

# Design patterns and trade-offs in responsive visualization for communication

## Supplementary Material - Survey of Practitioners

### 1 Methods

We recruited a convenience sample of 19 responsive visualization authors with an average of 5 years of experience with visualization authoring. From the contact information the participants provided, there were four practitioners, three journalists, and six researchers (not every participant provided their contact). We surveyed the participants via Google Forms and attached the screenshots of the actual questionnaire page in Section 3.

We asked

- whether they start with designing desktop views or mobile views,
- frequency of design process that explicitly considers mobile views,
- rank of seven possible design guidelines for responsive visualization (in 7-point scale), and
- two qualitative questions regarding “rule of thumbs” and difficulties in responsive visualization.

### 2 Results

#### 2.1 Design Process

As illustrated in Table 1, more than half of the authors (11, 58%) responded that they start designing the desktop view and then move on to the mobile version.

Table 1: Directions for responsive visualization design process. Responses in “” are suggested by participants.

Process	Responses
<b>Desktop first</b>	11 (58 %)
- After designing the desktop version, I (or my team) start on the mobile version.	11
<b>Both</b>	5 (26 %)
- I (or my team) design the desktop and mobile versions at the same time.	4
- ‘Drawing the basic visualization on paper and then trying it on both the devices’	1
<b>Mobile first</b>	3 (16 %)
- After designing the mobile version, I (or my team) start on the desktop version.	2
- ‘Optimized for mobile versions (Because of tight deadlines)’	1

13 authors responded that they consider mobile views at least half of the time, and eight authors among them consider more than half of the time (Table. 2).

Table 2: Frequency of considering mobile views.

Frequency	Responses
10% or less of the time	2 (11%)
More than 10%, but less than half of the time	4 (21%)
About half of the time	5 (26%)
More than half of the time, but less than 90% of the time.	3 (16%)
90% or more of the time.	5 (26%)

## 2.2 Rank of guidelines

In general, maintaining takeaways and information and adjusting interactivity were ranked high.

Table 3: Average rank indicating perceived importance (out of 7) for seven possible guidelines.

Guideline	Avg. Rank
Maintaining the main “takeaways” or message.	2.12
Maintaining the same information across versions.	3.42
Changing design to acknowledge greater difficulty users face interacting on a SS (e.g., reducing interactivity)	3.42
Maintaining the “information density” (i.e., the amount of information conveyed relative to the screen size)	4.32
Changing design to acknowledge attention limits in mobile context (e.g., reducing information)	4.53
Changing design to acknowledge other technical constraints (e.g., computing power)	4.53
Maintaining aspect ratio across versions.	5.68

## 2.3 Qualitative responses

We open coded qualitative responses in terms of whether they mentioned information density problems. 10 participants appeared to negotiate maintaining message and adjusting information density. We attached relevant responses.

- The simpler, the better (P4)
- Maximize screen space. Not accidentally creating graphics/tables/etc. where the user has to scroll forever to get to the next section. (P6)
- Try to keep everything on a single screen if possible so that people don’t miss something, or have to scroll up and down. (P7)
- (Use) single column layouts. (P11)
- Maximize main view, hide secondary views with toggles. (P14)
- Step by step information reveal rather than showing everything at once. (P15)
- Help users stay ‘oriented’ within the narrative of the visualizations, because only a fraction of the storyline is visible on mobile compared with large-screen format. (P16)
- Readability. (P17)
- Creating a similar experience without overwhelming the user. (P18)
- Many things work better when rotated 90 degrees, e.g., vertical timelines on mobile instead of horizontal. Little screen space and low touch precision. (P19)

Below, we listed the entire response of two qualitative items.

### **What other design guidelines or “rules of thumb” do you use in deciding how to design the small screen version of a visualization?**

- (P1) Limit interactivity because accidental touches that change experience can ruin the viewing experience.
- (P2) Viz should convey the main message without any interaction. Interaction conveys extra/deeper info.
- (P3) zoomable
- (P4) the simpler the better
- (P5) I’ll sometimes consider a points per pixel and make changes to the layout based on the amount of size I have. I’ll also sometimes add or remove affordances depending on the size (e.g. if on a smaller screen remove some tap interactions because you are more likely to hit them).
- (P6) Maximize screen space (Don’t be afraid to turn maps on their “side.” North is a social construct), reduce tooltips (or make them stick to bottom of screen), make sure anything that’s “touchable” isn’t tiny
- (P7) Try to keep everything on a single screen if possible so that people don’t miss something, or have to scroll up and down.

