Reflections on Working With Fellow Tool Builders

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Abstract

While it is true that fellow tool builders can threaten the success of a design study, there are also advantages to working with individuals that have strong software development skills. We present a review of two information visualization projects using thematic analysis, that provides additional insight and guidance for collaborating with people that have strong software development skills. Additionally, we discuss minor implications for the design of node-link diagrams and adjacency matrices, and report observed differences in engagement with respect to touch tables versus traditional keyboard, mouse, and monitor configurations.

1 Introduction

As identified by Sedlmair, *et al.* [3], **fellow tool builders** are collaborators in a design study that "should be treated with great care." There are many potential pitfalls when developing a visualization system in collaboration with people that have extensive software development abilities. For example, a fellow tool builder may only be seeking someone to augment their existing system with visualization capabilities, relegating the visualization researcher to the role of a software developer and preventing the discovery of actual visualization needs. Working with fellow tool builders can also result in data access problems, where access to existing software is provided, instead of the raw data, or synthetic datasets are provided. In a design study, it can be easy to mistake a fellow tool builder as a front-line analyst or end-user, and this distinction is often not clear until late in the collaboration.

While concern is absolutely warranted, too much concern can also be a pitfall, where a collaboration is prematurely winnowed simply on the basis of a collaborator's extensive technical skill. We present a review of two visualization projects using thematic analysis [1] that identifies benefits of working with fellow tool builders and provides additional insight into how to tap into their abilities, while keeping the focus of the project on actual visualization needs. Our observations also contain minor implications for designing node-link diagrams and adjacency matrices. Additionally, we report and discuss different levels of engagement that we observed between a large touch table interface, and a more traditional keyboard, mouse, and monitor display.

2 Visualization Projects

As part of the author's role on a student committee in a large research institute, two visualizations were created. The first was a map of the institute itself, created for an institute open house, and can be seen in Figure 1. It allowed users to see where various research areas were presenting, as well as locate individual posters. The second was a system created for managing and presenting the results of an in-house ping pong tournament; its main interface elements can be seen in Figure 3 and Figure 4.

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Figure 1: The institute map, displayed on a touch table at an exhibition. Map areas, research areas, and individual posters can be selected.

3 Collaborators

The design and development of each system was a result of collaboration across the student committee. For the open house map, feedback was also recieved in an institute-wide meeting consisting of more than forty computing-focused researchers and supporting staff. Student committee members and other major contributors are shown in Figure 2. We classify these collaborators as fellow tool builders because, for each project, the task and data abstractions were based solely on the inferences of a technically-minded group of individuals, rather than direct contact with end-users—exposing each project to the most fundamental dangers of this kind of collaboration.

ID	Role	Gender	Research Area
I1	Mid Grad Student	F	Biomedical Computation
I2	Mid Grad Student	F	Biomedical Computation
I3	Staff Developer	F	Scientific Computing
I4	Research Faculty	M	Information Visualization
I5	Senior Grad Student	M	Biomedical Computation
I6	Senior Grad Student	M	Biomedical Computation
I7	Senior Grad Student	M	Biomedical Computation
I8	New Grad Student	F	Scientific Visualization

Figure 2: Basic information about the student committee and other collaborators. Each collaborator is proficient in writing software.

4 Method and Results

The raw dataset that we analyze consists of git histories, emails, Slack conversations, and group meeting notes. We analyzed this data using an open coding process, with further analysis to extract themes. Data extracts and open codes, with their relationships to themes, are documented in the supplemental material; here we only report the resulting themes (in bold), with selected supporting details. Naturally, as with any study based on thematic analysis, these themes are general trends in observed phenomena, not hard-and-fast rules for all collaborations with fellow tool builders.

4.1 Collaborator Help

Collaborator technical involvement in the project varied; the personality of each collaborator appeared to dictate whether and how much someone contributed, rather than their interest in the overall project or their interest in its technical aspects. **Technical involvement did not seem to have any relationship with a collaborator's specific expertise (A1)**. For example, I6, while a proficient programmer, does not do much web development, especially compared to some of the other collaborators. However, he contributed the only change to any code, and was the interface's principal beta tester.

