# Data visualization process and challenges: Key thoughts from data viz experts

## A peak into [our] future

Photo credit: Lkshay Jain via Pexels

# Challenges: Audience, Stakeholders, Tools

**Audience:
Visual literacy**

**Stakeholders**

**Tools to
create visuals**

# Sampling Method

- Purposive reputational sample
- Individual contact
- Data visualization experts
  - Published books, articles, blogs, or podcasts
  - Topical interest group leader for a professional association
  - Taught courses
  - Conducted presentations or workshops at professional conferences
  - Snowball sampling

# Sample

- 70 → 26 (37%)
- Age 27 to 67 years
  (M = 38.85, SD = 9.70)
- All but 3 from North America
- No visual impairments of any kind
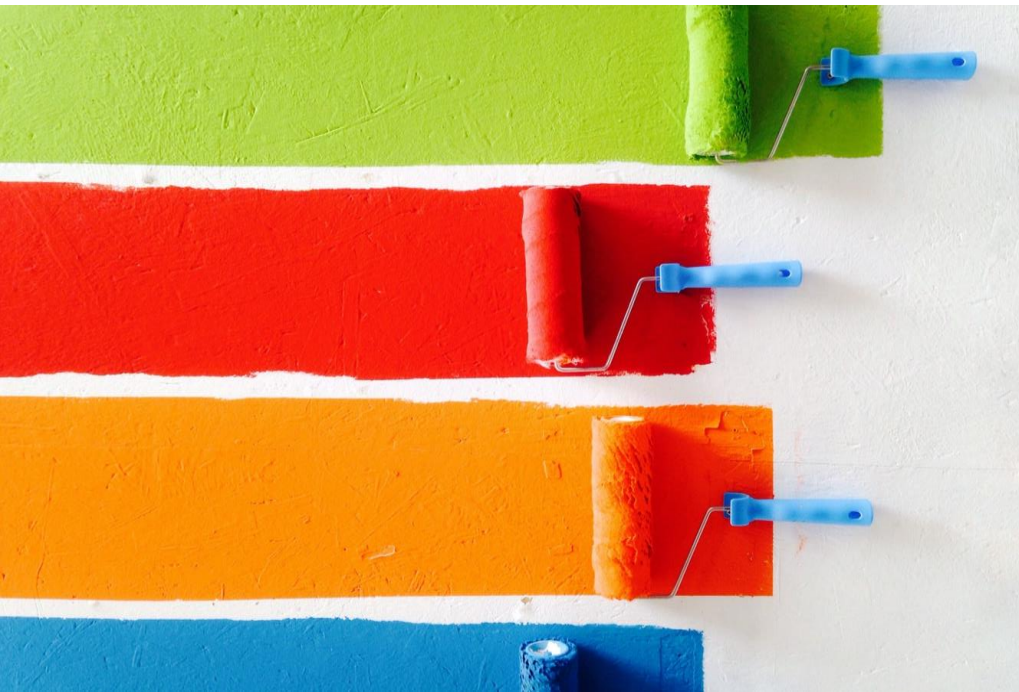


| *Demographic Information* | | |
|---|---|---|
| | N | % |
| Gender | | |
|   Female | 16 | 61.54 |
|   Male | 10 | 38.46 |
| | | |
| Ethnicity | | |
|   Asian or Pacific Islander | 3 | 11.54 |
|   Hispanic or Latino | 1 | 3.85 |
|   White/Caucasian | 19 | 73.08 |
|   White/Caucasian *and* | | |
|     Hispanic or Latino | 2 | 7.69 |
|     Native American | 1 | 3.85 |
| | | |
| Highest Education | | |
|   Bachelor's Degree | 3 | 11.54 |
|   Master's Degree | 12 | 46.15 |
|   Advanced graduate work or PhD | 11 | 42.31 |

# Sample Background

**Academic Training**

Evaluation
Psychology
Public health
Education
Social work
Economics
Journalism
Interior design
Urban planning
Web design
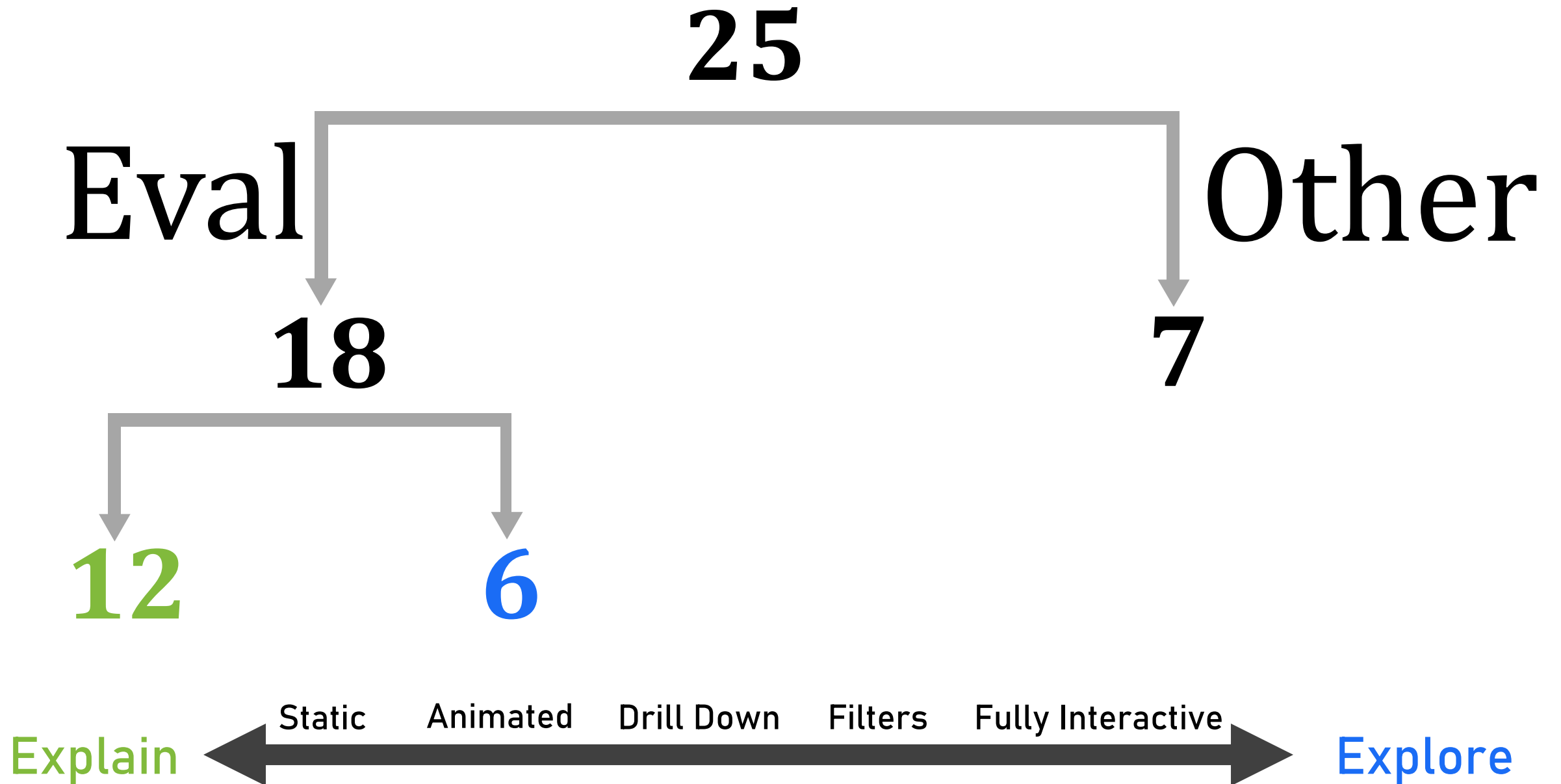Architecture
Law

