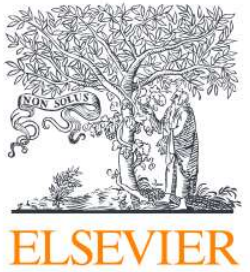
HIGHCHARTS



Accessible Visualizations: Maps, Annotations, and Sparklines

CSUN 2020

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Overview

- **About Highcharts and Elsevier**
- **The Evolution of Highcarts Accessibility Features**
- **Our new concepts and user feedback study**
- **Annotations**
- **Spark lines**
- **Geomaps**
- **Future Direction**

Highcharts is a tool for developers to easily visualize data on the web or in mobile apps, used by over 80% of the top Fortune 100 companies.

Elsevier is a global information analytics business specializing in science and health

Our Mission

Lead the way in advancing science, technology and health

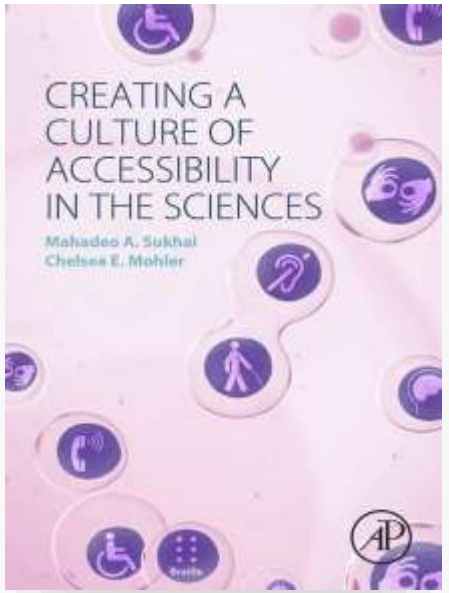
Largest publisher of books and journals in Science

Prolific publisher in disability research and accessibility

81% of revenue from digital products

17% of global research output in Elsevier journals

430K peer-reviewed research articles



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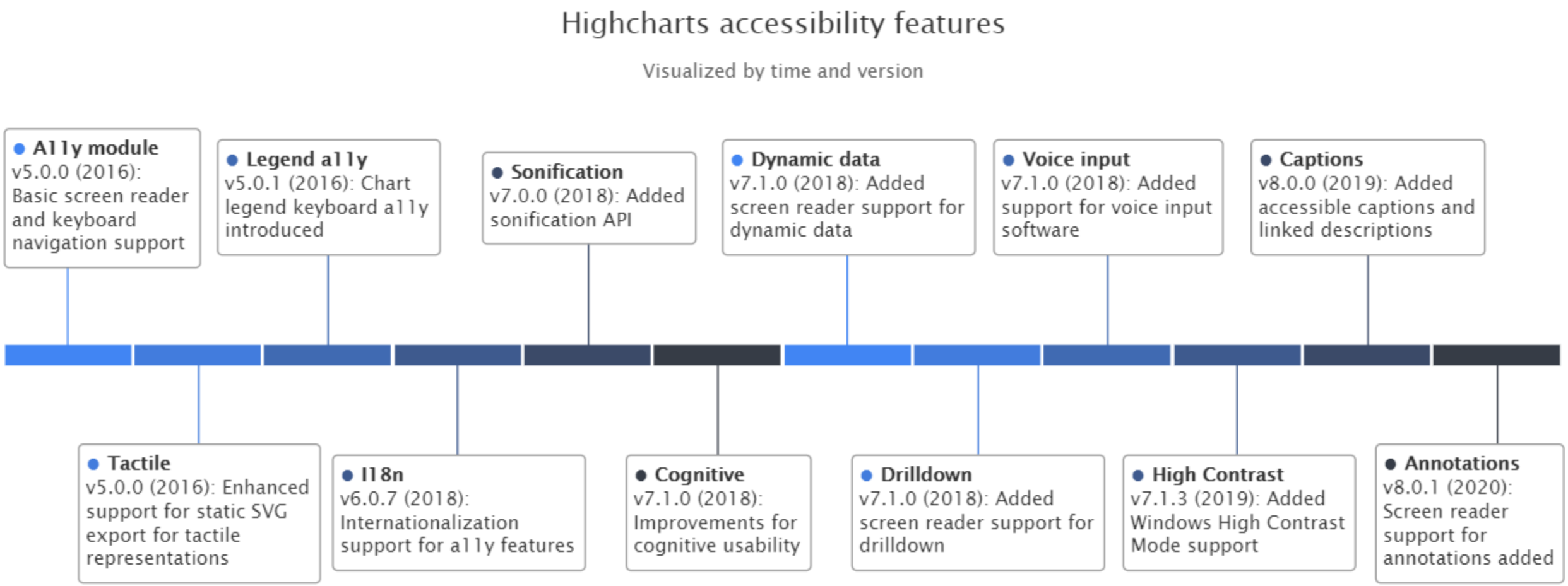
Highcharts Accessibility Features Over Time



