

User Study 47B: Interactive Dashboards After Answer-First Analytics

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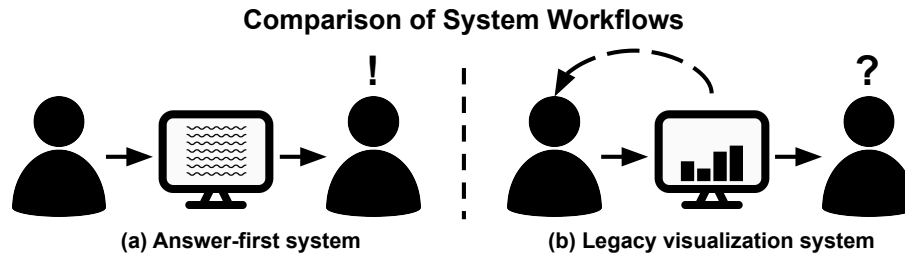


Figure 1: Comparison of contemporary and legacy analytic workflows. (a) In an answer-first system, the user asks a question, receives an interpretation or recommendation, and exits the workflow. (b) In a legacy visualization system, the user inspects the chart, compares patterns, adjusts the view, thinks for a while, asks a better or worse question, and often re-enters the loop.

ABSTRACT

In 2054, most analytic workflows begin with an answer and conclude before anyone has been required to look at the data, an arrangement generally regarded as progress. We report User Study 47B, an evaluation of a legacy interactive dashboard with participants accustomed to answer-first systems. Participants often treated interaction as analysis the system had failed to finish and interpretive ambiguity as an interface awaiting a finalized answer. These responses reverse two familiar visualization values: agency begins to resemble labor, and interpretive openness begins to resemble poor interface quality. We use these findings to ask how visualization can make looking at data feel worthwhile and how it should fit workflows where users begin by uploading data and asking for an answer. This remains a viable direction for the field, although perhaps not the one envisioned in its grant proposals.

Index Terms: Information visualization, human-AI interaction, analytic automation, interpretive ambiguity, unfinished analysis, please just tell me the answer.

1 INTRODUCTION

It is 2054. Most analytic work begins by asking a system a question and ends several seconds later when the system provides an answer, a recommendation, three caveats, and a sentence suitable for forwarding to one’s manager. Data continues to exist somewhere in this process, at least that is what we are told. A small visualization research community continues to study an earlier analytic tradition in which people were shown the data before anyone told them what it meant.

Back in the first quarter of the century, visualization sat closer to the center of analytic work [2]. Dashboards asked users to inspect charts, compare values, adjust filters, and slowly form an interpretation. This process was called sensemaking [5]. It was respected for several decades, despite requiring the user to do it.

Answer-first systems [8] changed what users expect from analytic tools. They identify relevant patterns, summarize their meaning, and recommend what should happen next [3]. A dashboard, on the other hand, asks the user to inspect several views, determine

which comparisons matter, manipulate controls, reconcile conflicting patterns, and eventually arrive at an interpretation, which is, when stated plainly, kind of a lot of work.

In order to examine what happens when users accustomed to answer-first systems are returned to this older arrangement, we conducted *User Study 47B*. We focus on two qualities visualization has traditionally valued: giving users control through interaction and leaving room for users to interpret what they see. Both have occupied a substantial portion of the visualization literature, so we had some professional interest in participants continuing to enjoy them.

2 USER STUDY 47B

Participants came from administrative, educational, healthcare, finance, logistics, and public-sector contexts, representing a broad range of occupations in which looking at a visualization was now considered a specialty skill [1]. Participants used a legacy dashboard that included an answer-first conversational panel. In the visualization-only condition, the answer-first panel was removed so participants could experience the full historical procedure of looking at the data. In the answer-first condition, much to our participants’ relief, the panel was enabled. We recorded what participants did, what they said while doing it, and, where necessary, general vibes. Through our study we discovered that the dashboard worked exactly as designed, which turned out to be the issue.

3 RESULTS

We organize the results around the two ways participants most consistently objected to being asked to think about the data.

3.1 Interaction as System Failure

We discovered that participants did not generally describe interaction as agency, control, or exploration. They described it as work, which was rude but not inaccurate. Features historically presented as giving users analytic control instead made participants wonder why so much of the analysis had been assigned to them.

P18 said that the dashboard *‘feels like the model had stopped halfway through the job, maybe the API credits ran out?’* We were initially encouraged that participants understood what the interactions were for. This lasted until we realized that understanding the controls had only made their presence more irritating.

This expectation became clearest when participants were asked to form insights from the visualization. P10 asked, *‘Is the answer hidden, or is the answer the chart?’* The question produced a brief silence, as it was both a methodological problem and the paper.