**Data Visualization Work Sector**
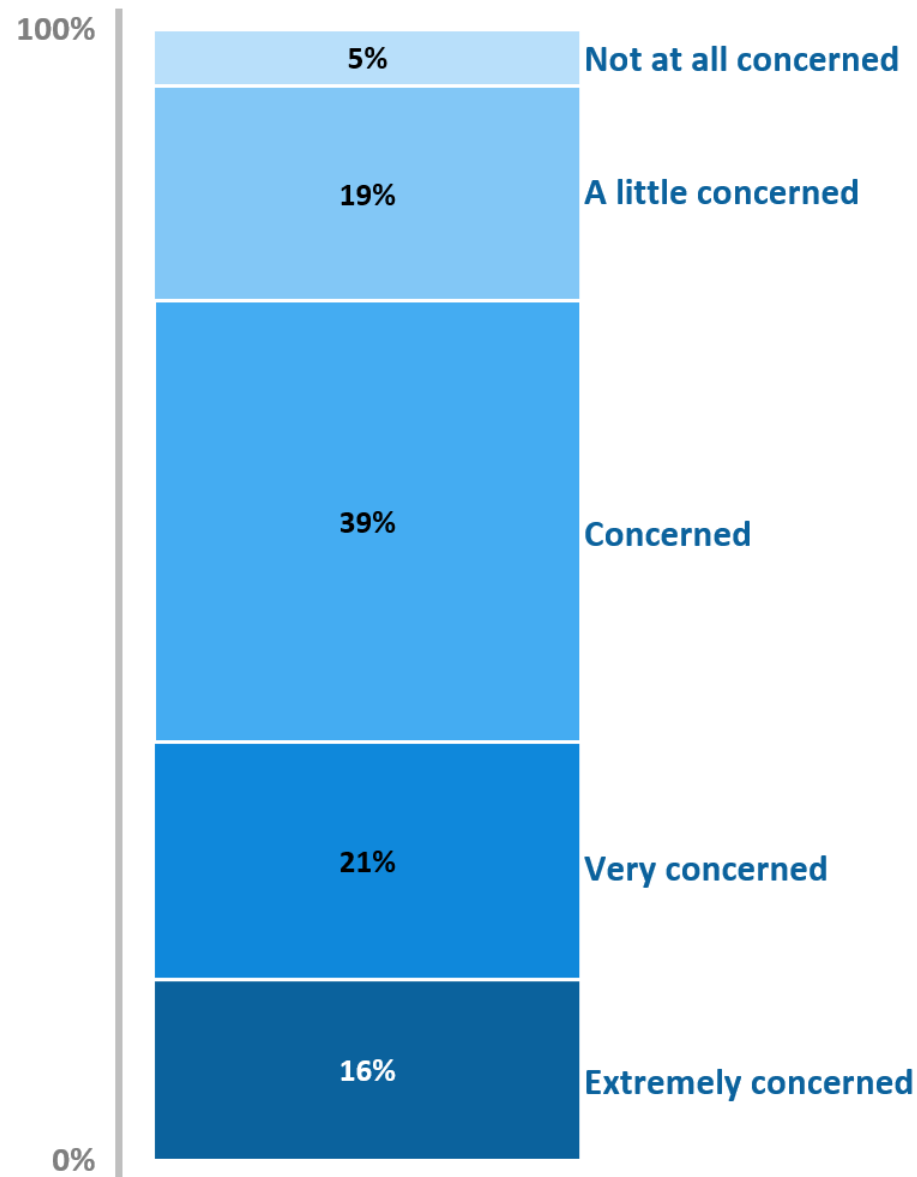
Education
Healthcare
Public health
Social welfare
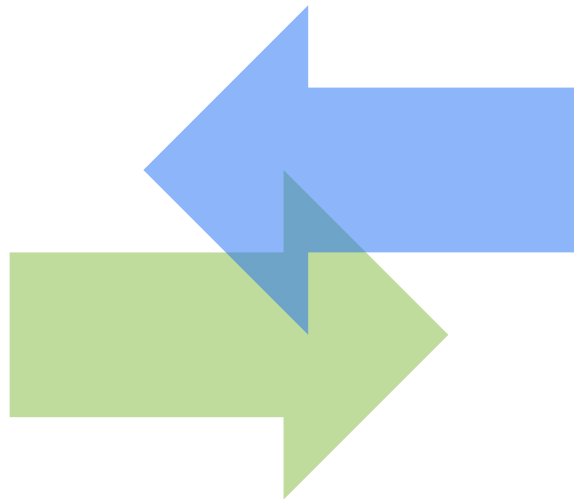
- Semi structured interviews
- Process and context
- Self-identified best work

25

Eval                    Other

18                        7

12        6

Static    Animated    Drill Down    Filters    Fully Interactive
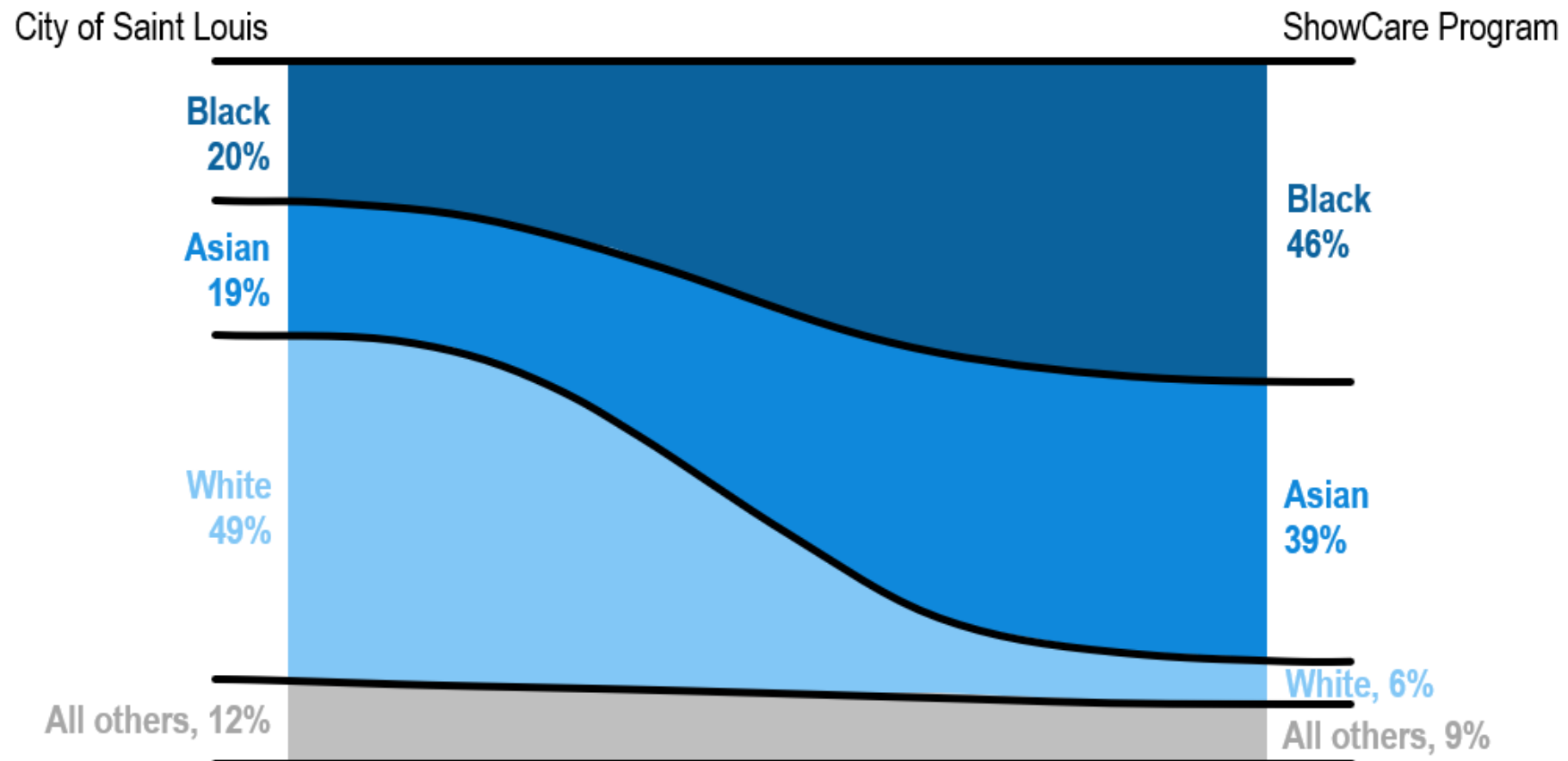
Explain ←————————————————————————→ Explore