https://jsfiddle.net/oysteinmoseng/6vbwdtn1/show

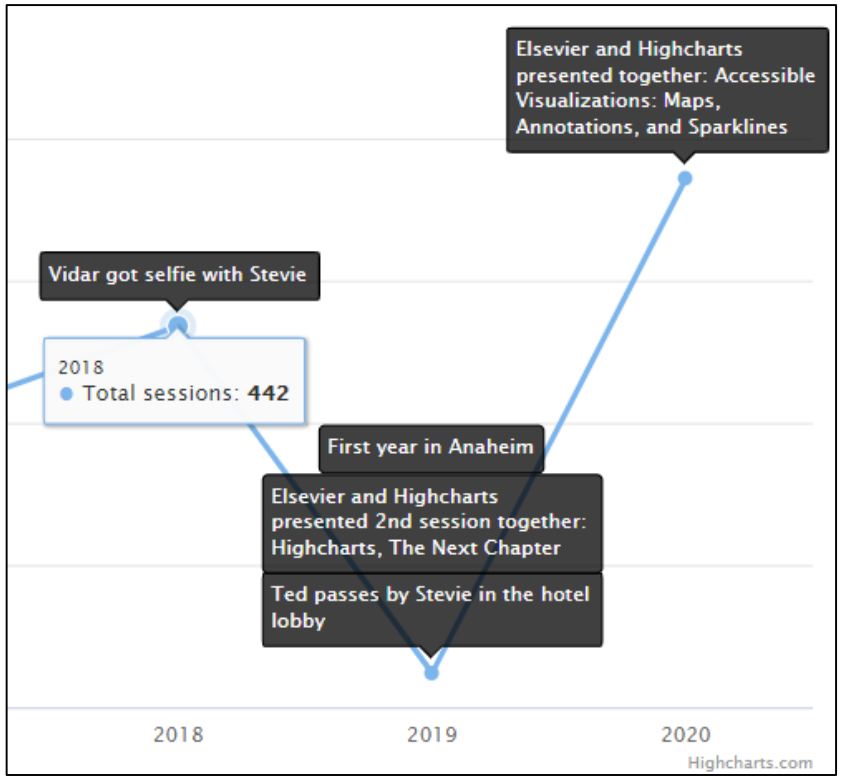
Elsevier Products Using the Highcharts Accessibility Module

	CHART USE CASE	USER BASE
Reaxys	Depict drug Likeness – E.g. radar chart to show Lipinski's rule of 5 or Pfizer's rule of 5.	Chemists, Scientists
Scopus	Largest abstract DB of peer-reviewed literature. Depict researcher citations per year with column chart.	Researchers, Scientists, Clinicians, Librarians
 SciVal	Visualizing research performance against peer institutions, helping find partnerships, identify research trends.	College Administrators, Head researchers, Deans
 Engineering Village	Visualizing research performance against peer institutions, helping find partnerships, identify research trends.	Engineers, Researchers