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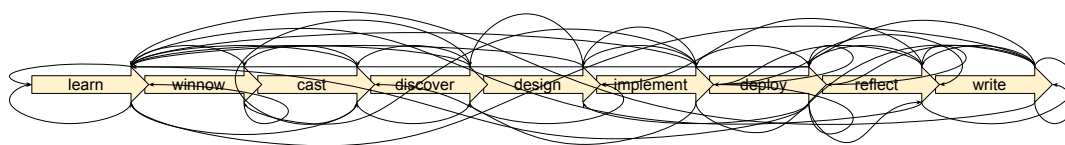


Figure 2: A reconstructed model of legacy visualization-system design [6]. The model documents the overly complicated and time-consuming process by which early visualization researchers transformed data, tasks, users, encodings, interactions, evaluations, revisions, and several meetings into what was once called a visualization system. At the time, it was common practice to assume that the number of arrows in a figure corresponded roughly to the amount of thinking and self-reflection required.

"Participant responses are unevenly distributed across conditions, with most evidence indicating a preference for generated summaries over manual inspection."

Figure 3: Our analysis of the response patterns observed in the study.

3.2 Ambiguity as Poor Interface Quality

Participants reacted similarly when visualizations supported several plausible interpretations. The problem was that the visualization left the final meaning unresolved, a feature that earlier generations apparently found useful.

In one task, an aggregate trend appeared stable while one subgroup gradually increased. Both patterns were present, along with the considerable inconvenience of deciding what to do about that. Participants struggled to determine how the patterns should be interpreted together. P04 asked, *"The graph makes it look like there are a few ways to read it. Is there a finalized version?"*

P12 summarized this expectation neatly: *"If it can show me all of these views, why can't it just tell me which one is important?"* This was difficult to answer without accidentally summarizing several decades of visualization research in a tone no one had asked for.

Generated answers handled this difficulty by selecting an interpretation before presenting it to the user. Participants generally described the resulting experience as clearer. Something had simply made the interpretive decision upstream, which participants considered an important interface improvement since it meant they were no longer responsible for it. This was an efficient solution to ambiguity, although it made several decades of work on supporting interpretation somewhat awkward to cite.

4 DISCUSSION

Together, these findings suggest a reversal of familiar visualization values. Interactive visualization was built around the assumption that producing an interpretation was part of the user's role [7]. Under answer-first expectations, the same design choices communicate that some portion of the analysis remains unfinished. This idea is somewhat unfortunate because leaving that portion to the user was, for a considerable period of time, the design goal.

Interaction illustrates the problem particularly well. A filter transfers responsibility for deciding which comparison matters to the user, zooming asks the user to decide which region deserves further attention, and a tooltip announces that additional information exists, but requires the user to retrieve it one point at a time, like an animal [4]. These mechanisms still provide plenty of control for the user. Control is simply less exciting once the alternative is having the system deal with it so you can tell your boss it's done.

Interpretive openness encounters the same change in expectations. Visualization has long been useful precisely because data

can support exploration of competing readings and subgroup differences. Earlier visualization researchers might have called the resulting process sensemaking. Participants called it unclear, which was less flattering but much easier to put in a post-task questionnaire.

The underlying problem extends beyond interface preference. Answer-first systems alter where users expect analytic effort to occur. Increasingly, the workflow begins with something close to "here is my data, tell me what is going on." The system performs the search, comparison, prioritization, and interpretation before the user encounters the result. Visualization enters a workflow that may already contain an answer, which is a slightly unfortunate time to arrive with a chart.

This idea leaves the visualization community with two fairly substantial problems. The first is motivational: how do we convince users that there are moments when looking at the data is still worth doing? Simply providing an interactive view seems unlikely to help if opening it feels like additional work. Systems may need to make the value of inspection visible before asking users to inspect anything. The field may therefore need to demonstrate that looking at the data has benefits, a claim it had previously been able to treat as more or less foundational.

The second problem concerns system design. If users increasingly begin by uploading data and asking for an answer, visualization needs to fit into a workflow where substantial analysis has already happened before the chart appears. Where should visualization enter? Which parts of an answer should become visual? How should users move from a generated interpretation into the underlying data, and how much analytic responsibility should be returned to them once they get there? These questions suggest a design space around transitions between generated answers and interactive analysis. Much of our existing guidance assumes that users begin with the visualization, which was a reasonable assumption years ago and is now somewhat inconvenient.

Answer-first analysis therefore creates an inconvenient research opportunity. Visualization researchers need to understand how to make inspection feel worthwhile and how to design systems for users who arrive with an answer already in hand. Resolving these questions may require reconsidering several assumptions on which interactive visualization was built. Fortunately, reconsidering foundational assumptions is a well-established way to generate at least three more papers for the BELIV workshop.

5 CONCLUSION

User Study 47B found that interaction increasingly resembles analytic work delegated to the user, while interpretive openness increasingly resembles an answer that has not finished processing. Answer-first systems change what users expect to happen before information reaches them. The resulting challenge for visualization is straightforward to describe: give people a reason to look at the data, then design something useful for when they actually do.

ACKNOWLEDGMENTS

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