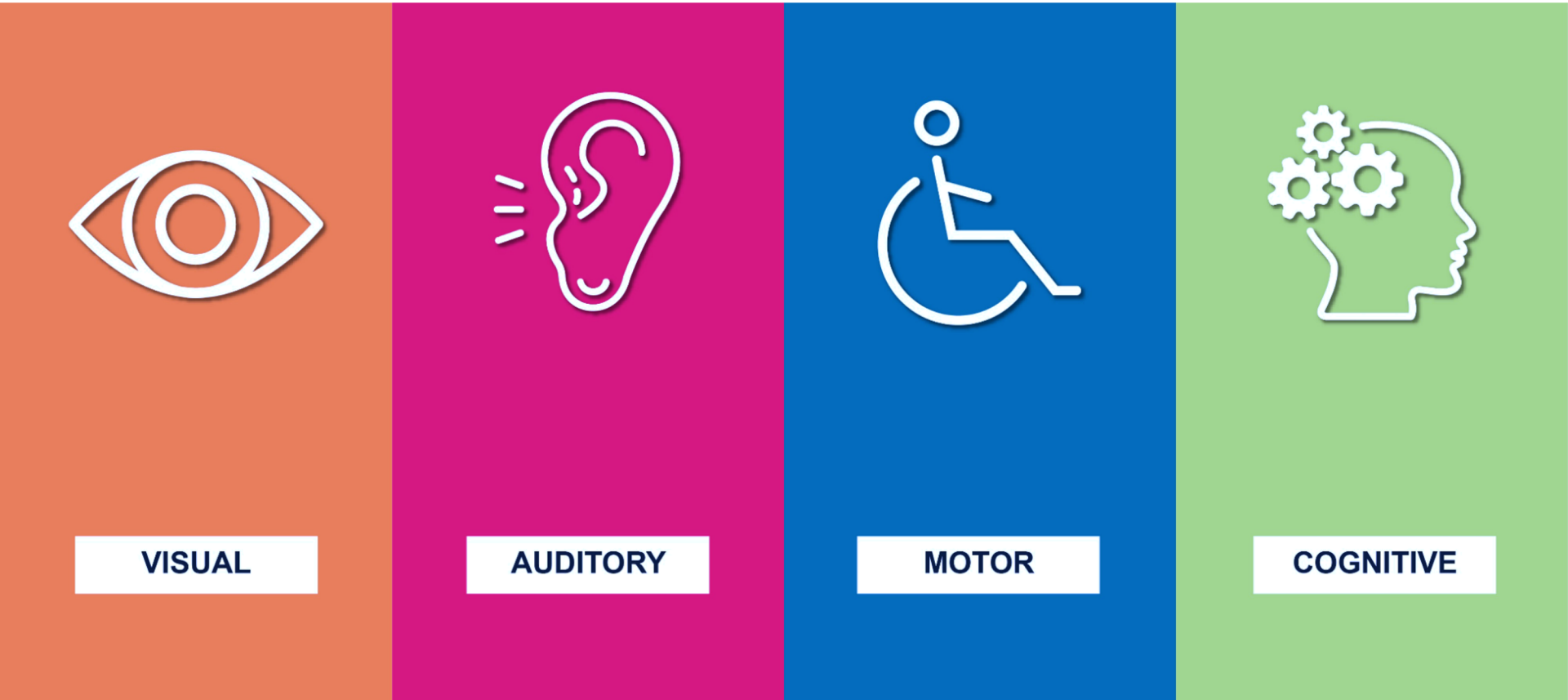
Understanding Data Accessibility for People with Intellectual and Developmental Disabilities (IDD)

Keke Wu, Emma Petersen, Tahmina Ahmad,
David Burlinson, Emily Shea Tanis, Danielle Albers Szafir

Accessibility

Disability

Accessibility by Disability



Data Visualization Accessibility

most researched

VISUAL

AUDITORY

MOTOR

COGNITIVE

Data Visualization Accessibility

most researched

VISUAL

AUDITORY

MOTOR

largest population

COGNITIVE

Data Visualization

Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an **accessible** way to **see** and **understand** trends, outliers, and patterns in **data**.

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TL;DR

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TL;DR

#1 Visualization is a cognitive tool.

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TL;DR

#1 Visualization is a cognitive tool.

#2 Using visualization requires a good mastery of numeracy, graphicacy, and data & vis literacy.

Data Visualization

Data visualization is the graphical representation of information and data using visual elements like charts, graphs, and maps. Data visualization tools provide an accessible way to **see** and **understand** trends, outliers, and patterns in **data**.

Visualize the invisible!

Understanding Data Accessibility for People with Intellectual and Developmental Disabilities (IDD)

1,000,000,000

15 % of the population

1 in 6 children in the US

What is IDD?

Related to Thought Process

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Intellectual Functioning (e.g., reasoning, learning, problem-solving)

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Adaptive Behavior (e.g., social & practical skills)

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People with IDD

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Intellectual Functioning (e.g., reasoning, learning, problem-solving)

Adaptive Behavior (e.g., social & practical skills)

People with IDD

Struggle with abstract thinking, spatial reasoning

What is IDD?

Related to Thought Process

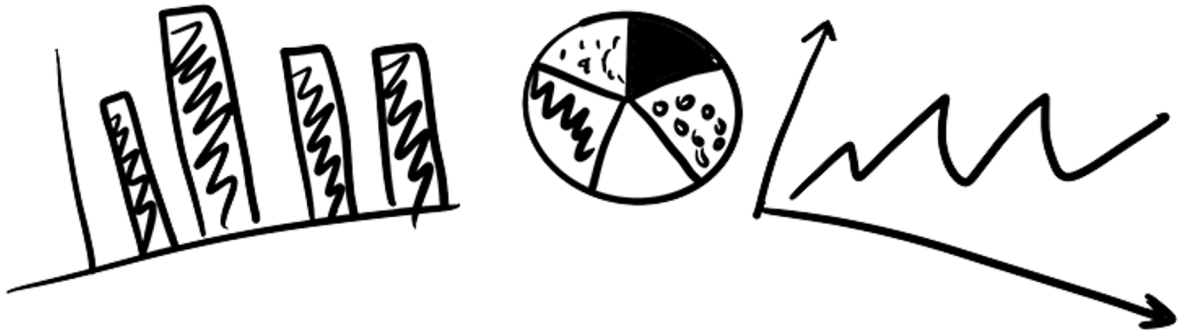
Intellectual Functioning (e.g., reasoning, learning, problem-solving)

Adaptive Behavior (e.g., social & practical skills)

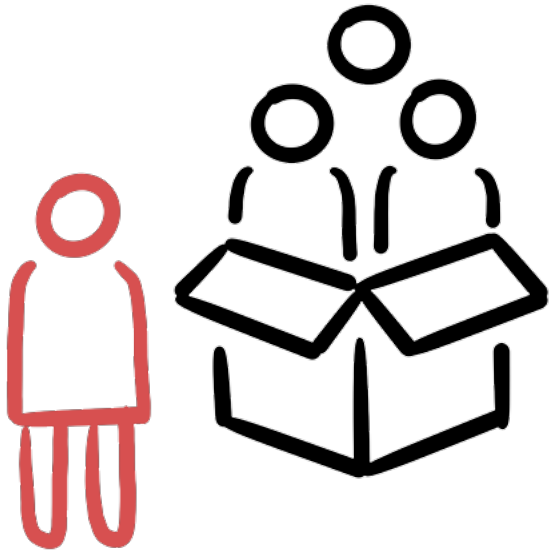
People with IDD

Struggle with abstract thinking, spatial reasoning

Have limited exposure to mathematical & statistical training



People with IDD been Excluded from
Data Visualization



People with IDD been Excluded from Data Visualization

Access to data is...

Access to data is...

A basic human right

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The prerequisite for decision-making
& independent living

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The key to social participation & self-advocacy

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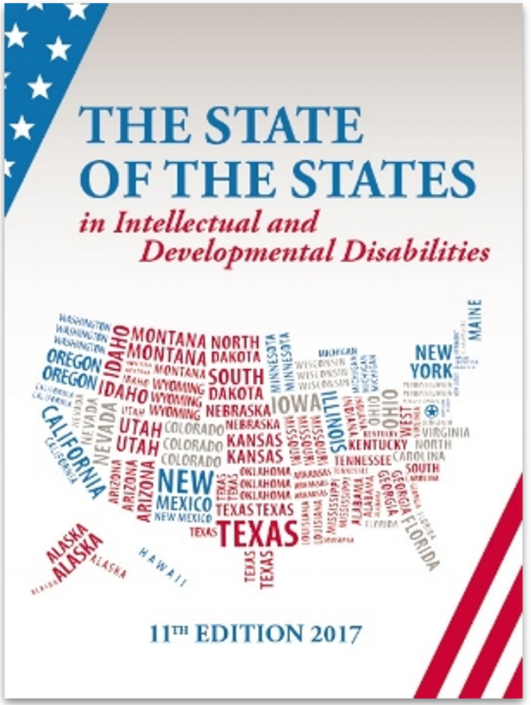