# Static Eval Example: Stacked bar chart

**When community members were asked how concerned they were about diabetes in their community, they said they were....**

100%

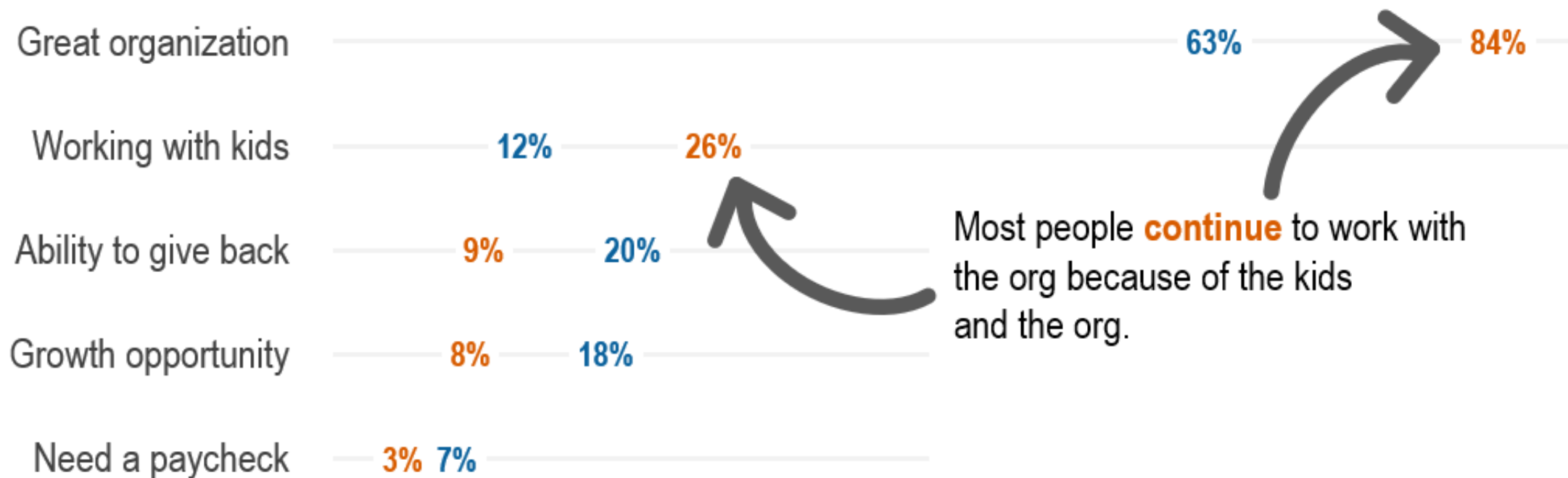| | |
|---|---|
| 5% | **Not at all concerned** |
| 19% | **A little concerned** |
| 39% | **Concerned** |
| 21% | **Very concerned** |
| 16% | **Extremely concerned** |

0%

*recreation*

**Black** and **Asian** families were disproportionately represented in the ShowCare Program. If the pandemic impacted all groups the same, the shares on both sides would be equal.

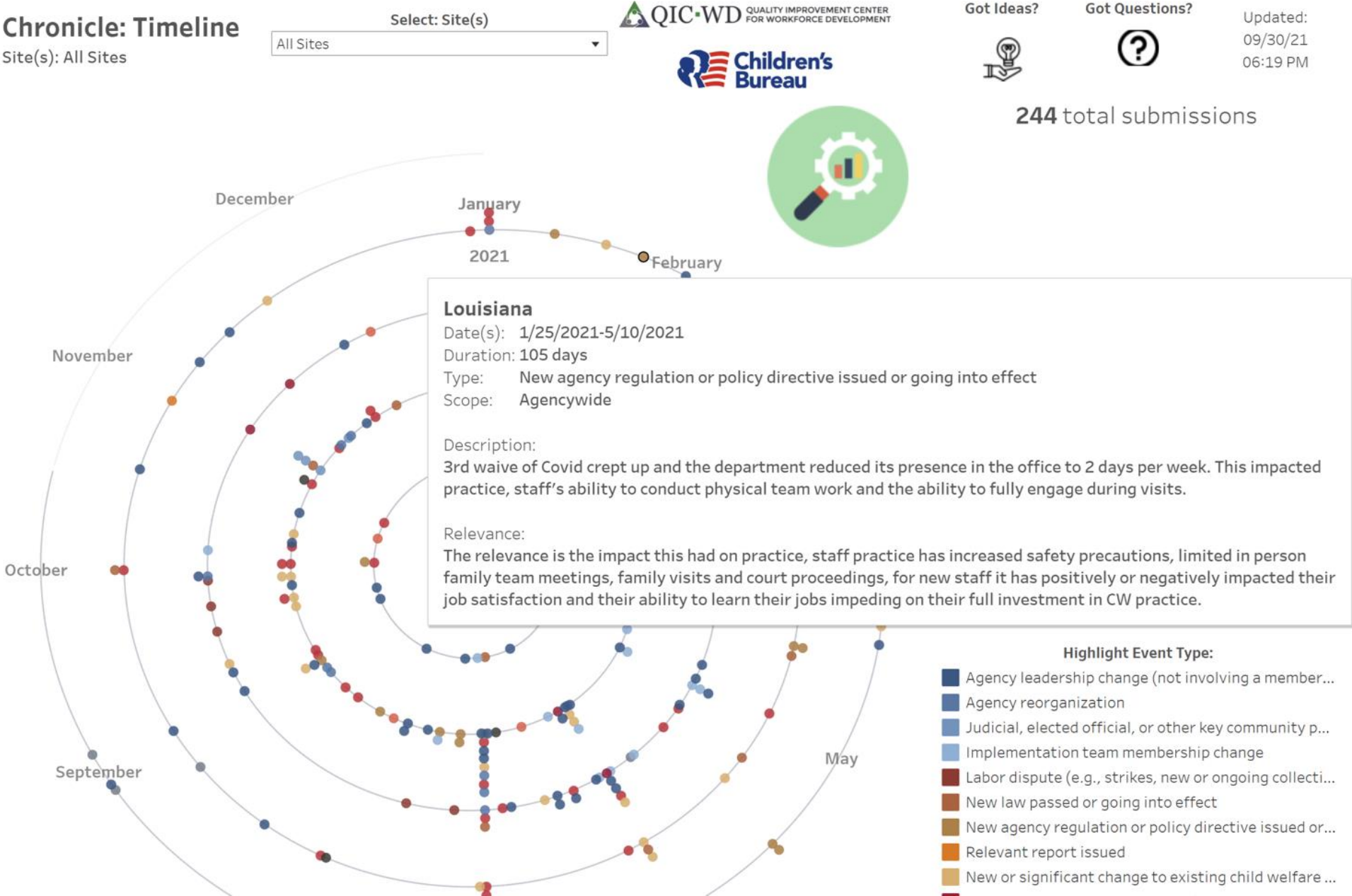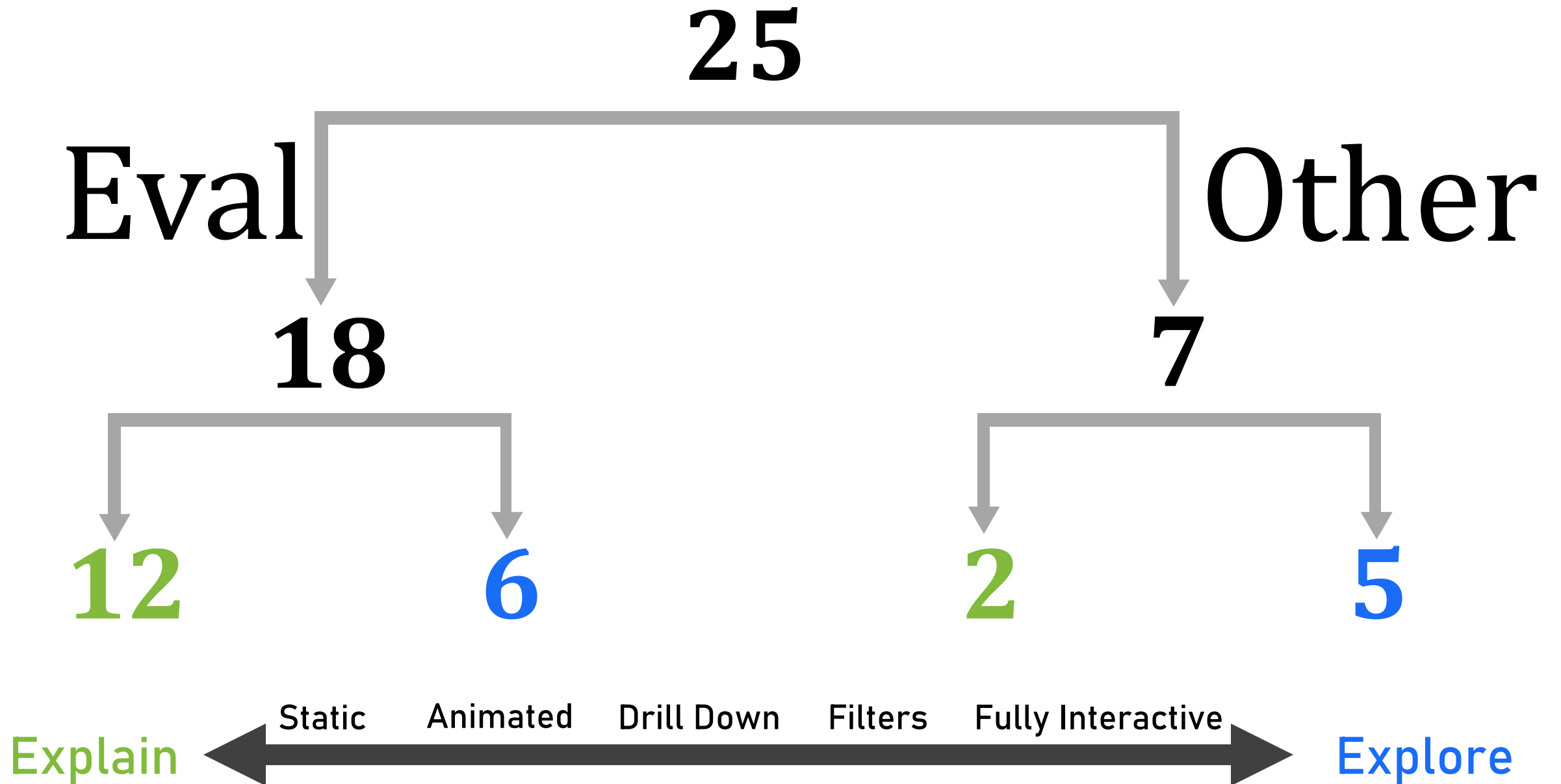Source: 2015-2019 American Community Survey, 5-year estimates