Collaborators most readily contributed data when the tools were familiar (A2); Google spreadsheets, used in the ping pong interface, were the most freely adjusted, particularly by I5, I6, and I7. Github CSV files, used in the interactive map, came in second: every committee member was required to submit information about their assigned areas of the open house, but these edits tended to be less extensive. Beta-testing the interfaces themselves came in third—I3, I5, I6, and I8 helped stress-test the ping pong interface using a simulation mode that showed what the interface would look like as different deadlines passed. Finally, the interface code itself was only touched by I6.

4.2 Collaborator Feedback

Most of the feedback that collaborators provided was helpful (A3); compared to non-developer users [2], people seemed more willing to provide critique. Because these collaborators had a better sense of the kind of changes that could be easily imlemented, they were more willing to mention them. This theme must be tempered, however: as with non-developer feedback, collaborators still tended to be unwilling to provide critique when they percieved changes as being difficult. For example, a seemingly simple change—the orientation of the map—was extensively discussed in the institute-wide meeting. However, a more critical detail relevant to the task abstraction—that some visitors would be looking for specific posters—was only mentioned in passing.

Some feedback was too specific or failed to capture the scope of the project (A4), such as typography, style, or superfluous interaction suggestions. This theme must also be treated with caution, however. For example, I3 suggested replacing an arrow in the adjacency matrices with the name of the match winner, as shown in Figure 3. Initially, the conversation was framed as a style suggestion, when, in fact, her critique had real usability ramifications.

4.3 Visualization Techniques and Deployment

In addition to collaboration patterns, we also observed patterns that have implications for visualization design and deployment. **Adjacency matrices were confusing to a subset of a technical audience (A5).** While some institute members described this part of the ping pong interface as intuitive, others were initially confused, and, in some cases, explanations were necessary.

Encoding direction with triangular shapes was ambiguous and confusing (A6). We used triangular edges—using the wider end of the edge to indicate the winner of a match—in two node-link diagrams; a bracket view, and a free-form force-directed view, as shown in Figure 4. In the bracket view, the meaning was clear; the winner was redundantly encoded spatially. However, in the force-directed view, it was often unclear whether the wider end indicated the winner, or if the triangular shape was meant as an arrow, pointing in the opposite direction.

Finally, **presenting a visualization on a touch table proved more engaging than a fixed monitor (A7).** The open house display was on a large touch table, and guests readily interacted with it. The ping pong display was on a fixed monitor of approximately the same size, with a keyboard and mouse below it. Passers-by seemed more hesitant to interact with the ping pong deployment.

Figure 3: I3 provided useful feedback about showing text labels instead of arrows, clarifying the meaning of the adjacency matrix.

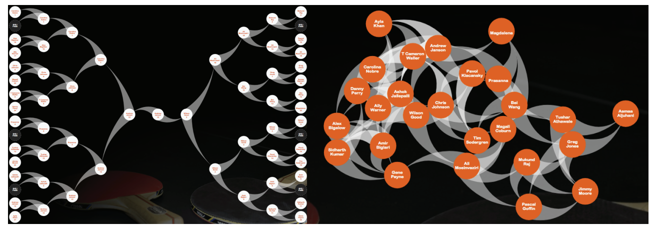

Figure 4: Direction is encoded along edges in the graph, with the wider end toward the winner of a match. Redundant spatial encodings make the meaning clear in the bracket (left), but the meaning is ambiguous in the force-directed layout (right).

5 Discussion

With respect to fellow tool builders, there were no straightforward predictors that could be used to anticipate whether a technically skilled collaborator would barely participate, add meaningful contributions, or exert undue interference. However, a successful mitigating strategy was to provide clear assignments and familiar channels through which collaborators could contribute—even though some of them were largely unused **(A1, A2)**. It is also clear that, while involving fellow tool builders adds some risk to a project, that risk comes with a reward: these collaborators have a strong eye for detail, and are more willing to provide valuable critique that other collaborators might not **(A4, A5)**.

We also observed some patterns that are worth pursuing more fully with future visualization research. While it is possible that the confusion surrounding the adjacency matrices in the ping pong interface was an effect of the adjacency matrices' rotated design, we observed strong indications that adjacency matrices in general may require an explanation as to how to read them **(A5)**. Additionally, as triangular shapes are sometimes used to encode direction in visualizations, care should be taken to explain how to interpret their meaning **(A6)**. Finally, public deployments of visualizations appear to attract more engagement on touch tables than traditional keyboard, mouse, monitor interfaces **(A7)**.

References

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