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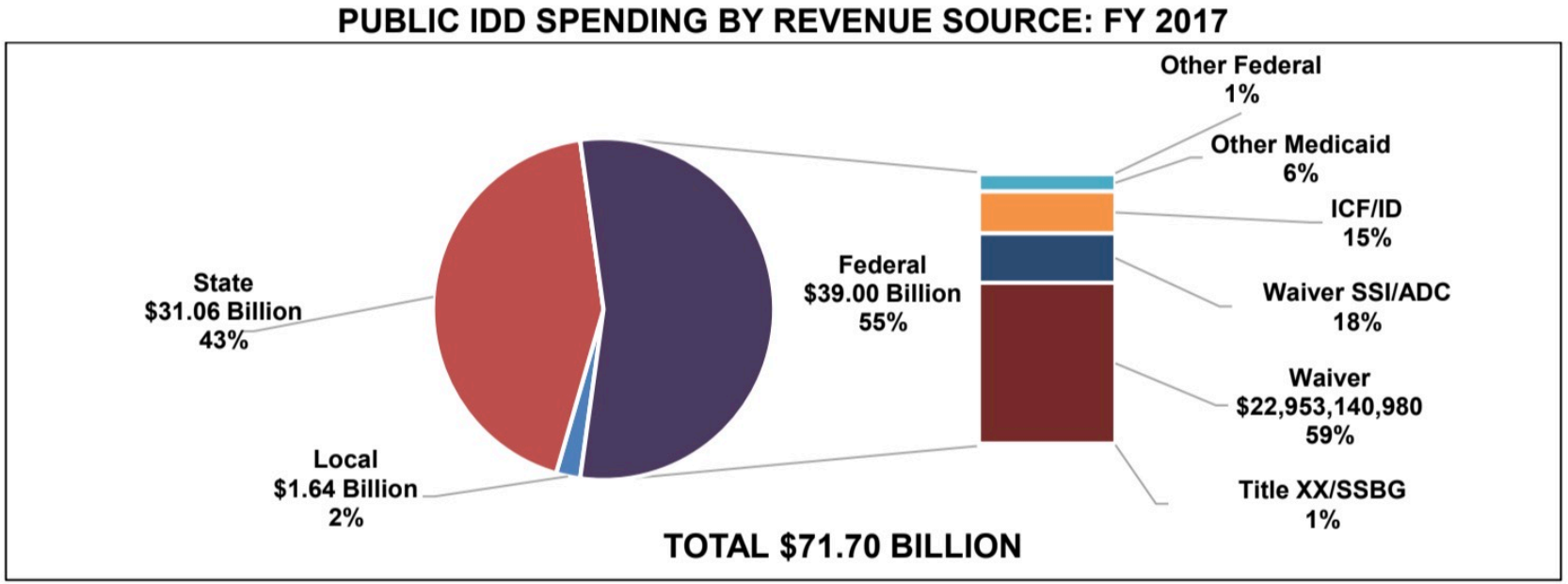
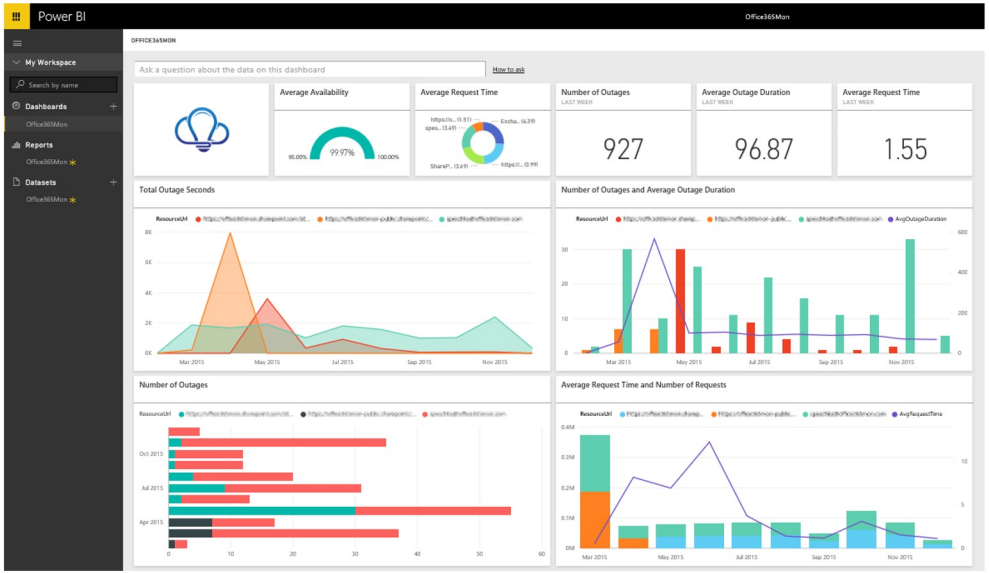
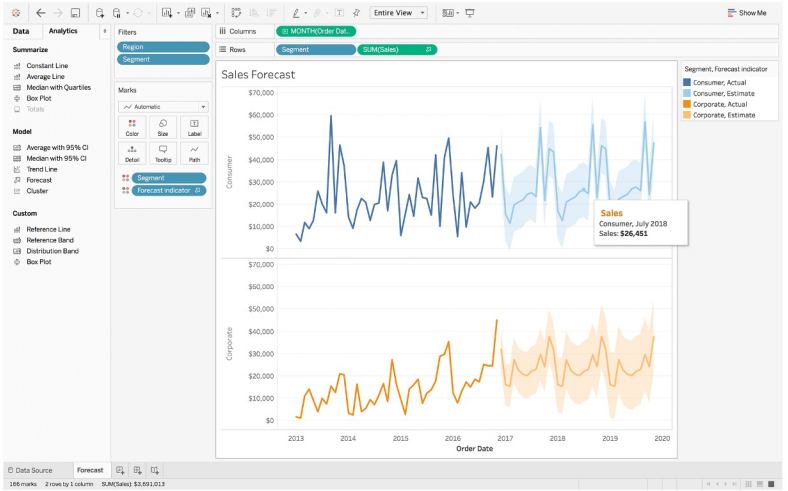
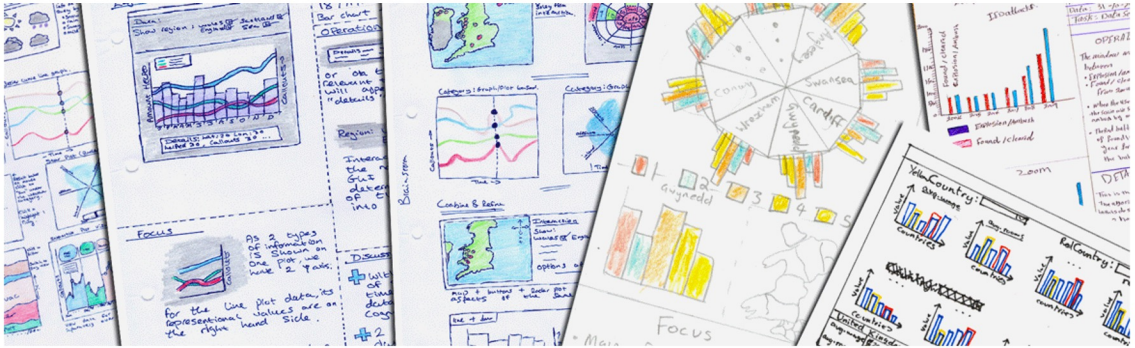


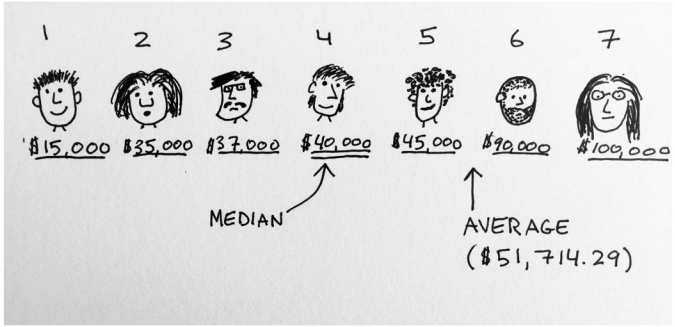
Tableau / Power BI



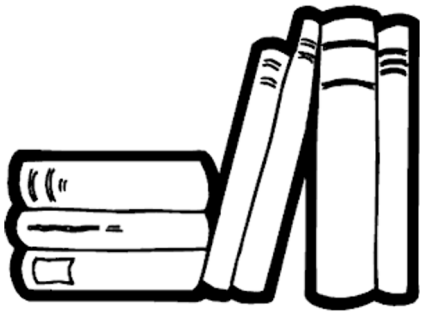


Paper-based Sketch

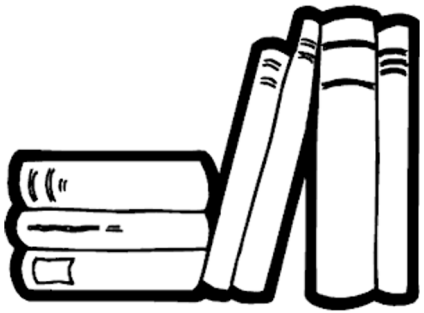




How do People with Intellectual and Developmental Disabilities Interpret Data Differently?



