

Figure 1: One of three views of the visualization is an interactive map that displays districts and key structures of homelessness in Saint Paul, Minnesota alongside a narrative providing contextual information.

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# VISUALIZING HOMELESSNESS IN SAINT PAUL, MINNESOTA

Keywords: movement; bicycling behavior; quantified self (QS); cartographic interface; network flow map; urban planning

## 1. INTRODUCTION

In this paper we present a visualization of homelessness and housing data for Saint Paul, MN using mixed methods. This work is the culmination of a term project for the graduate level CSci-5609 Visualization course at the University of Minnesota. To explore data visualization in a real-world context with meaningful datasets and visibility, the instructor and students partnered in Spring 2019 with the City of Saint Paul's Office of Technology & Communications and the Bell Museum of Natural History.

The structure included onboarding meetings, checkpoints with feedback from stakeholders, and a final public showcase at the Bell Museum held at the end of the semester. A demo can be found at [4].

## 2. RESEARCH PURPOSE

We sought to create a data-driven visualization to present a narrative for the general urban resident that fuses personal experience with data to examine urban processes, scenarios, and issues concerning homelessness. Blending expository and exploratory elements with interactivity, our goal was for residents to learn about the state of their city and connect with the often hidden experiences of those who have fallen through the cracks.

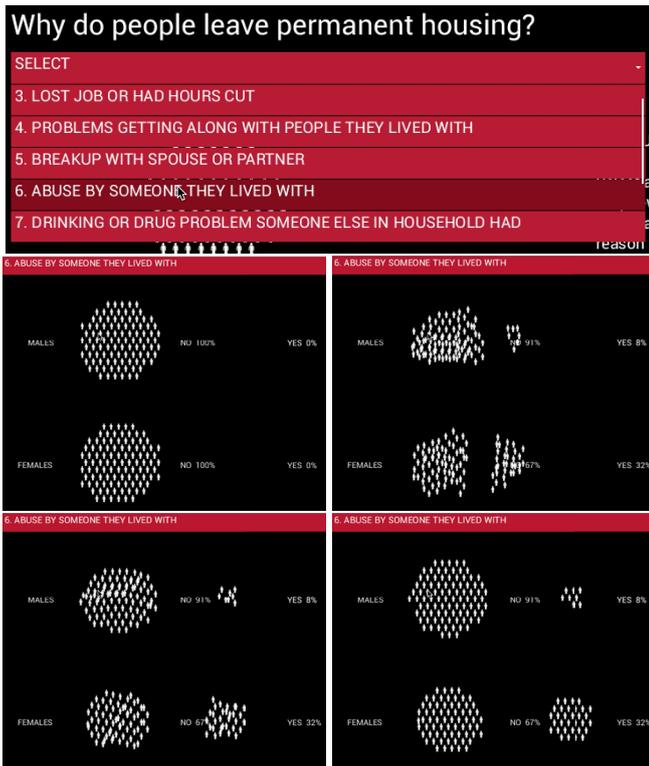


Figure 2: The user selects one response (top), and figures move from “no” to “yes” area to show the proportion of affirmative responses. Smooth motion produced by velocity easing. This example shows 8% of males and 32% of females selected “abuse by someone you lived with” as a reason for their current experience with homelessness.

In addition, we aimed to help residents become more engaged and informed when making their voices heard in local politics. We also hoped to learn how best to leverage collaboration with city officials and museum curators and administrators to enable the interdisciplinary co-creation of the visualization as well as provide guidance in facilitating public-facing interactive data representations.

### 3. BACKGROUND

Research on homelessness often lies embedded in data tables and lengthy reports, away from the eye of general resident. When found, this research can be difficult to connect with due to lack of interactivity and overbearing academic language. In St. Paul specifically, research on homelessness is compiled into a handful of reports [1, 9]-reports displayed separately from human-centered data, such as interviews and stories. Although data visualization has previously been used to depict homelessness data [3, 5], this work does not combine human-centered data, quantitative data, and interactivity into a holistic presentation.