City of Saint Louis

ShowCare Program

Black 20%

Asian 19%

White 49%

All others, 12%

Black 46%

Asian 39%

White, 6%

All others, 9%

*recreation*

**Reasons for Joining and Continuing to Work for KidsEducation**

| | | |
|---|---|---|
| Great organization | | 63% → 84% |
| Working with kids | 12% | 26% |
| Ability to give back | 9% | 20% |
| Growth opportunity | 8% | 18% |
| Need a paycheck | 3% | 7% |

Most people **continue** to work with the org because of the kids and the org.

*recreation*

# Interactive Eval Example: Tableau Timeline

# Static Example: The Seinfeld Chronicles
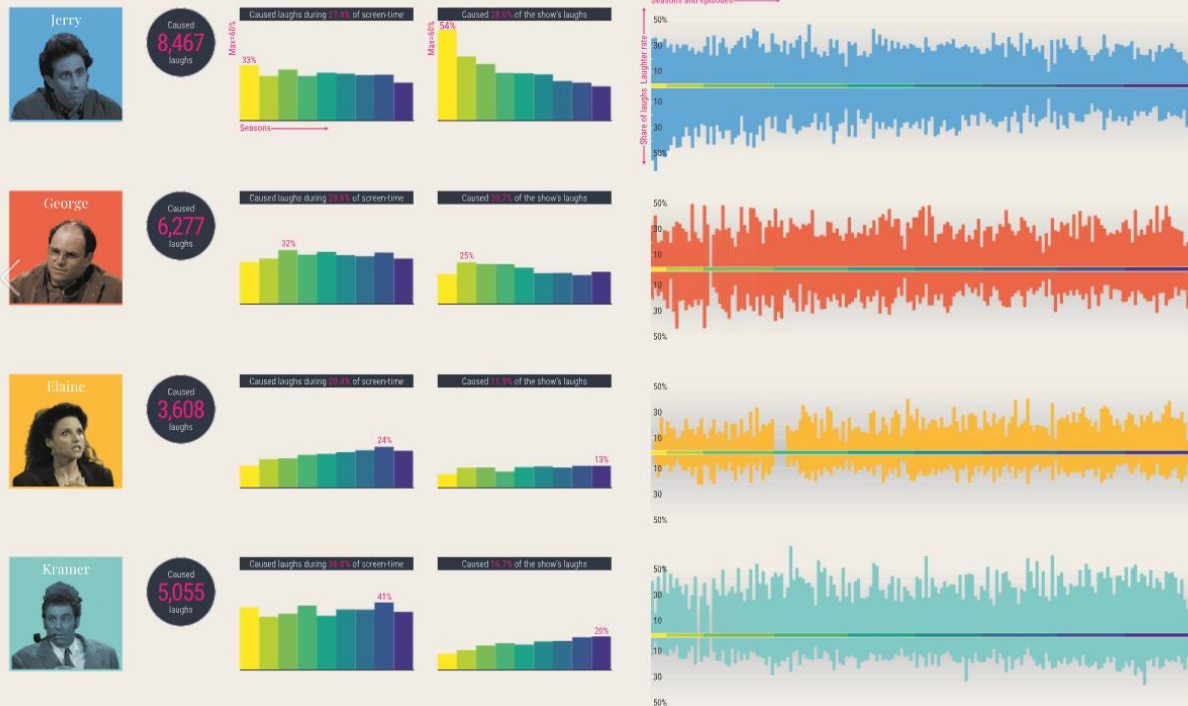


*used with permission*
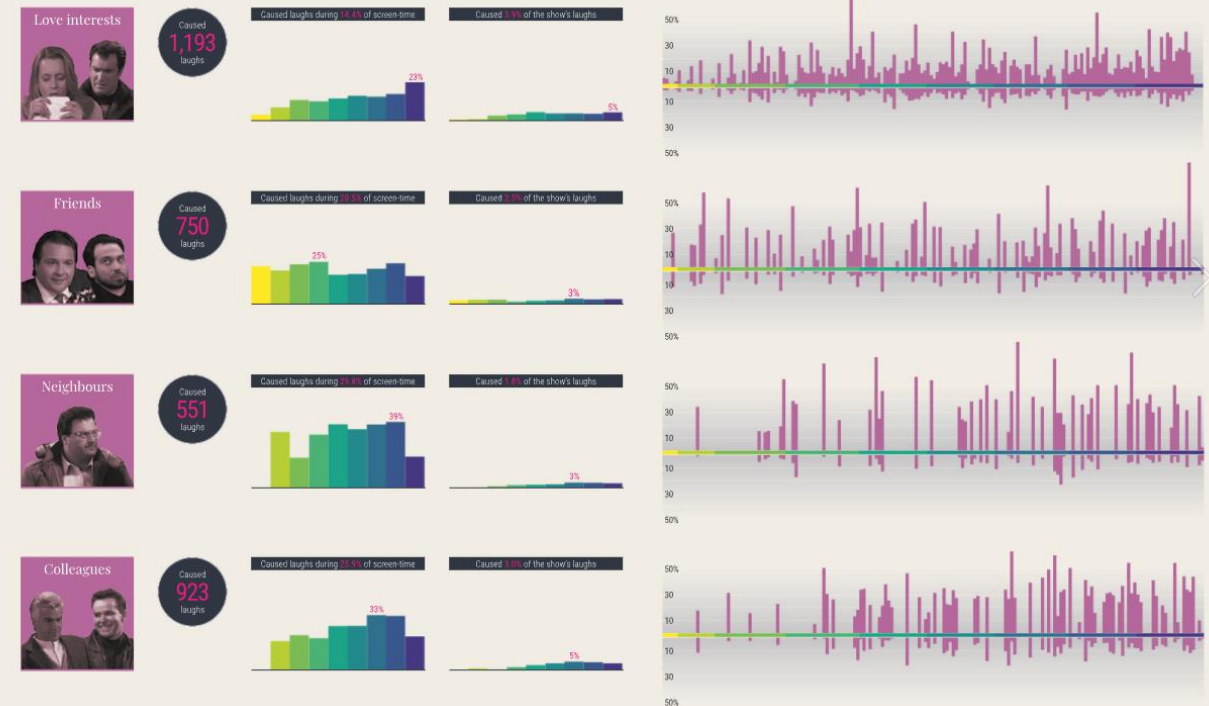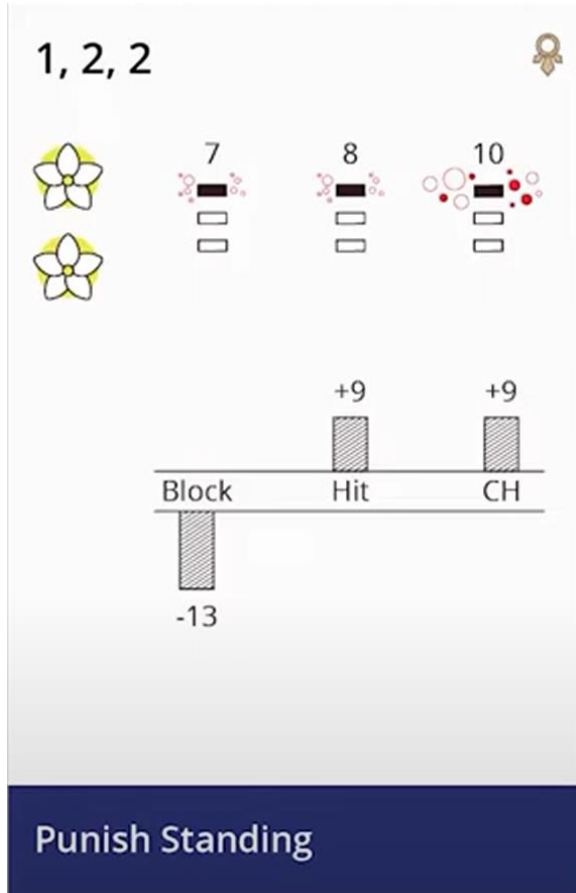
BRITISH & EXOTIC MINERALOGY

All 2,242 illustrations from James Sowerby's compendium of knowledge about mineralogy in Great Britain and beyond, drawn 1802–1817 and arranged by color.

Scroll/pinch to zoom

Drag to move

Click/tap for descriptions

EXPLORE

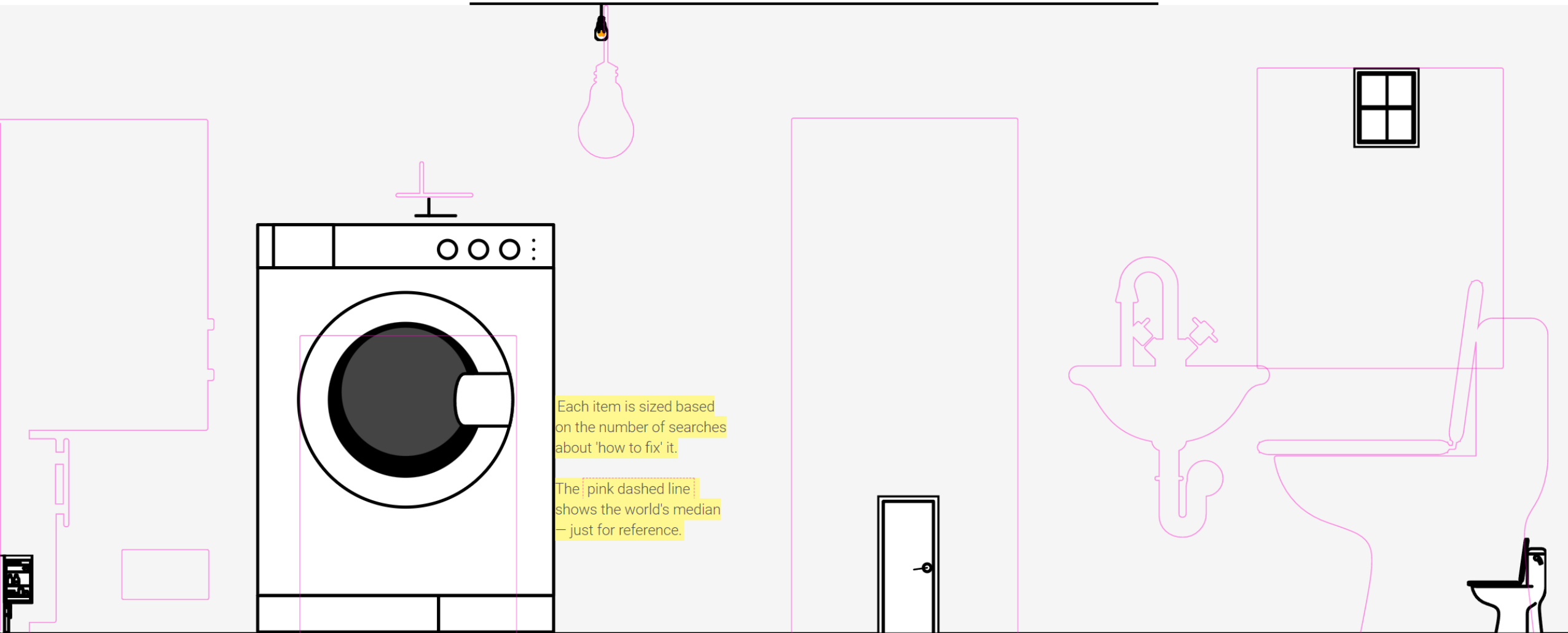About the project    Get a poster    Index

used with permission

# Interactive Example: How to fix a toilet

In **Belarus** ▾ ✕ , we searched **'how to fix' these things** around the house

Each item is sized based on the number of searches about 'how to fix' it.

The pink dashed line shows the world's median — just for reference.

**Audience:
Visual literacy**

**Stakeholders**

**Tools to
create visuals**

# Visualcy Defined

"the ability and skill to read and interpret visually represented data and to extract information from data visualizations"

*(Lee et al., 2017, p. 552; Börner et al., 2018)*

# Visualcy Described

Nearly every participant discussed challenges and frustrations related to limitations surrounding creating visuals based on what their clients could understand.

"*[T]hey're a very **traditional** audience.*"

"*We **don't understand** this. And like, it needs to be a lot **simpler.**"*

"*Oh gosh, this just **looks like a mess.** It's just a bunch of stuff splattered on a screen.*"

# 🚫 Participants felt like creativity and complexity is limited

" "We have skills to do really fancy things, but **we never use them** because **no one can understand our charts if they're fancy.**"

"There's **nothing about this visualization that's radically exciting.** It's bar charts and line charts."