Literature Review



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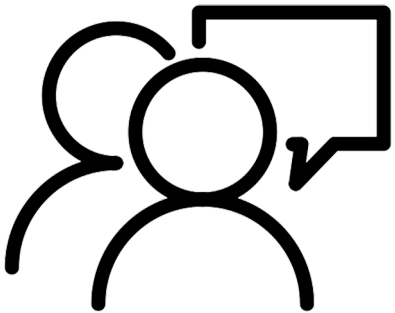

Informal Interview

Three Hypotheses

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H1: The best chart type for a given task will differ between people with and without IDD

DataVis 101: Mapping Data to Chart Types for Best Task Performances

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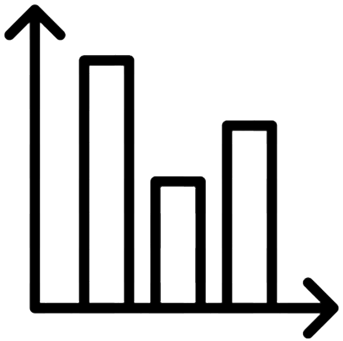

data across categories

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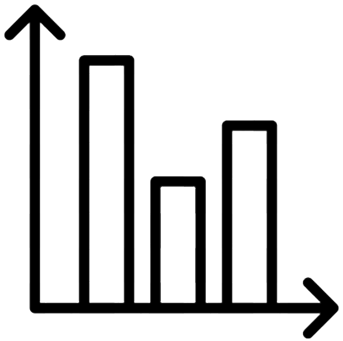

data across categories

change over time

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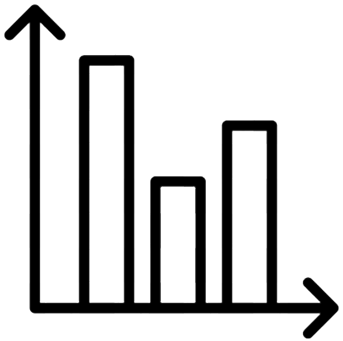

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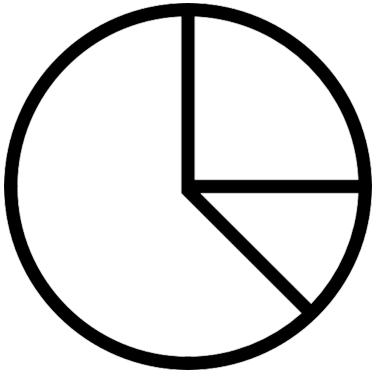
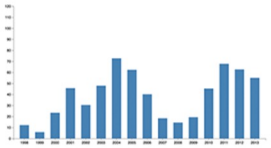
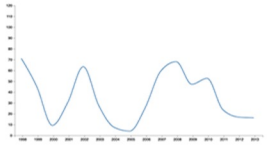


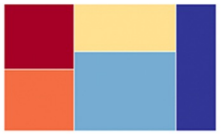
part-to-whole

Three Hypotheses

Chart Type







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H1: The best chart type for a given task will differ between people with and without IDD

H2: Discrete data representations will lead to more accurate performance for people with IDD

DataVis 101: Isotype Visualization May Benefit Working Memory

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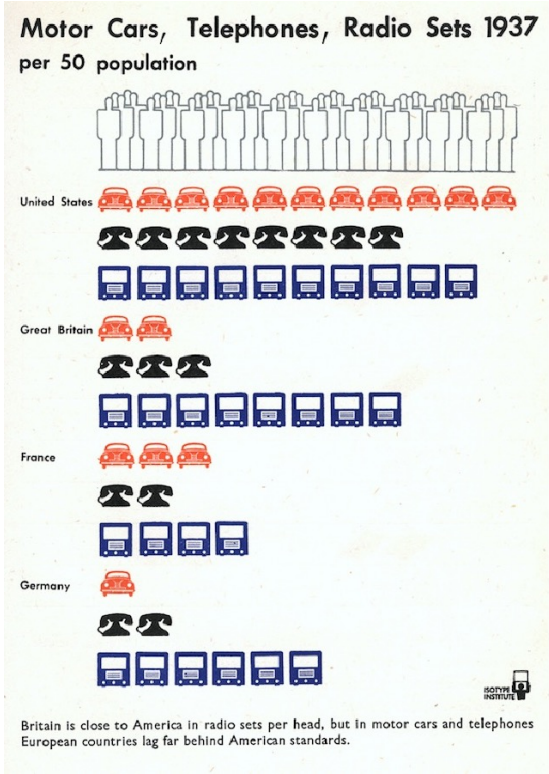

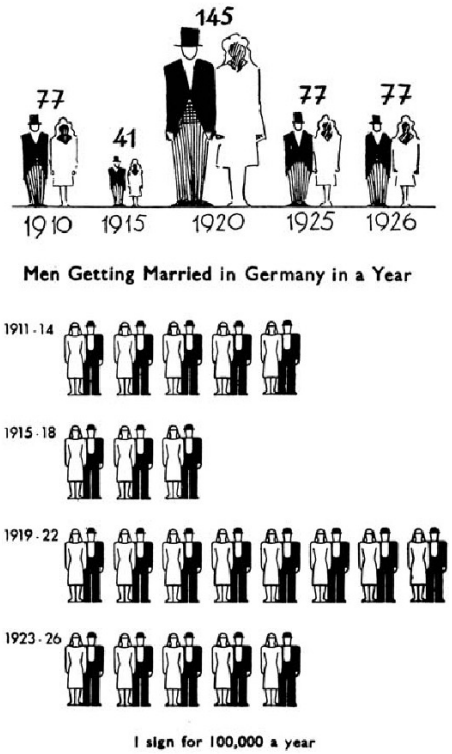

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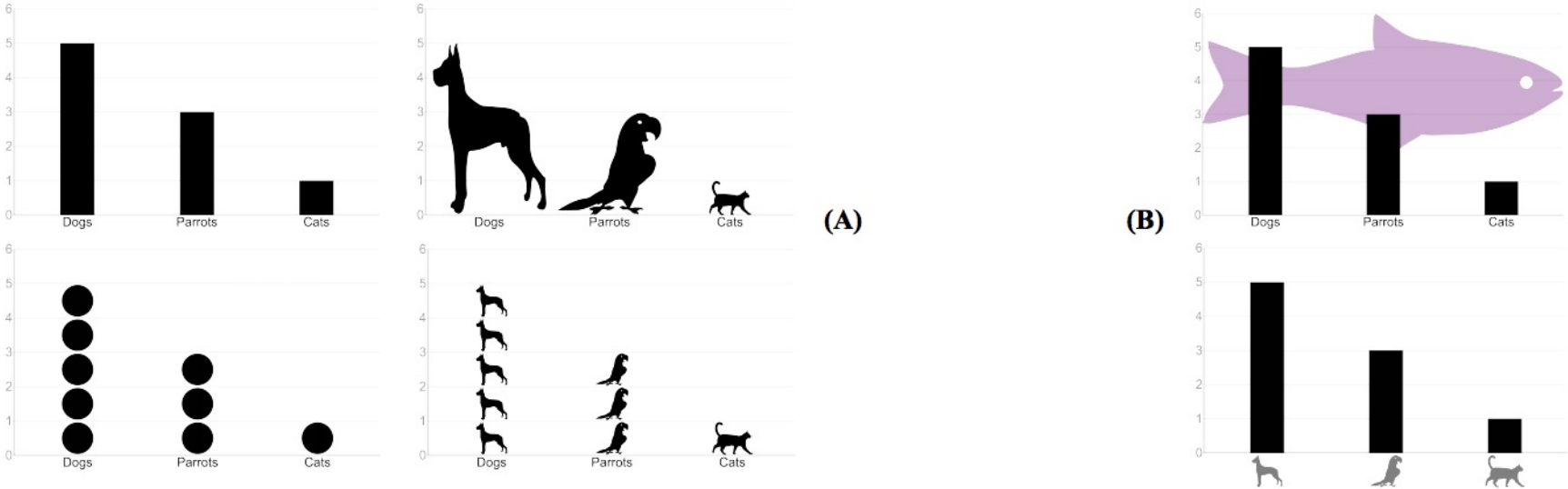
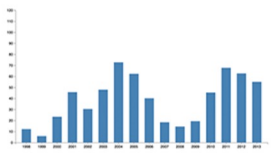
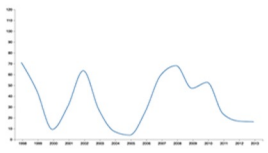
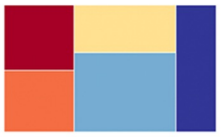


*Haroz et al. 2015. ISOTYPE Visualization: Working Memory, Performance, and Engagement with Pictographs.