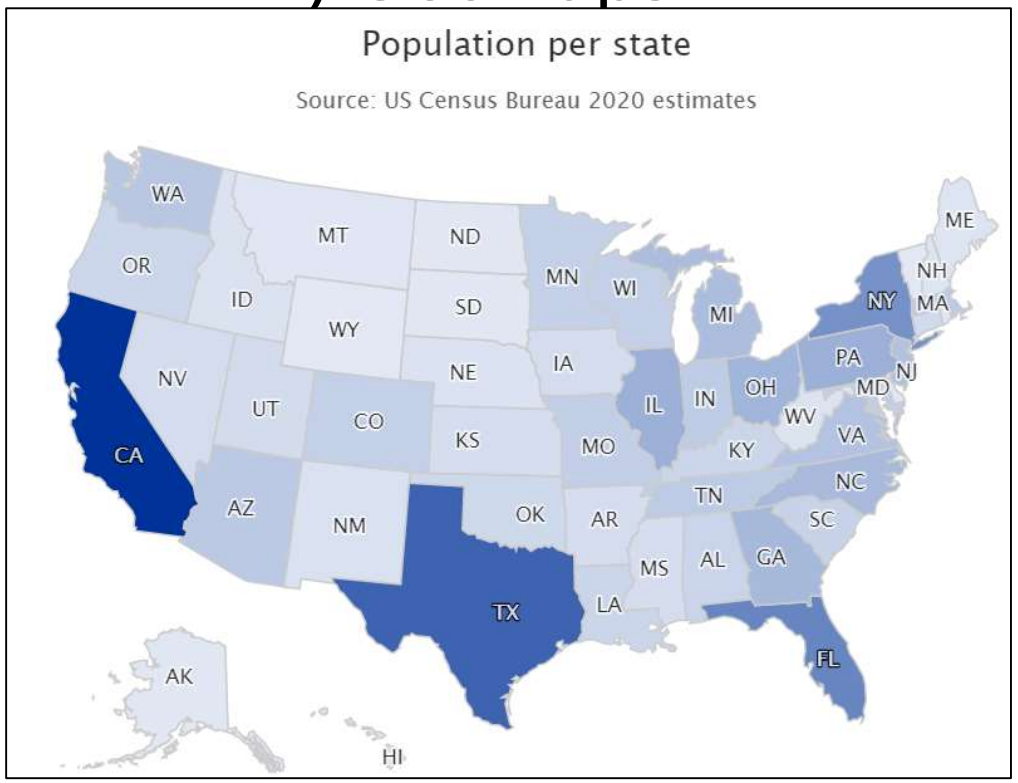
Poll: What is the best way to experience accessible visualizations on the Web?

a) **I’ve never experienced an accessible visualization**
b) **A Table**
c) **Have a sighted person explain it to me real time**
d) **Human created text description**
e) **AI generated description**
f) **Tactile Display**
g) **Sonification**