# Audience misinterpret the data visualization

"*[A] country team...might conclude, 'Oh, we're not performing at the level of the others.' ...[I]t's not necessarily reflective of anything that they're doing wrong.* **It could be completely the context they're in.**"

"*'Is this telling me that the trainers who achieved poor results are bad trainers?'* **Someone could easily interpret the graph that way.**"
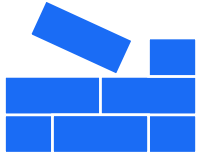
# Designers must determine how to build audience capacity to understand visualizations

"*[H]ow do we **help the end users get oriented and more comfortable working with more sophisticated data visualizations** that ultimately probably enable them to gain insights that they wouldn't otherwise gain from a bar chart?*"

# Approaches

- Use clear labels or annotations
- Check the visualcy of audience at different stages of the design process
- Educate the audience throughout the design process

" *...making sure that you are bringing your audience along with you, that you're providing enough context or information.*"

# Relevant Competencies

## AEA Evaluator Competencies

- Communicates in meaningful ways that enhance the effectiveness of the evaluation
- Facilitates constructive and culturally responsive interaction throughout the evaluation

## AEA Public Statement on Cultural Competence in Evaluation

- Employ culturally congruent epistemologies, theories, and methods

*"We can have our own internal checks... Our eyes are... calibrated differently than most people."*
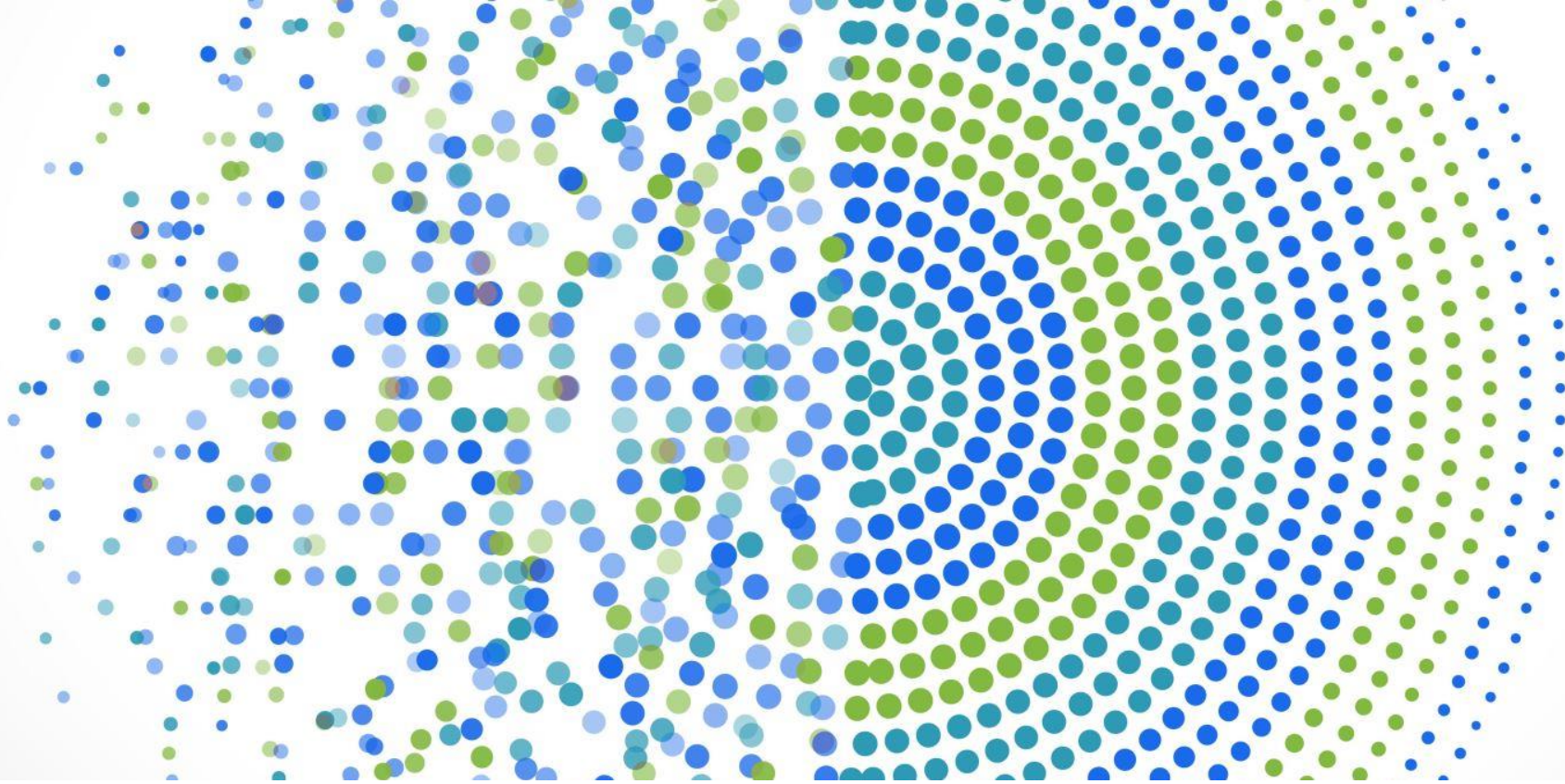
# Context, Politics, and Truth: Challenges and Solutions at the Intersection of Competing Interests

Building the *contextual* value proposition of data viz

"**So it's really hard to try to sell this to a client**... And the reason is because clients tend to have very specific understanding of what data viz is...

The only way to overcome it is just focus on the consumer... if consumers buy in, clients will buy in eventually... **the main important thing [is that] I have to show value.**

And that's also very frustrating... Like I know it'll work, but **I have to prove it.**"

Including uses and users of viz in "telling the story"

Understanding and managing client expectations

Incorporating feedback: Another stage of client engagement
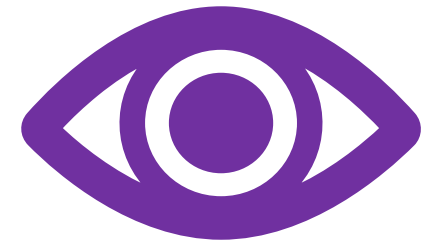
Bolstering visual literacy: Data viz capacity building
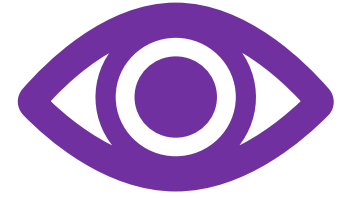
# Including uses and users of viz in "telling the story"

**Challenges**

- Understanding content of the data
- Co-creating the data story with clients
- Audience identification
- Tailoring for contextual relevance

**Approaches**

- Ascertaining the goal of the visualization
- Using a focused approach to data viz

"*[Among] the different core attributes of [data viz] of creativity and technical skills and stats, [what] is **always at the core is communication.** ...It's about communicating to [people]—about progress, about ideas—but crucially, it's **listening: hearing from them what you think they want, getting their feedback, taking on board their suggestions.**"*

# Understanding and managing client expectations

### Challenges

- Demonstrating the value of data Visualization
- Expectation vs reality
- Reframing focus from specific visuals to bigger picture
- More ≠ Better

### Approaches

- Discussing the visualization's purpose
- Clarifying the process: Advancing a holistic approach
- Setting expectations for visualizations early on

"*We learned with our client earlier on that if they saw a **pixel perfect** [visualization], that's what they thought they were gonna get at the very end of the day...it was a bit of a **dangerous slope** to go down if you went ahead and presented things that ultimately you weren't sure that you could deliver on... So forcing that **constraint** early on was actually really helpful.*"

# Incorporating feedback:
# Another stage of client engagement

## Challenges

- Conflicting feedback
- Negative feedback
- Balancing the viz design, preference, and aesthetics

## Approaches

- Openness to various types of feedback: taking the constructive with the congratulatory
- Procuring feedback: structured and early on
- Providing visualization options: the menu approach

*"We learned that it was better off to **earlier** on display a range of different chart display options for a given question or data story... then they could all **give feedback all at once early on...** we started out with individual... worksheets or dashboards that were actually just the question and then six **different displays of that data."***

# Bolstering visual literacy:
# Data viz capacity building

## Challenges

## Approaches

- Wanting to put "everything" in the viz(es)
- Distracting interactive design elements
- Presenting new chart designs
- Explaining technical aspects

- Coaching for key questions
- Explaining the process of data viz
- Speaking a common language

*"Inevitably, people would be like, 'Well, then there's too many bar charts, it's boring.' ...it's trying to explain to them that, "Okay, **we could put some fun, goofy stuff on here** that would... make it exciting, but with the dashboard, especially the 25th time you look at it, **you're gonna hate it."***