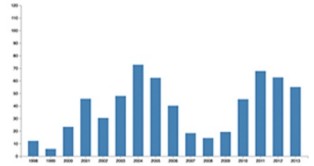
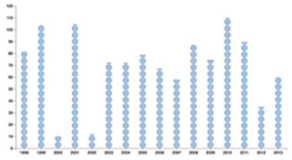
Three Hypotheses

Chart Type

Data Continuity

Three Hypotheses

H1: The best chart type for a given task will differ between people with and without IDD

H2: Discrete data representations will lead to more accurate performance for people with IDD

H3: Semantically meaningful chart embellishments will enhance data interpretation for people with IDD

DataVis 101: Embellishments Can Connect Data to Meaning

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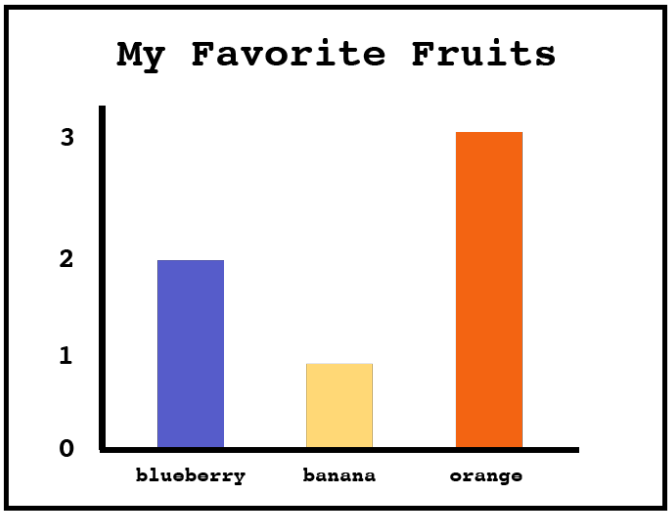
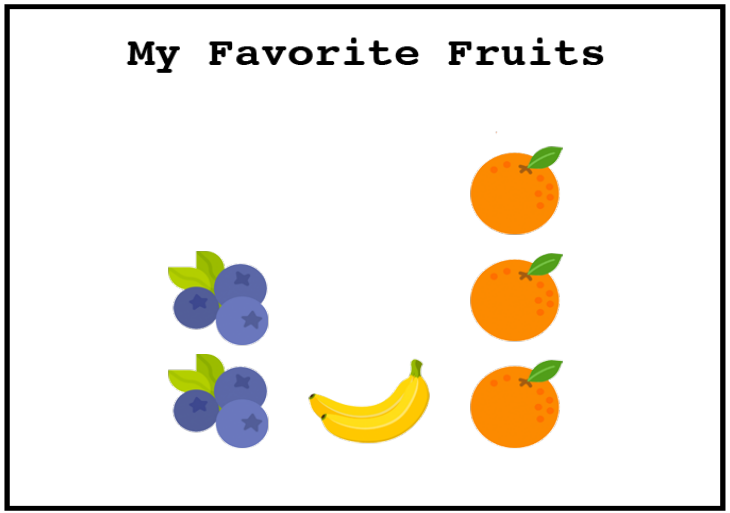
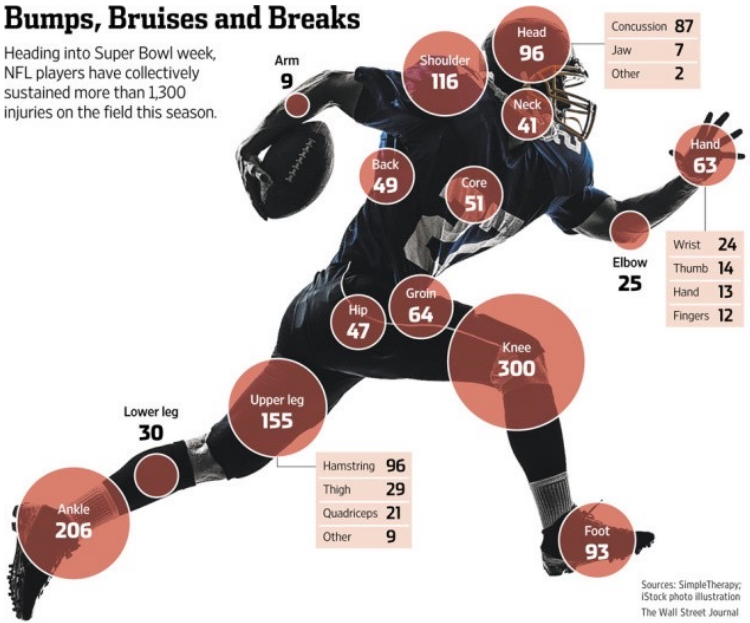




Icon

DataVis 101: Embellishments Can Connect Data to Meaning



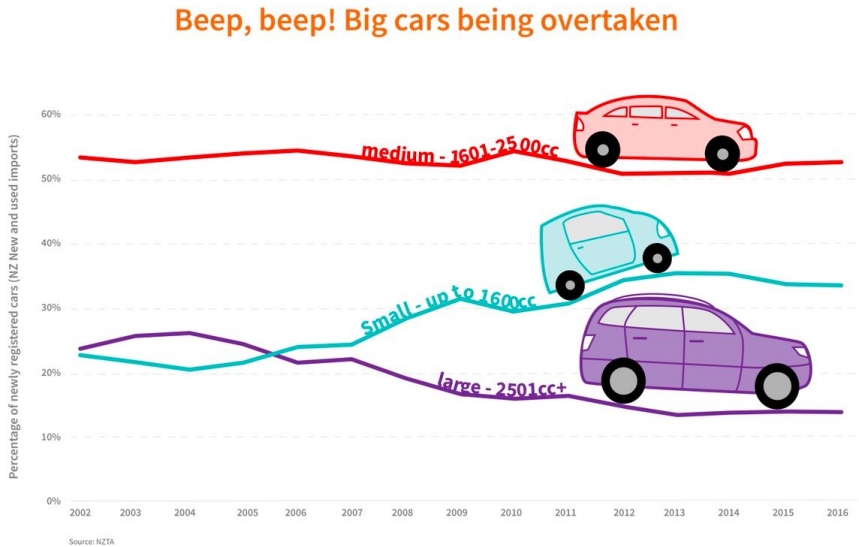
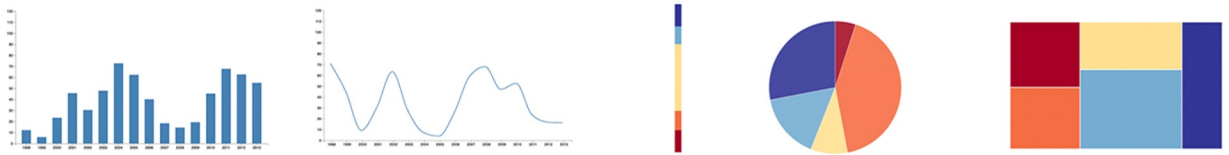


Chart Junk

Three Hypotheses

Chart Type



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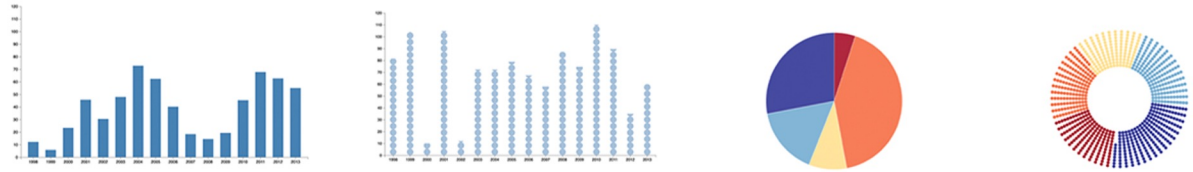
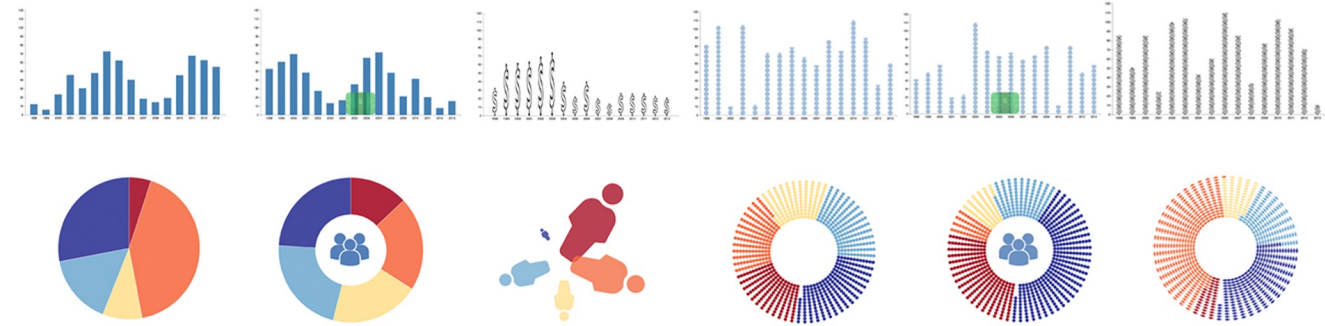
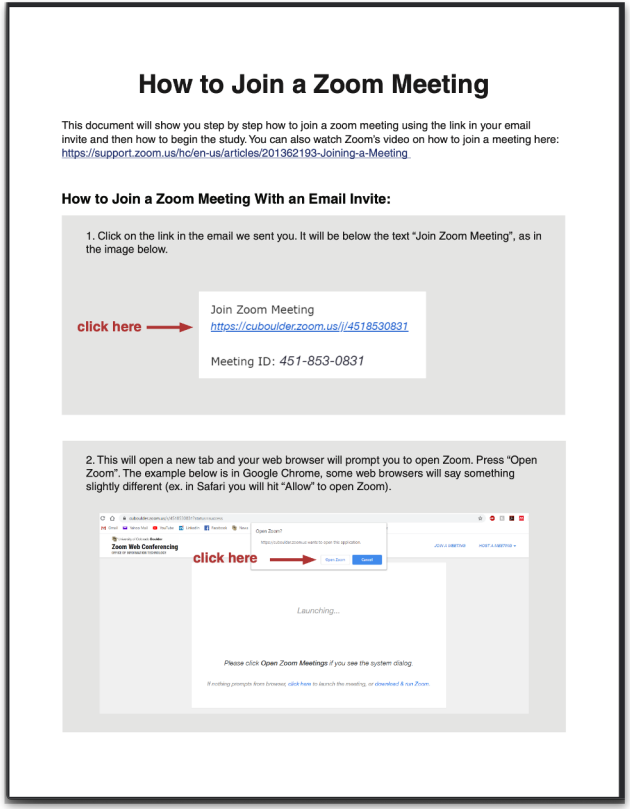