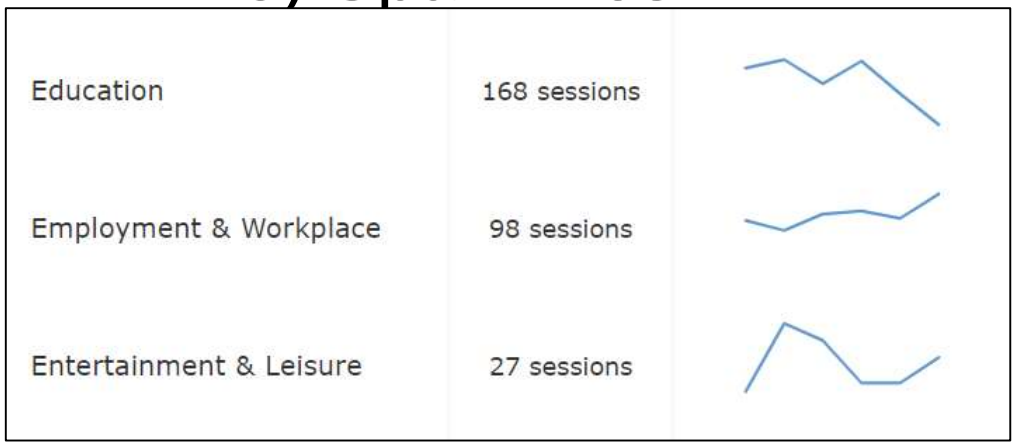
1) Annotations



2) Geomaps



3) Sparklines



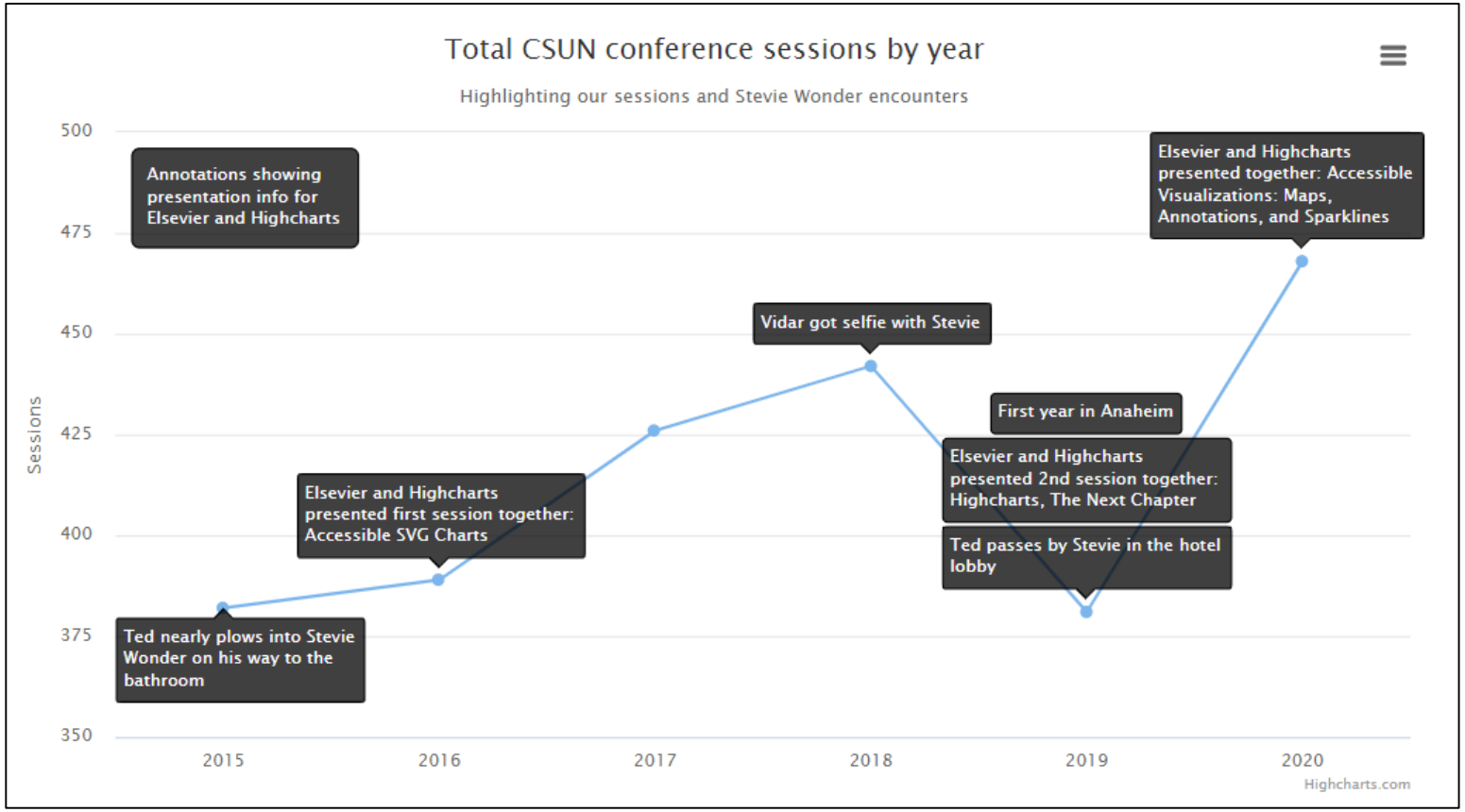
Approach

We user tested 3 functional prototypes showcasing new accessibility features of Highcharts and Highmaps. The goal of the testing was to collect feedback on the prototypes, and identify both the validity of the approaches, as well as potential usability improvements. Revised prototypes based upon user feedback.

User tester	Screen reader	Role	Browser	Other AT
1	NVDA (not latest)	Accessibility Specialist	Firefox	
2	JAWS 2020	Librarian	Chrome	OS zoom 125-150%
3	NVDA	Forensic Scientist	Firefox	
4	JAWS	Accessibility Specialist	Edge chromium	
5	JAWS 2020	Chemist	Chrome	
6	JAWS 2020/NVDA	Accessibility Specialist	Firefox	Braille display

Annotations

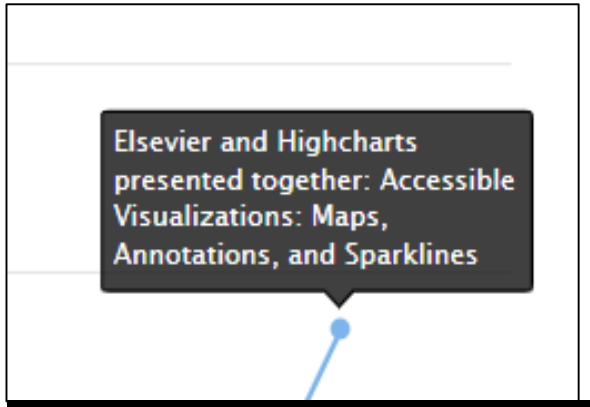
- Allows chart creators to place labels at various points of interest.
- Use cases: Provide context to a specific phenomenon, e.g. the year of a stock market crash.
- Design Considerations/Things to listen for



