# *Skeleton*: Facilitating Collaborative Design and Development Scaffolding of Accessible Data Navigation Experiences

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## 1 Abstract

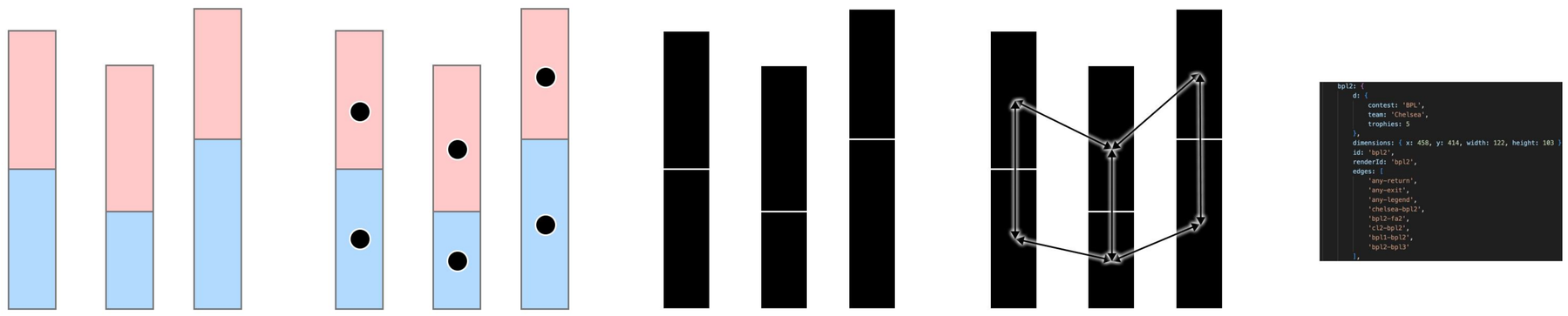
User pastes or uploads a chart into our tool

Users uses our “node” tool to add nodes

User can edit the shape, size, and location of nodes

User uses our “edges” tool to connect nodes

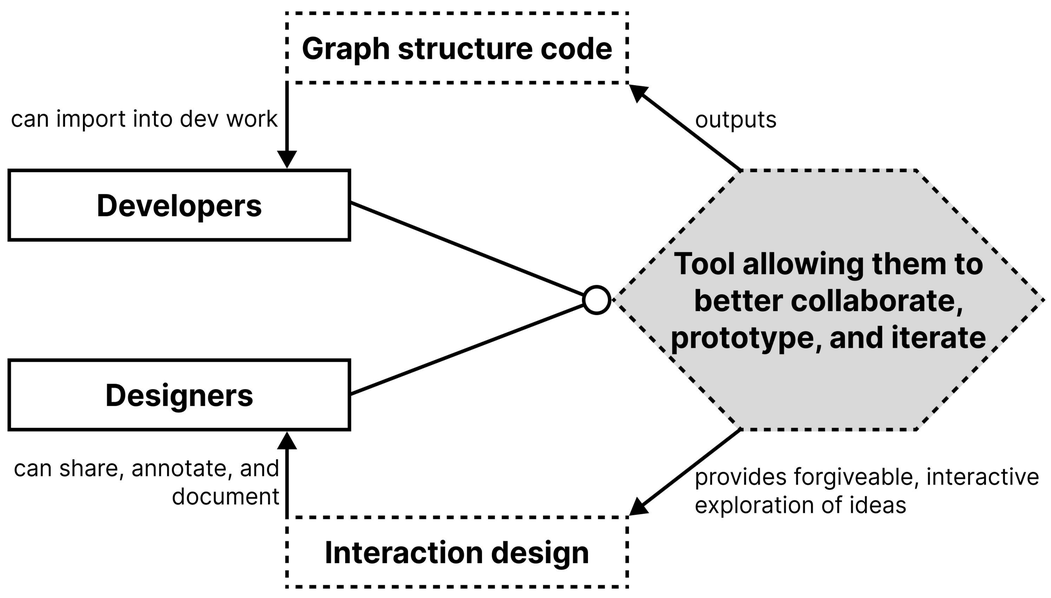
User exports their structure as code




Currently, designing and building accessible data navigation using a tool such as *Data Navigator* is difficult due to the complexity of knowledge required to specify interaction possibilities using code. Exploring and expressing ideal experiences for end-users becomes time consuming. Our solution, *Skeleton*, provides a visual user interface canvas (with affordances similar to popular tools such as *Figma* or *tldraw*) and automatically generates code based on specified visual design constraints. Our approach enables creators to visually design data navigation structures without having to worry about code while easily adjusting their designs as they see fit. We hypothesize this interface will provide a flexible design experience that facilitates more active collaboration, faster iterations, and clearer communication of prototype ideas through demonstration.