Chart Embellishment

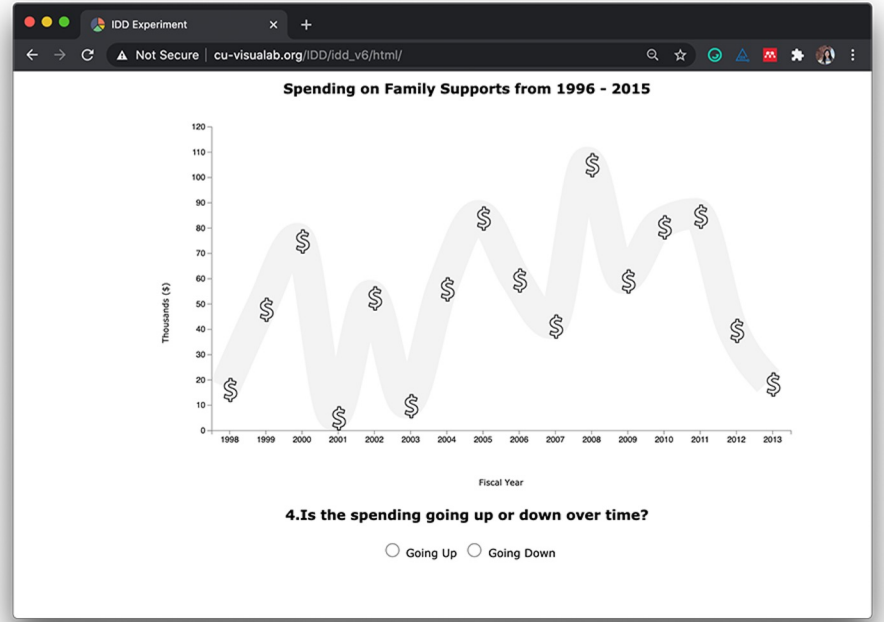


Recruitment

Recruitment

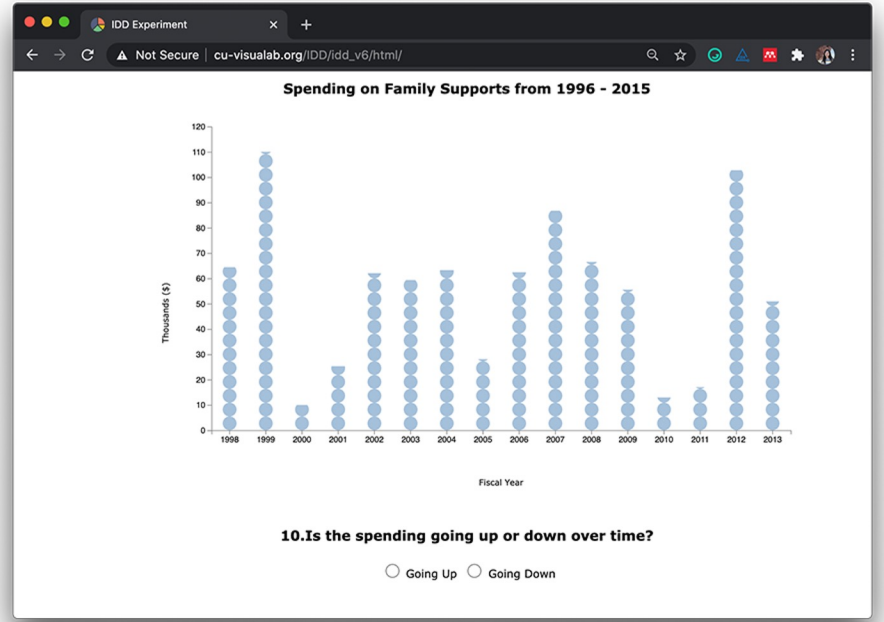


Mixed-Methods Experiment



34 Participants
with and without IDD

Mixed-Methods Experiment



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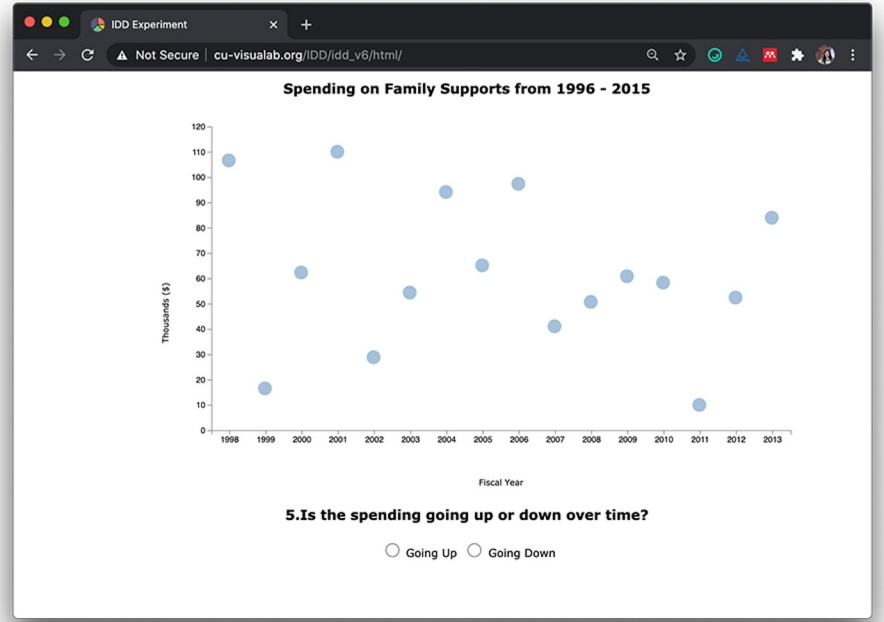

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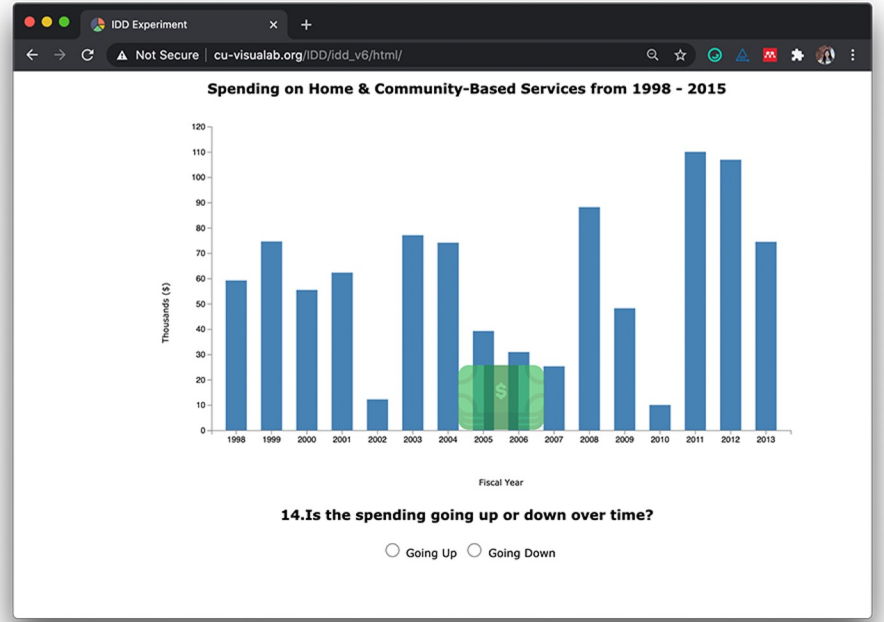

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Time Series &
Proportion Data

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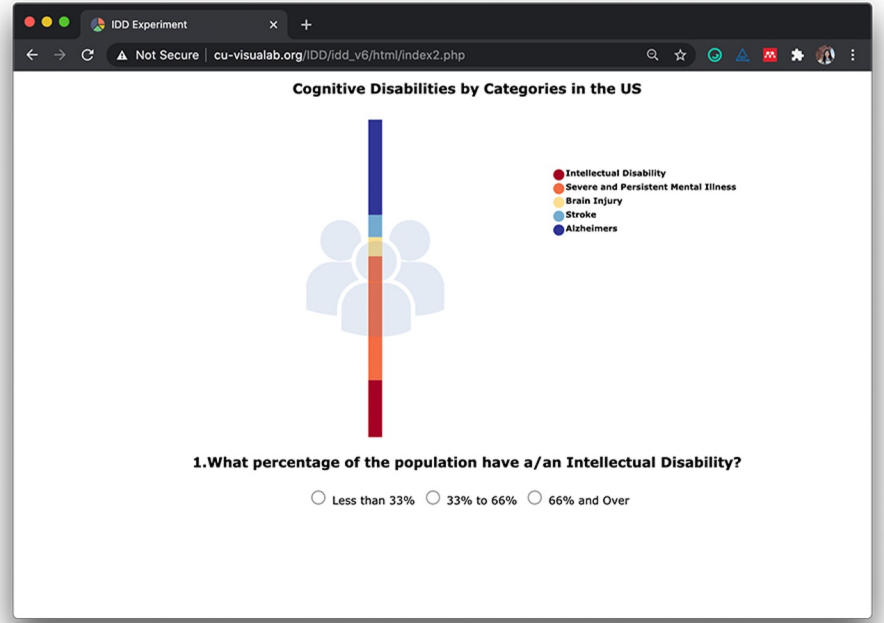