Annotations User Feedback

- Overall users understood our approach to labelling annotations with “annotation” and understood the in context annotation with the data points.
- Unconnected annotations should be labelled just as that.
- Mixed reaction on whether or not the separate annotations was needed, at least collapse and give a proper heading.
- Some found it confusing and redundant to repeat annotations separate from the chart itself.

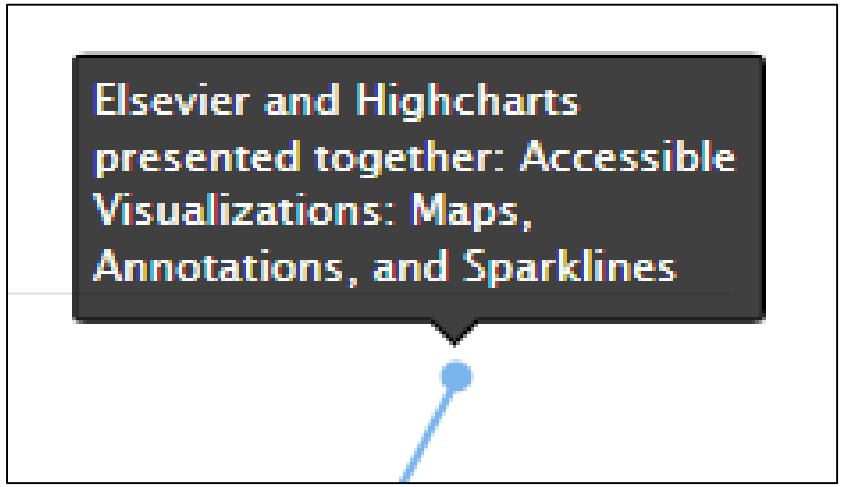
User Test Ratings. 1 = worst, 5 = best	
Understandable	Usable
4.4	4.6



aria-label="6. 2020, 468. Annotation: Elsevier and Highcharts presented together: Accessible Visualizations: Maps, Annotations, and Sparklines. "

Annotations Wider Insights

- Annotation data is crucial to make accessible and integrated into the main chart itself.
- Find the balance between helpful and descriptive versus overly verbose (it's an art!).
- People like that no special commands are needed to navigate the UI with a screen reader.