## 2 Introduction

While we see potential for code-focused tools like *Data Navigator [1],* prototyping ideas and sharing them can be slow, confusing, and leaves room for miscommunication in a collaborative setting because code-writing remains a necessary step within design iterations.




To address this, we built *Skeleton*, a user interface where designers and developers can directly create data navigation structures on top of existing data visualizations. Our approach provides manipulable visual and textual elements that represent both the abstract schema and the rendered results of a navigable data structure. *Skeleton* then also automatically generates code based on the user’s designs that can be imported into an existing data visualization ecosystem. We anticipate *Skeleton* will improve the experiences of both interaction designers and developers.

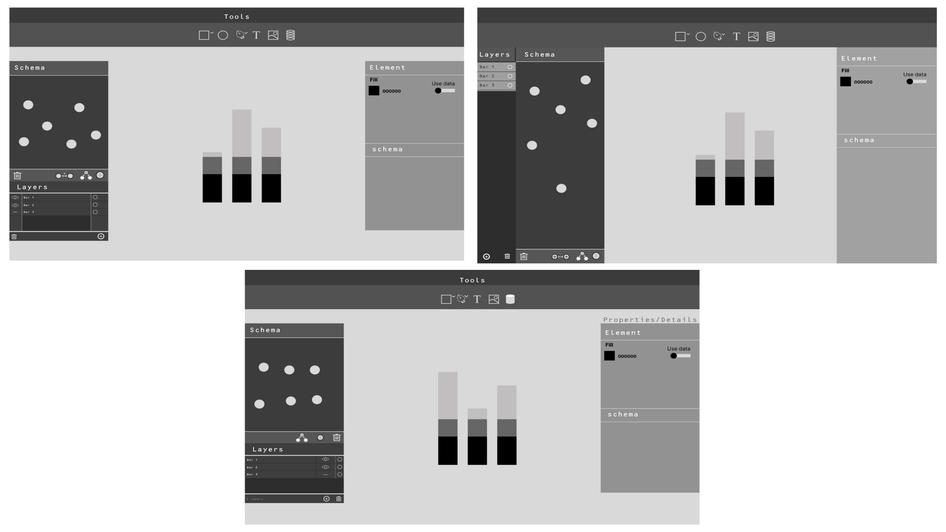
## 3 Sketching Low-Fidelity Ideas

The very first step in this project was sketching out ideas to quickly explore several different designs. We wanted to to determine what the ideal functionality of the interface would communicate and enable.




The focus was to allow users to quickly generate and iterate over ideas. Simultaneously we wanted to allow users to share and collaborate on their designs freely. All this kept in mind the possibility of the user being able to control the design of the schema and the elements independently in such a way that moving nodes would not necessarily directly affect the corresponding visual elements.

## 4 Prototyping and Refining to Higher Fidelity Ideas




Using Figma, we defined and organized the interface space and explored different ways to lay out our key components. The main focus with each version was to enable users to work and prototype faster, share ideas with less resistance while focusing simplicity.
Of the initial wireframe iterations, those selected possessed some of the following traits:

- Unrelated components were separated, while similar ones were grouped
- Tool bar was located at the top of the space, where it would be most readily accessible
- The space was split into the sides and the top, where the Sides are contextual and moving/changing while the top is unmoving, not context dependant

## 5 Building *Skeleton*’s Interface

We decided to build top of the open source library *tldraw for Skeleton*’s interface. *tldraw* is a library for creating infinite canvas experiences in *React*. The primary reason we decided on *tldraw* was due to the fact that as a web technology it can be accessed on the browser by anyone with internet.

## 6 Future Work

Looking forward, the next steps for this project would be to fully flesh out the remainder of our designs into *Skeleton*, test and improve our code output algorithm, and then involve visualization practitioners to evaluate the usability of our interface and approach. Lastly, we would want to also include users with disabilities in collaboration with designers and developers without disabilities, to get a better sense of how *Skeleton* can facilitate collaboration between a range of users with and without disabilites.

## 7 References

1. F. Elavsky, L. Nadolskis, and D. Moritz. Data navigator: An accessibility-centered data navigation toolkit. IEEE Transactions on Visualization and Computer Graphics, p. 1–11, 2023. doi: 10.1109/tvcg.2023.3327393

## 8 Acknowledgments

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