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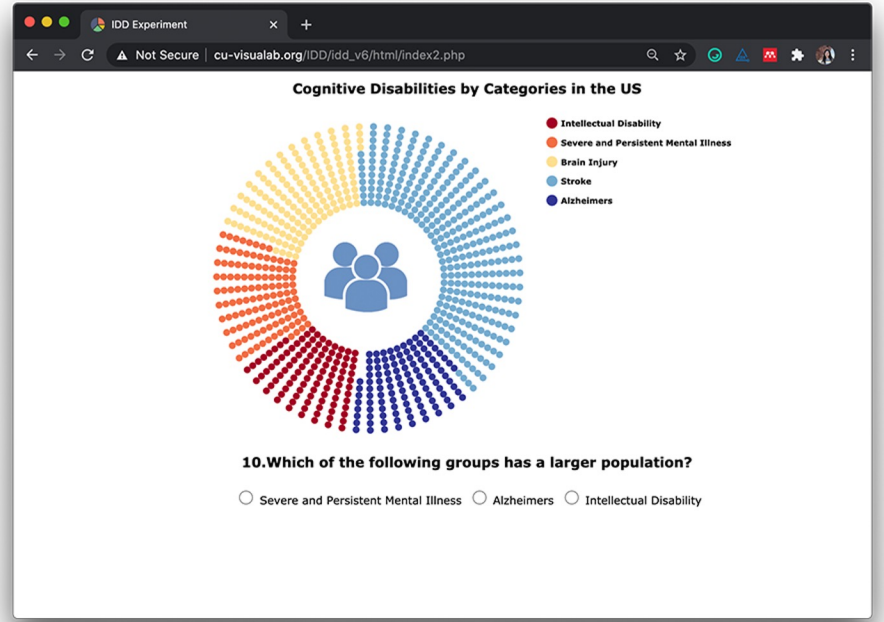

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Time Series &
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**Task Performance &
Chart Preference**

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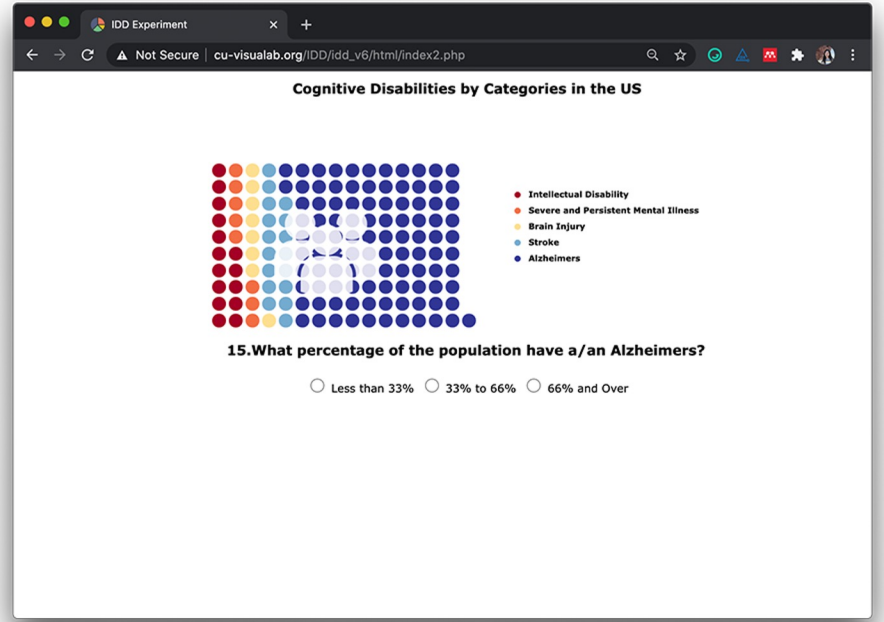

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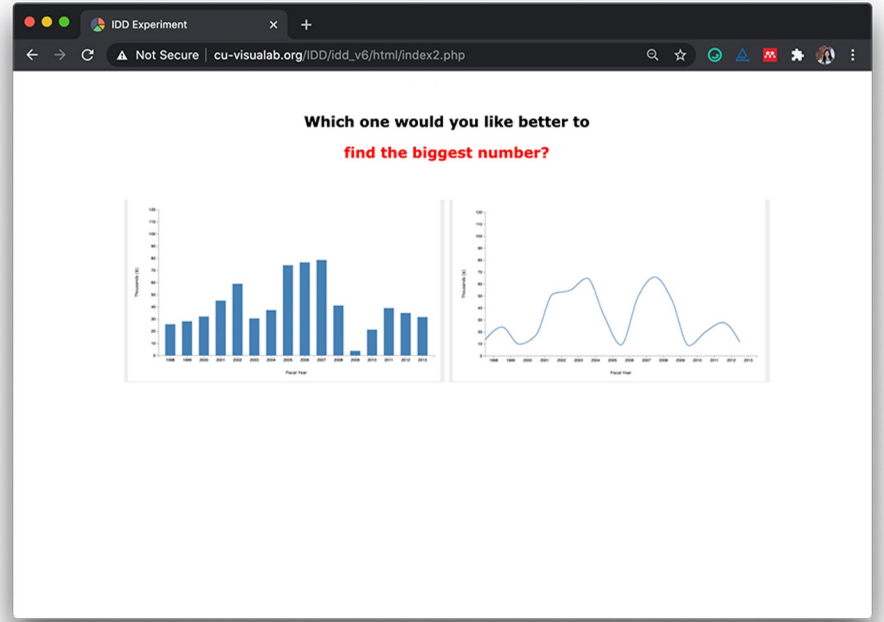

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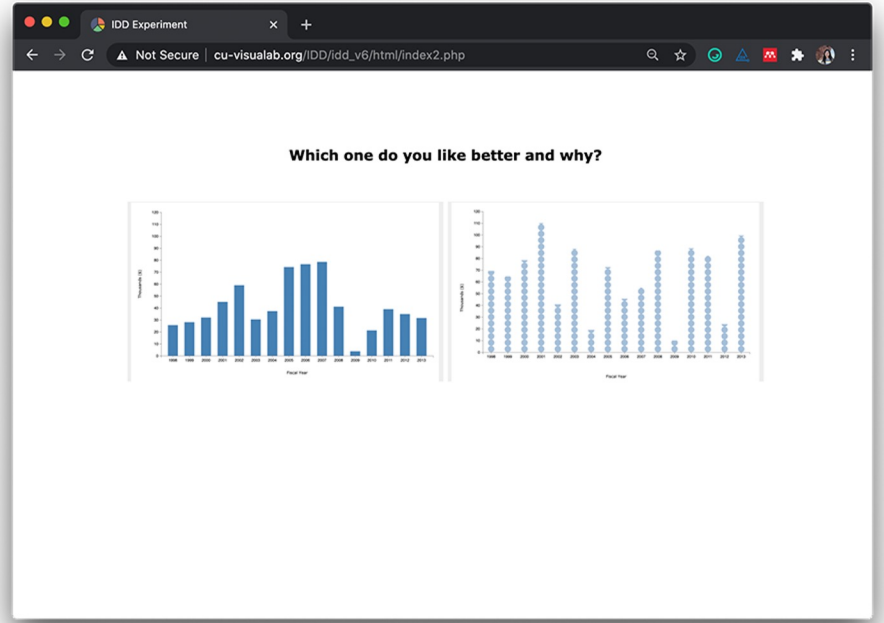

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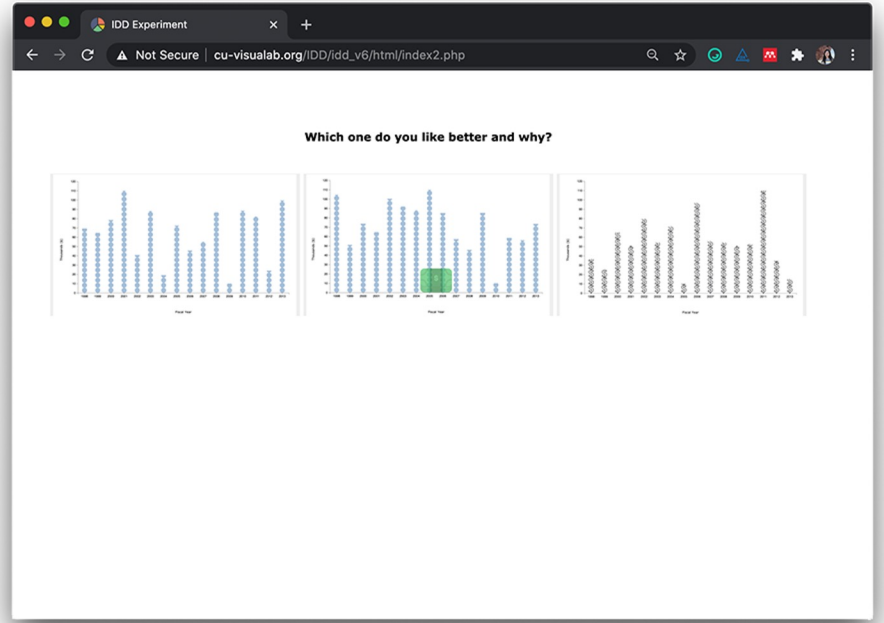