# The contextual value proposition of data viz

**Including users**

**Managing expectations**

**Incorporating feedback**

**Bolstering visualcy**

*"When someone really has a very strong vision in mind... one of best approaches I've seen... is* **reminding them again** *that we have a certain design process that we're trying to follow.* **We're trying to start with understanding your goals, your audience, who you're trying to reach** *and designing, figuring out what their needs are and then figuring out a visual solution that meets those needs...***We need to take a step back and we really need to get down to the fundamentals and dig deeper** *into understanding those issues before we can jump to, 'This is a chart we want,' or '[these are] the interactions we want to offer.'*

*So we try, some mixed success, right? Sometimes people are still like, 'But I still want this.'* **You have to rein them back in."**
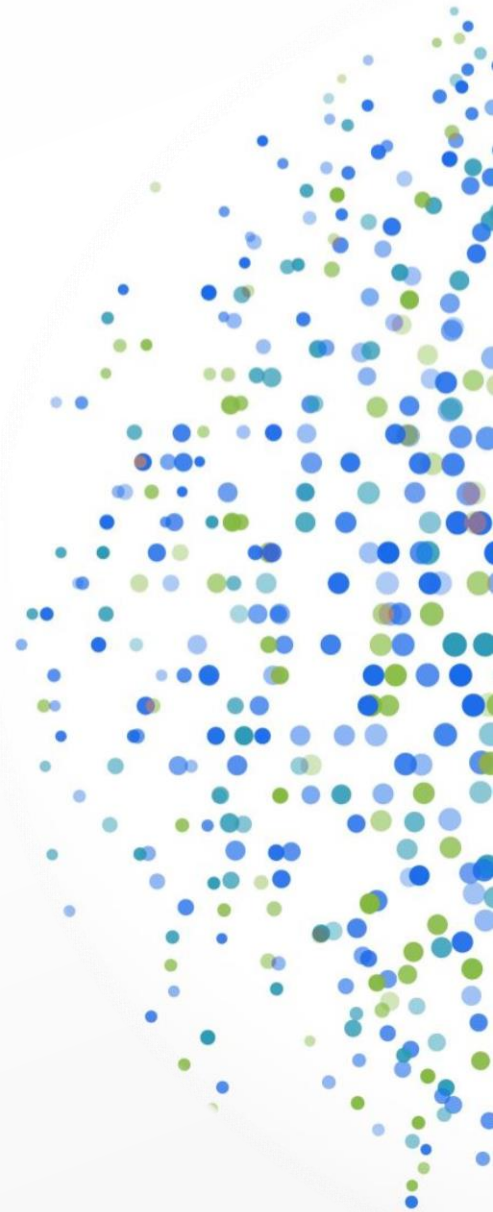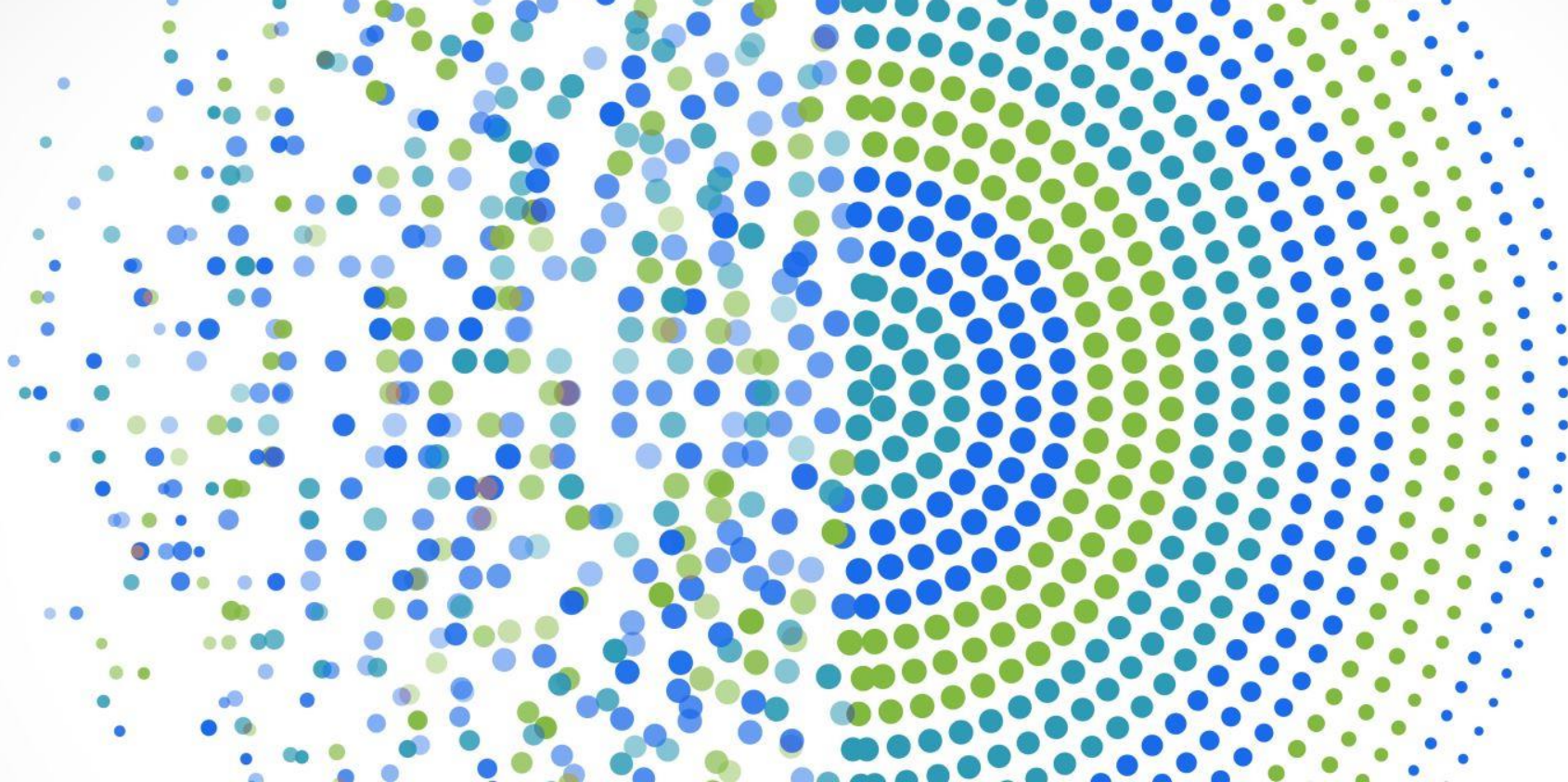
# The Proliferation of Data Viz Software Tools: Challenges and Opportunities
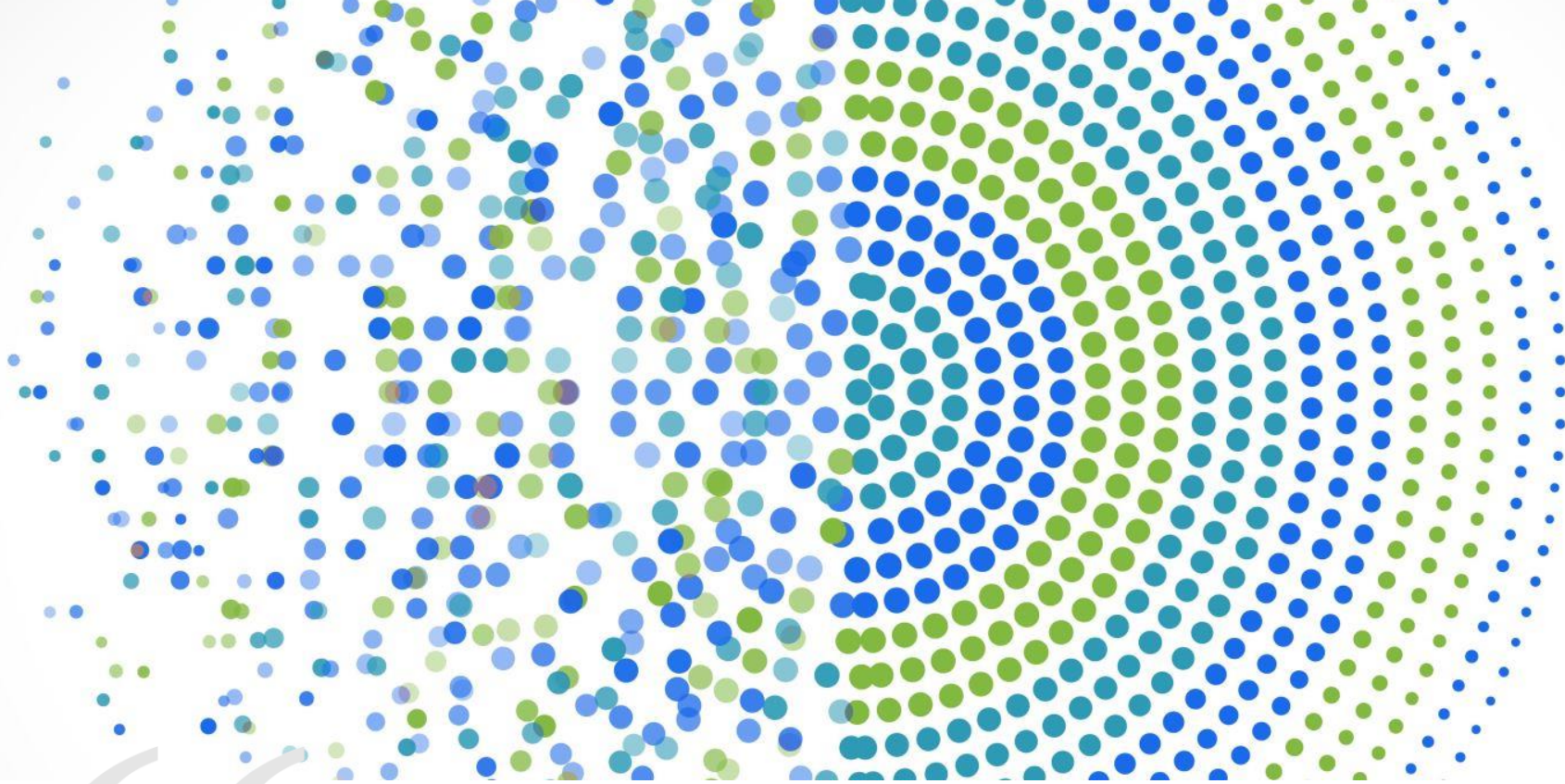
"*I just wish we would stop saying one tool is inherently better than another tool because...*