- (P8) variable font size, horizontal scroll bar on mobile devices
- (P9) Maintain a consistent appearance (sometimes) across different resolutions and devices
- (P10) -
- (P11) Single Column layouts, Reduce to the max
- (P12) Top load critical info needed for understanding, so the reader doesn't need to scroll down and then back up to read, for example, axis labels.
- (P13) Less pointer accuracy
- (P14) Maximize main view, hide secondary views with toggles.
- (P15) Step by step information reveal rather than showing everything at once. Layering the information so that short attention users can see the gist and explorers can dig into the details.
- (P16) Note that my app development work is primarily for research projects, and I have spent only a few months converting research-oriented dataviz into 'consumer' apps. Given that caveat, I included my email below in case of follow-up (also because I am interested in following your research), not for lottery. For small screen development, I have had to pay much more attention to how to help users stay 'oriented' within the narrative of the visualizations, because only a fraction of the storyline is visible on mobile compared with large-screen format. So, I have experimented with ways to repeat, summarize, and connect 'messages' across dataviz screens.
- (P17) readability
- (P18) Visual consistency
- (P19) Many things work better when rotated 90 degrees, e.g. vertical timelines on mobile instead of horizontal

**What are the most difficult aspects of creating mobile versions of visualizations?**

- (P1) Tooltips. Engineering them to work on both mobile and desktop screen sizes is difficult for me, an intermediate coder at best.
- (P2) Size constraints. Since data viz involves comparison, less space limits the information that can be onscreen at one time for comparison.
- (P3) Aspect, sides, make it zoomable
- (P4) legibility and range of devices
- (P5) Emulating the actual experience of developing for a small device from a computer. While browser dev tools do a lot of work to help smooth the iteration cycle, it only gives glimpses of the experience of looking at it on mobile.
- (P6) Providing the same information while limiting interaction. Not accidentally creating graphics/tables/etc where the user has to scroll forever to get to the next section.
- (P7) Testing. Lot's of different devices and browsers and screen sizes. Difficult to test for everyone.
- (P8) double work if creating mobile specific vis
- (P9) It's often a lot of effort
- (P10) Variety of devices and standards, lack of hover interaction, fat thumb
- (P11) Space, Zooming/ Panning, Tooltips
- (P12) Being unable to rely on reader making immediate cross comparisons between all visual elements
- (P13) Accessibility and text editing
- (P14) Different devices.
- (P15) Screen and UI optimization and dealing with fat finger problems when allowing users to explore the visualizations.

- (P16) The 'guideline' I mentioned above leads to problems of balancing repetitiveness, density of text, inconsistency of visual representation, and oversimplification of the 'messages' that might cause users to feel disoriented and confused. I also am challenged by users' expectations of increased, not decreased, interactivity on mobile, because many have expected a more tactile relationship with consumer mobile apps.
- (P17) It is not easy to omit information to reduce complexity (It may makes difficult to communicate the context.)
- (P18) Creating a similar experience without overwhelming the user: Keeping a similar level of functionality and visual representation.
- (P19) Little screen space and low touch precision

### 3 Actual Questionnaire

## Survey for Mobile Visualization Authors

Hello! The goal of this short survey is to develop a better understanding of design practices around mobile visualizations. Thank you for your participation.

This survey is being conducted by [REDACTED]  
[REDACTED] Contact us if you have any questions.

Eligibility: You are eligible for this survey if you have created at least one visualization intended for both large screen (e.g., desktop) and small screen (e.g., mobile) displays.

Lottery: For every 20 participants we will randomly select one person to receive a \$25 Amazon gift card.

\* Required

Choose the option below that best describes your typical design process for creating a visualization for multiple devices. \*

- After designing the desktop version, I (or my team) start on the mobile version.
- I (or my team) design the desktop and mobile versions at the same time.
- After designing the mobile version, I (or my team) start on the desktop version.
- Other: \_\_\_\_\_

When creating visualizations, how often would you say your design process involves explicitly considering mobile views? \*

- 10% or less of the time
- More than 10%, but less than half of the time
- About half of the time
- More than half of the time, but less than 90% of the time.
- 90% or more of the time

Rank the importance of the following design guidelines in your typical process for designing the small screen version of a visualization. Assign each rank only once (one per column). Rank 1 means most important, Rank 7 means least important. \*

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7
Maintaining the same information across versions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintaining aspect ratio across versions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Maintaining the main "takeaways" or message

      

Maintaining the "information density" (i.e., the amount of information conveyed relative to the screen size)

      

Changing design to acknowledge greater difficulty users face interacting on a small screen (e.g., reducing interactivity)

      

Changing design to acknowledge attention limits in mobile context (e.g., reducing information)

      

Changing design to acknowledge other technical constraints (e.g., computing power)

What other design guidelines or "rules of thumb" do you use in deciding how to design the small screen version of a visualization? \*

Your answer \_\_\_\_\_

What are the most difficult aspects of creating mobile versions of visualizations? \*

Your answer \_\_\_\_\_

How many years have you been creating both mobile and desktop versions of visualizations? \*

Your answer \_\_\_\_\_