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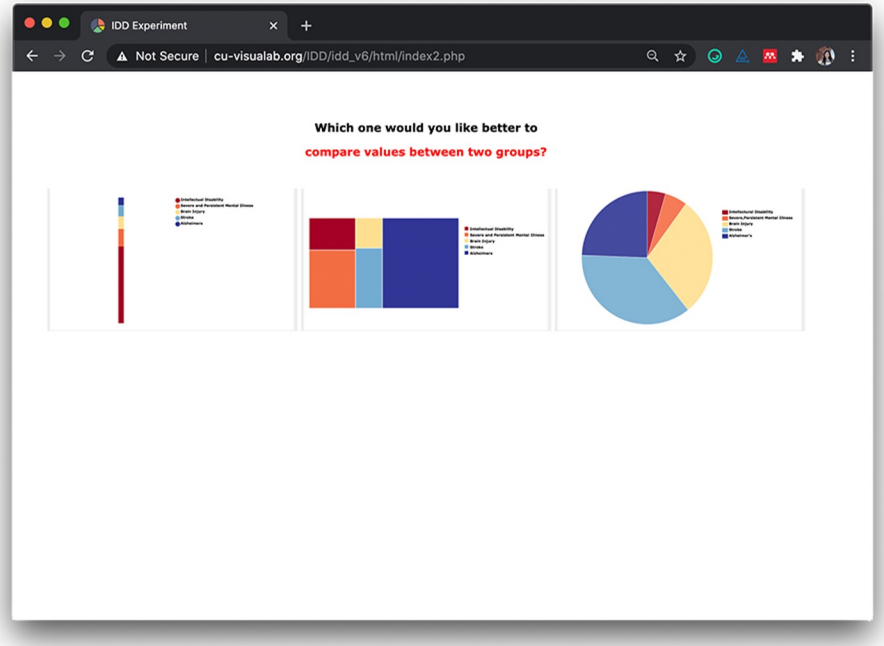

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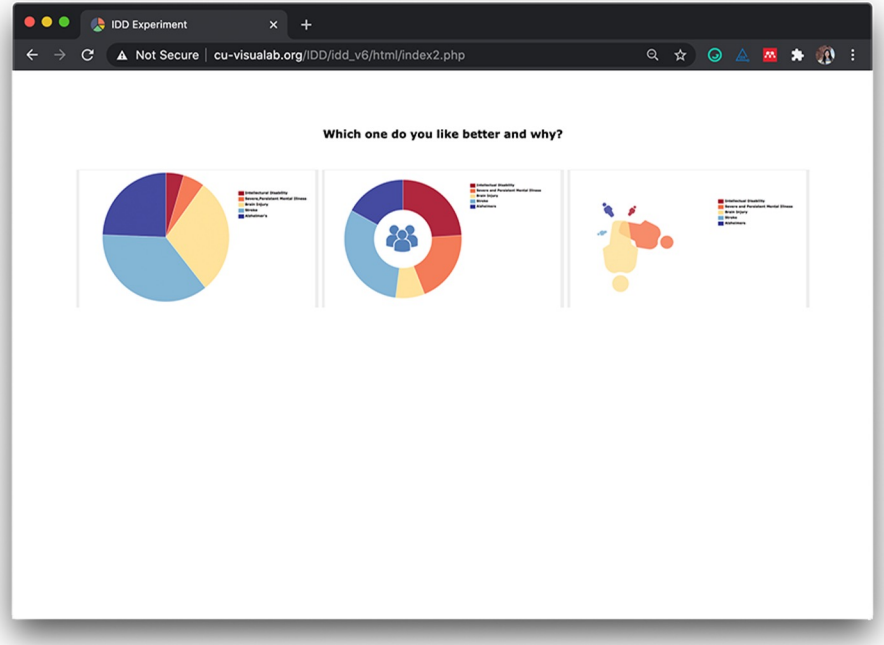

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Four Design Guidelines

Design Guidelines

Avoid pie charts

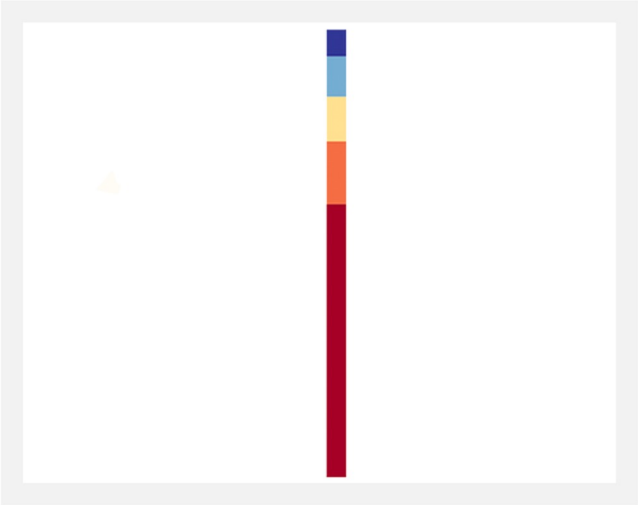
Use familiar metaphors

Manage visual complexity

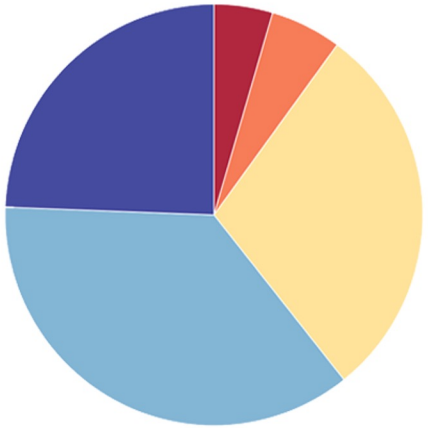
Use discrete encodings for axis-aligned representations

Design Guidelines

Avoid Pie Chart



Accessible



Not Accessible

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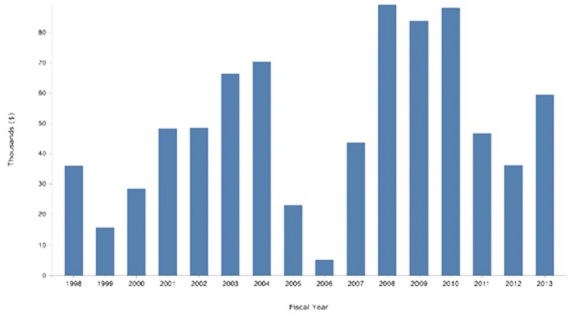
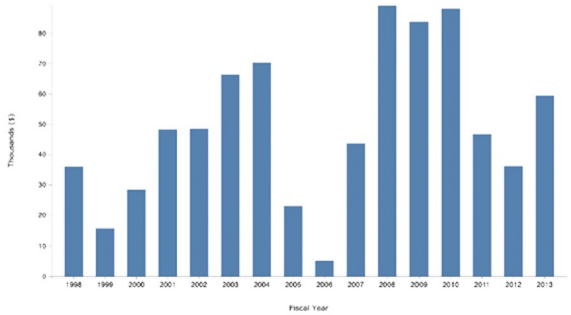
Design Guidelines