"Highcharts is one of the first super-accessible interactive charts, so things like annotations might be new concepts to screen reader users".

Sparklines

- A sparkline is a small intense, simple, word-sized graphic with typographic resolution. Sparklines mean that graphics are no longer cartoonish special occasions with captions and boxes, but rather sparkline graphics can be everywhere a word or number can be: embedded in a sentence, table, headline, map, spreadsheet, graphic. Data graphics should have the resolution of typography. -**Ed Tufte**

Cases:

- Condensing table data into digestible visuals
- Comparison! Dashboards of stock prices, researcher citation performance, voting turnout over time between states.

Sparklines User Feedback

- Overall sparklines were unfamiliar, all users responded well to the *stripped down line series* design.
- Data point values should definitely be available to AT even though sparkline design deemphasizes data points over trends.
- “Increased overall” leaves out important information about peaks and valleys in trends.
- The table grid of sparklines worked very well for some users, the structure of the page needed some explanation.
- Heading navigation worked very well to navigate between sparklines.
- Some users really liked the sonification, while others thought they needed training or didn’t get it.

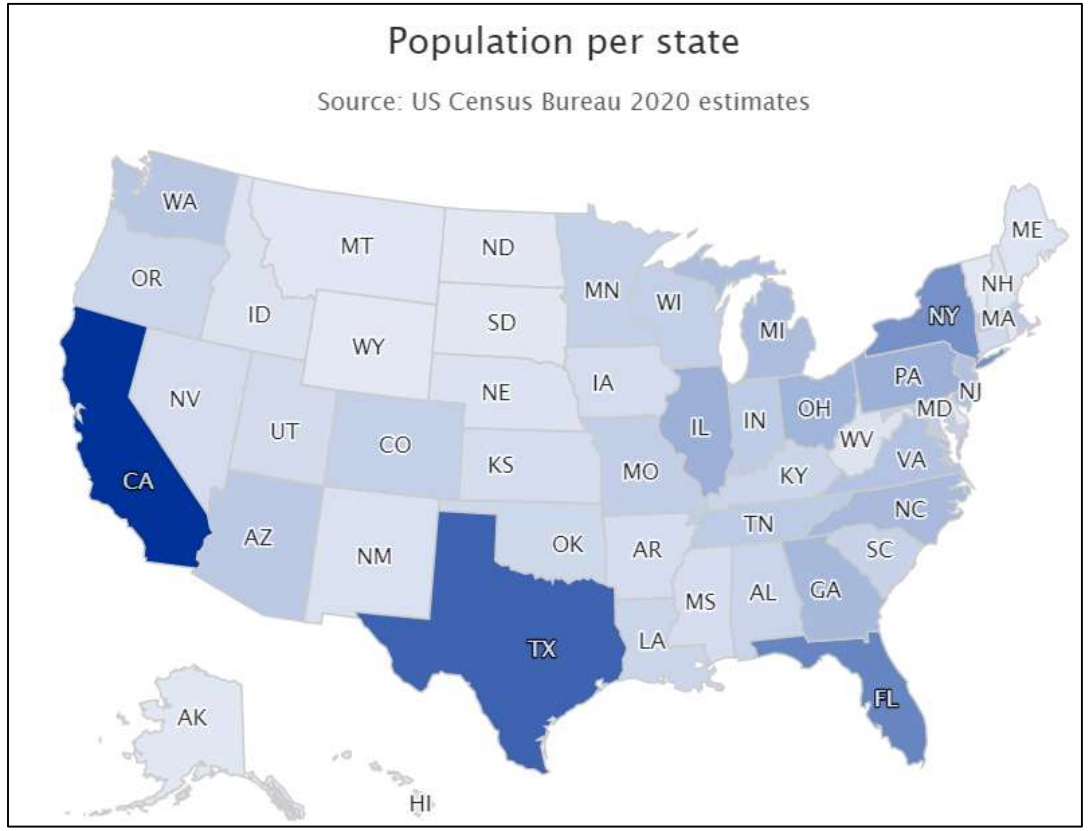
User Test Ratings. 1 = worst, 5 = best	
Understandable	Usable
4.2	4.2

