2004). These findings suggest that students coordinate between data, representations and mathematics. We wanted to explore this coordination in a new context, using interactive, narratively driven data visualization.

Methods:

Two girls enrolled in middle school participated in a semi structured interview about fuel consumption in the UK that lasted 45 minutes. Video and screen capture was used.

Double Interpretations:

Distribution vs. Trends over Time

Stryker: We're adding in another variable. Which [inaudible] everyone will go down some, **to make room** for green energy.

Aphrodite: True.

Stryker: But I think biomass will still go up.

Aphrodite: Solid... How much [inaudible]? **That's been going down down down down** [looking on the screen, browsing along the years].

Stryker: I think we could put solid at 14.

Aphrodite: 14? I feel like it should be a little lower than that.

Stryker: But... [inaudible]

Aphrodite: 13, 12. Cause it's been going down a lot.

Interviewer: This one [refers to biomass] was the... the most stable one?

Stryker: Yeah. Aphrodite: 2%... 2% increase.

Stryker: Even.. **No one really use it, but, it stayed steady.**

Resolution of Conflicts:

Contextual and Mathematical knowledge

Interviewer: So, if they use their cars... if we have more cars, actually, than in 1970s, and we use petrol mostly in cars, why do you think it didn't change much? The consumption?

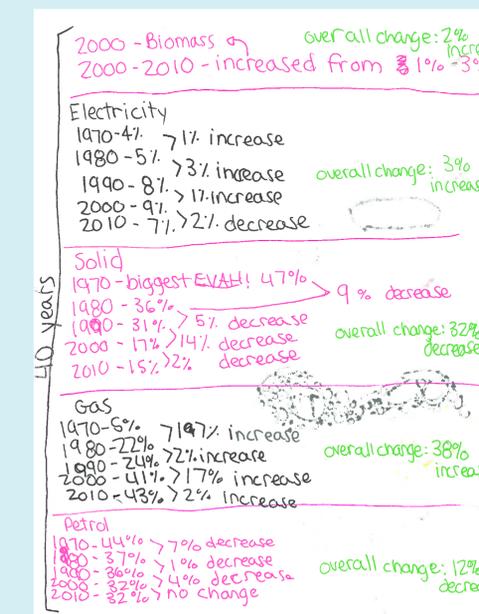
Stryker: **There are new ways to power cars now.**

Stryker: So, these... Most of them sadly... [finding total change on the paper] Em... Two of the biggest ones, petrol and solid **decreased** over the... how long is it?

Aphrodite: Overall it's gas that's been up the most. [inaudible] And... down the most... solid. **So gas went up the most and solid went down the most.**

Conclusion:

Narrative visualizations involve complex, multivariate data, organized to emphasize a certain point of view or path for investigation. Dealing with narrative visualizations requires learners to coordinate among multiple possible patterns embedded within the data and to navigate designers' often explicit intentions. In this study, the girls interpreted the data in two ways and created a story of the visualization by reorganizing and manipulating data presented, adjusting interpretations of those data, and adjusting justifications for patterns observed.



Girls' written Work



Stryker: Oh, we can make it in a heart shape!

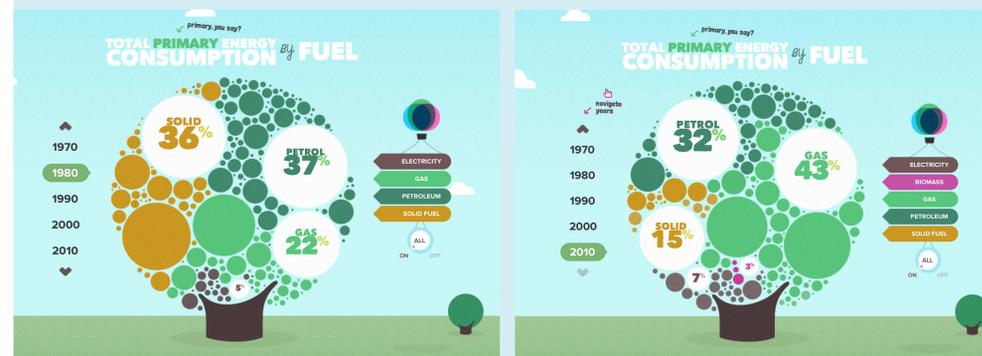
Stryker: We would send the message "Love the Earth".

References:

Ben-Zvi, D., & Arcavi, A. (2001), Junior high school students' construction of global views of data and data representations. *Educational studies in mathematics*, 45(1-3), p. 35-65
 Lehrer, R., & Schauble, L. (2004), Modelling Natural Variation through Distribution. *American Educational Research Journal*, vol. 41 (3), p. 635-679

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Data Visualization Screenshots