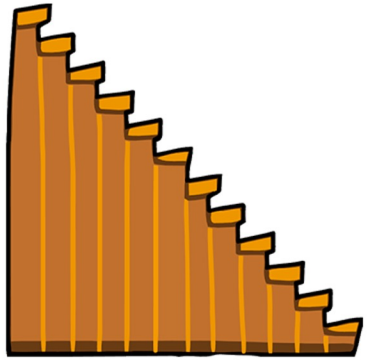
Use Familiar Metaphors



Design Guidelines

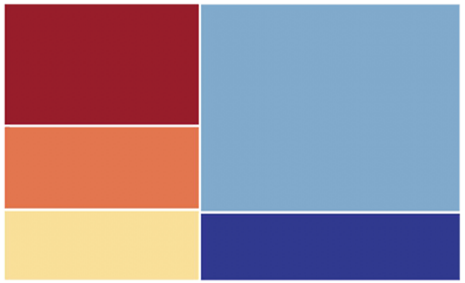
Use Familiar Metaphors





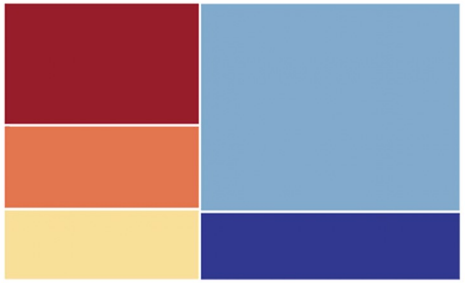
Design Guidelines

Use Familiar Metaphors



Design Guidelines

Use Familiar Metaphors



Design Guidelines

Avoid pie charts

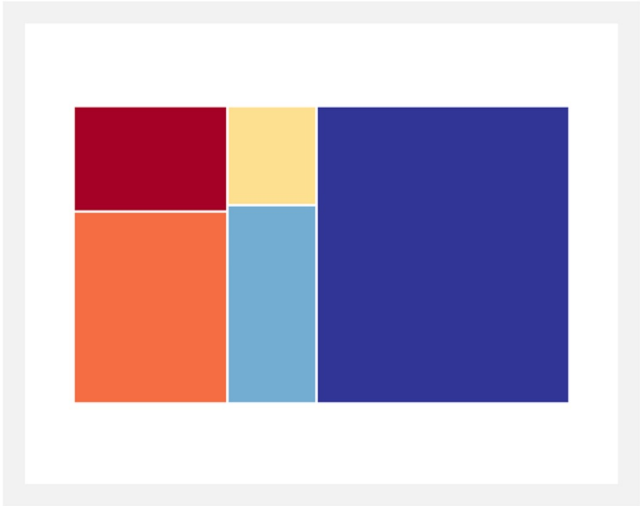
Use familiar metaphors

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Guidelines

Manage Visual Complexity



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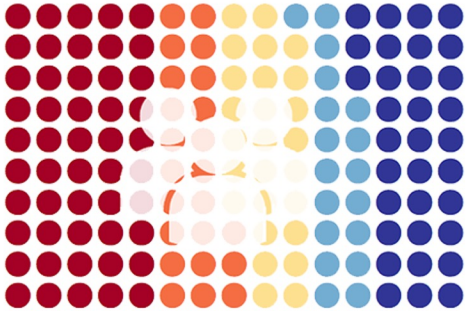

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Design Guidelines

Avoid pie charts

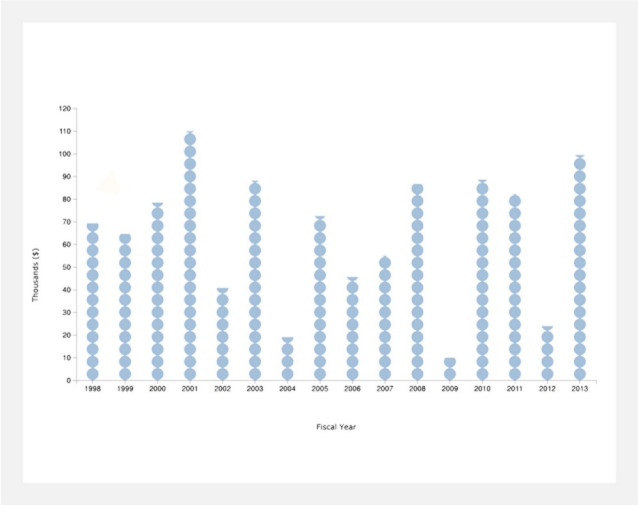
Use familiar metaphors

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Guidelines

Use Discrete Encodings for Axis-aligned Representations



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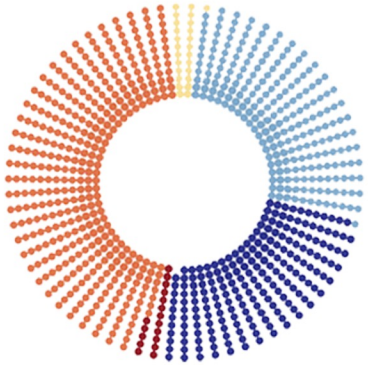


Not Accessible

http://cu-visualab.org/IDD/demo/

Variation is the Norm.

Creativity is a Spectrum!

Design Guidelines

Avoid pie charts

Use familiar metaphors

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Implications

Avoid pie charts

Use familiar metaphors

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Implications

Discover better ways to represent proportion

Use familiar metaphors

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Implications

Discover better ways to represent proportion

Add context to the data

Manage visual complexity

Use discrete encodings for axis-aligned representations

Design Implications

Discover better ways to represent proportion

Add context to the data

Understand individual differences

Use discrete encodings for axis-aligned representations

Design Implications

Discover better ways to represent proportion

Add context to the data

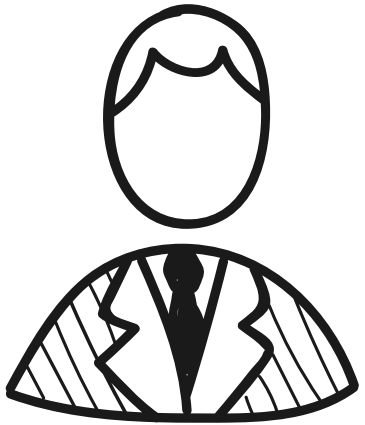
Understand individual differences

Repurpose old charts for new use

What's Next?

How do People with Intellectual and Developmental Disabilities Encounter Data and Build Visual Representations?

“Nothing About Us Without Us!”



—SOMEONE FAMOUS

Semi-Structured Interview

Semi-Structured Interview

What does data mean to people with IDD?

Semi-Structured Interview

What does data mean to people with IDD?

When & Where do they experience data ?

Semi-Structured Interview

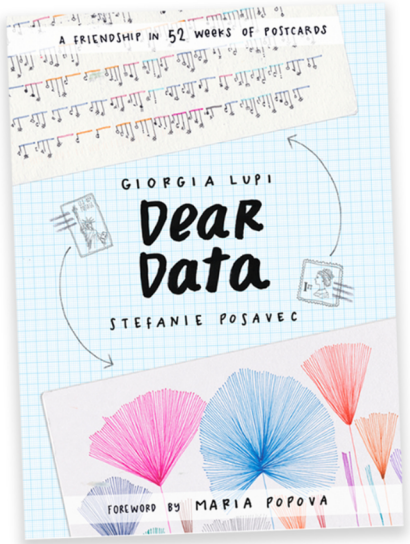
What does data mean to people with IDD?

When & Where do they experience data ?

What do they do with data?

Participatory Design Workshop

PUBLISHED IN NORTH AMERICA BY



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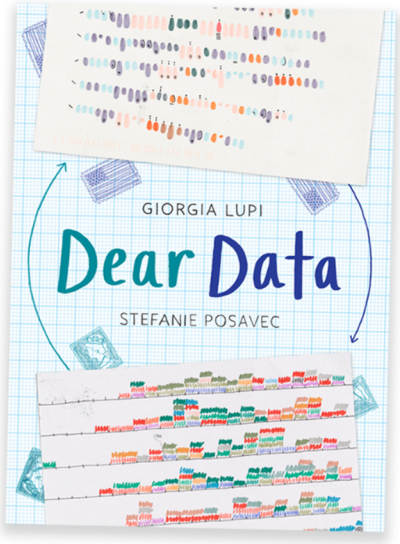

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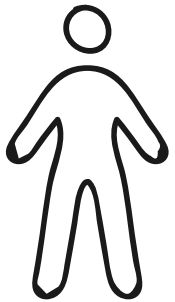
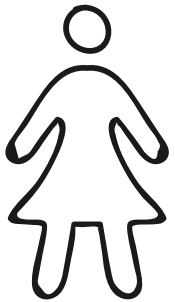
Participatory Design Workshop



Data-Pal



Role-Playing

Participatory Design Workshop

SCHEDULE

01 World of Objects

Categorical Data

(Week 1 & Week 2)

02 Past, Present, and Future

Time-Series Data

(Week 3 & Week 4)

03 Me, You, and Us

Proportion Data

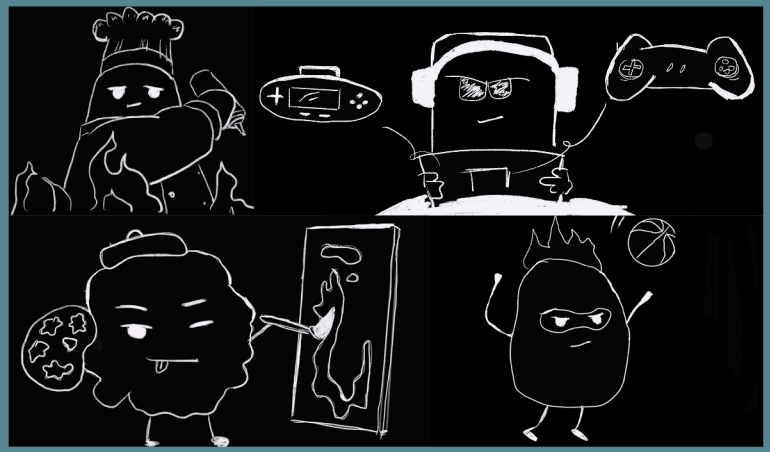
(Week 5 & Week 6)

04 BONUS

We'll also meet at Week 0 (today) and Week 7 for a short interview!

Participatory Design Workshop

Pick Your Favorite!



Who's your favorite alien?

Foodie Alien

Gamer Alien

Artist Alien

Athlete Alien

Participatory Design Workshop

How can we encourage creativity & self-expression through data visualization?

THANKS!

Project Page: https://cu-visualab.org/IDD/idd/

Contact Me: keke.wu@colorado.edu