Sparklines Wider Insights

- Automated detailed chart descriptions are highly valued by end users.
- Long descriptions of data and trends can be cognitively taxing, there must be better ways to do this with tactile or embossed versions, sonification, or other means.
- Further develop natural language approach to describe shape of data, surface peaks/valleys, average increase/decrease.
- Users differentiate between an accessible Highchart and an accessible table version of data.
- Users like Highcharts labeling data points an understandable way compared to a table version referring to multiple row and column headers. Table versions also require table to be marked up correctly and knowledge of table reading commands.

Geo Maps

- Extends Highcarts to allow building interactive maps to display sales, election results, or any other information linked to Geography.
- Use Cases: Voting results, population, animal habitats, location of research centers, states that have legalized marijuana (Highmaps).



Geo Maps User Feedback

- Users were generally able to navigate the map fine and even query by filtering or through virtual find.
- Table version would suffice for simple maps, e.g. State Name and Population Number.
- Was essentially regarded as a “list” and not a “map”.
- Do we need to index the order number of the states?
- Do not rely on color alone! Dark blue conveys meaning to visual users (e.g. higher populated state). Provide Non visual users with a relative measure of value as an equivalent.

Geo Map User Test Ratings. 1 = worst, 5 = best	
Understandable	Usable
3.8	3.7

Geo Maps Wider Insights

- People who are blind still think of maps spatially and in 2 dimensions.
- It is difficult to convey a 2 dimensional phenomenon in a 1 dimensional user experience.
- Tactile versions do provide 2 (or 3 dimensions) are much sought after.
- Users wanted a more sophisticated way than an alphabetized list to navigate the map, e.g. 4 way arrow navigation (West, East, North South), using Home key to go to Arizona, navigate by regions/landmarks.
- We’ve kept it simple with the first population map user feedback. There is much more to maps:
  - Spatial relationships between states
  - Regional trends
  - Shapes of regions
  - How to best sort data? (alphabetical, by quantity, by region, etc.)

User Test Participant Average Ratings (n=6)

Annotations (highest rated)	
Understandable	Usable
4.42	4.60
Sparklines (most liked overall)	
Understandable	Usable
4.20	4.17
Geo Map	
Understandable	Usable
3.80	3.67

1 = worst score 5 = best score

Verbosity User Ratings		
Annotations	Sparklines	Geo maps
3.92 (worst)	3.42	3.40 (best)

5/6 rated Geo maps at perfect level of verbosity

Future

- We are continually improving Highcharts and support of AT and disability personas.
- Collaboration with other companies and research groups is key to our future direction.
- Several new concepts to explore.
- Higher fidelity automated descriptions.
- Tell us what we should be working on!

Links and Resources

- Highcharts accessibility samples
- Highcharts accessibility module
- Highcharts in Engineering Village
- Sonification API
- Highcharts Dynamic Data
- Highcharts Features History

Previous Elsevier CSUN Talks

- VPATs for Business or Measure
- Accessible SVG charts using ARIA
- Elsevier: Article of the future collaboration
- Accessibility for Large Publishers: Challenges, Choices, Change
- Alt Text – A Process of Discovery
- Don’t Play Me – 2 Games in Web Accessibility
- Elsevier Company Accessibility Policy

Today’s Demos

- Annotations
- Spark Lines
- Geo Maps

Contact Us!

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