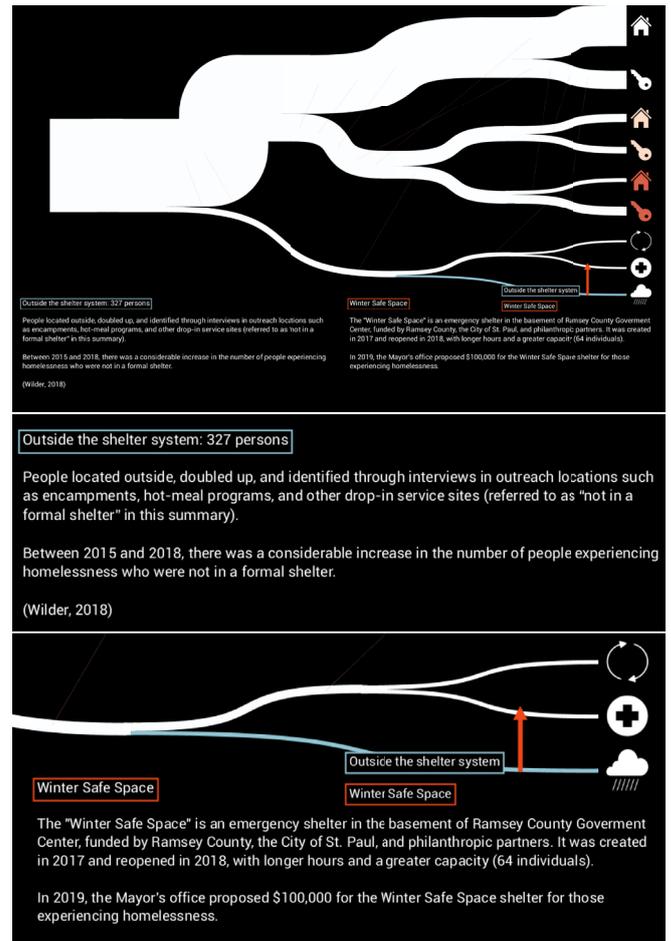


Figure 3: Ramsey County annotated population tree, with an example of user interaction (top). Mousing over the branches and arrows summons their labels, and clicking on each brings descriptive text into focus. Clicking a branch summons definitions about the population in the bottom-left, whereas clicking arrows fills the bottom-right with text about the intervention or trend. These texts are expanded in (middle) and (bottom), respectively.

### 4. DESIGN

In order to paint a more complete picture of this multifaceted issue, we organized the visualization as an integrated set of three data views, presented sequentially to users. We created three novel interactive views to examine homelessness and housing affordability as a paradigm to cultivate more informed city residents through a human-centered lens. We use interactivity in all the views to maintain the users attention and investment in tandem with narrative elements from human-centered data to create an empathetic connection, as displayed in the Figure 1 map. The three views are as follows,

- The user starts with a view of one result of the homelessness survey conducted by Wilder research [9]. In particular, we animate the responses to the question: “Why did you leave your last permanent residence?”.

Figure 2 shows human-shaped icons moving in response to user interaction, as if directly answering the user's questions. Testimonials gathered from news articles and the Shelter Interview Project [7] accompany the proportions to illustrate the experiences lived by the people who answered in the affirmative. The predominantly dark color scheme evokes the night, when public places close and housing problems manifest. The user directs the flow of information while the animation and human-centered data immediately engage them.

- The user next moves to a view of an interactive storytelling map to illustrate housing affordability and homelessness data spatially across neighborhoods using data from the American Community Survey [6], and public housing data from the St. Paul Public Housing Agency [8] (Figure 1). This was created using the Mapbox.js framework. The user steps through a narrative providing contextual information on rising rents, stagnant wages, and what it means to be classified as cost-burdened. This narrative is mirrored by a map displaying the locations of homeless shelters and public housing, and classifying neighborhoods based on income, rent, percent cost-burdened households, and percent in poverty. The user is prompted to find patterns on their own at the end of each narrative section, and is allowed to change what is displayed on the map at various points.

- Finally, the user faces an annotated population diagram (Figure 3). Divergences in the tree shape split the population of Ramsey County into increasingly specific groups, while the width of each branch gives the proportion of the population. Important definitions and research results from organizations like the Minnesota Housing Partnership [2] are available through user interaction. By clicking on the "cost-burdened" branch, for example, the user learns that households spending more than 30% of income on housing must make trade-offs between housing, health care, and education. The tree is annotated by arrows representing trends or policies that affect the connected populations. Details, such as the budget for the Saint Paul 4(d) Rent Incentive program, dynamically appear when the user clicks on the arrows. Figure 3 illustrates this flow for the Winter Safe Space shelter servicing people outside the shelter system.

## 5. ORIGINALITY

Our visualization goes beyond what is available in existing reports on homelessness in the city of Saint Paul. Moreover, this work also shows what is possible in a new model of instruction where a graduate-level computer science course was co-sponsored by both the city of Saint Paul and the Bell Museum of Natural History. This project spanned an entire semester, and serves as a testament to the possibilities of a mutually beneficial relationship between city governance or museum curators and the academic environment. There were multiple collaboration sessions throughout the semester, during which city stakeholders provided feedback that shaped the development of the project, including the encouragement of storytelling in the map and the inclusion of city budget elements in the intervention elements of the population diagram. With the feedback received by the city's data portal team and Bell Museum administrators, our work embodies a collaboration of graduate academics, stakeholders in the city's data presence, and experts in public-facing visual presentation.

## 6. PRACTICAL IMPLICATIONS

At the end of the semester, this work was presented at the Bell Museums "Saturday with a Scientist" program, where the public engaged with these visualizations. The language in our three views allowed engagement across a variety of age groups and educational backgrounds. The interactive map in particular allowed Saint Paul residents to view a narrative alongside neighborhood-specific information to see how many of their neighbors are cost-burdened on average and if homeless shelters or public housing structures are nearby, showing the success of the blend of expository and exploratory elements.

## 7. IMPACT

Visualizing homelessness and housing affordability in an interactive fashion via storytelling and integration of human-centered data enabled us to facilitate learning and exploration for the average urban resident. We also showcased the interdisciplinary collaboration between academic, municipal government, and museological institutions. We believe future work concerning how to visualize policy proposals around housing affordability and how to engage children through visualization of homelessness could add to residents' interests in the topic. Additionally, further study could explore housing for marginalized



populations, including black people, indigenous people, and LGBTQ+ youth.

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