*We just need to understand that the tool kit and the viz is just whatever is best for the person, for the organization, for the audience...*"

No tool to rule them all...
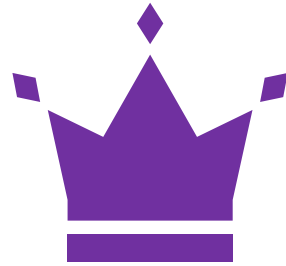
Excel is an embarrassing king

Financial cost of software licenses

Software envy

# Tool complexity and relationships
# (Nothing is as simple as it seems)

custom code

data workflows, cleaning,
storage, and connections

Data Factory

Power Automate

alteryx

SQL

interactive data displays

tableau

Power BI

ArcGIS

Adobe
Illustrator, Photoshop, InDesign

Ai Ps Id

Microsoft Office

X

W P

Google
Slides. Sheets. Docs

tablet & stylus

paper, sticky note, whiteboard

Simple

Complex

Tool complexity and relationships
(Nothing is as simple as it seems)

custom code

data workflows, cleaning, storage, and connections

R   Python   D3

Data Factory

Power Automate

interactive data displays

tableau

alteryx

SQL

Power BI   ArcGIS

Adobe
Illustrator, Photoshop, InDesign

Ai   Ps   Id

Microsoft Office

X   W   P

Google
Slides. Sheets. Docs

tablet & stylus

paper, sticky note, whiteboard

Thousands of
online tools!

Simple                                                            Complex

**No tool to rule them all...**

*No single software tool can create every data visualization*

# No single software tool can create every data visualization

custom code

data workflows, cleaning, storage, and connections

interactive data displays

**tableau**

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Simple ← → Complex

No single software tool can
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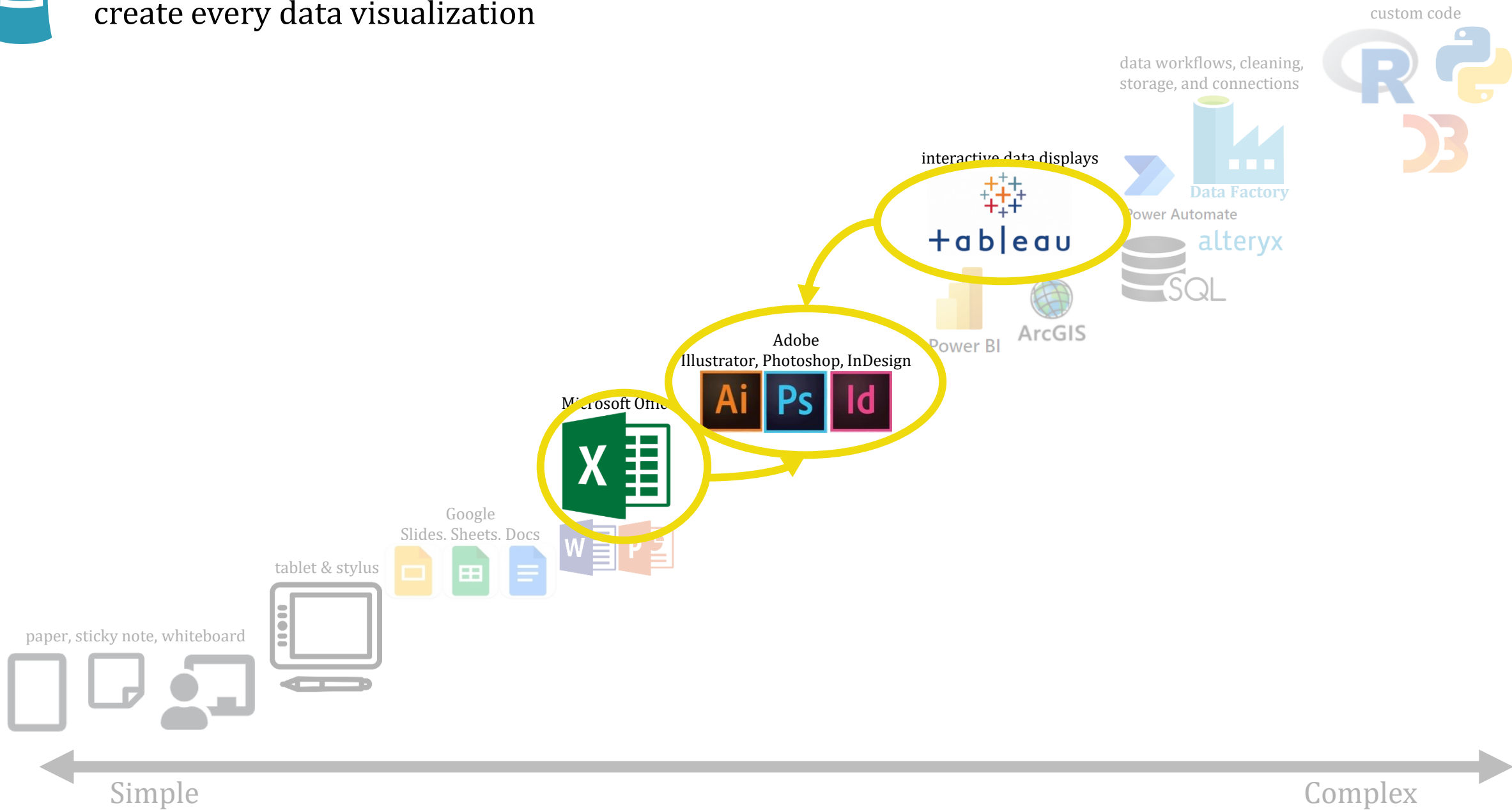
*"even in **R...** I just end up having to
export things as images and then
**tinker with it in PowerPoint."***

interactive data displays

Data Factory

Power Automate

**+ableau**

alteryx

SQL

Power BI    ArcGIS

Adobe
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Simple

Complex
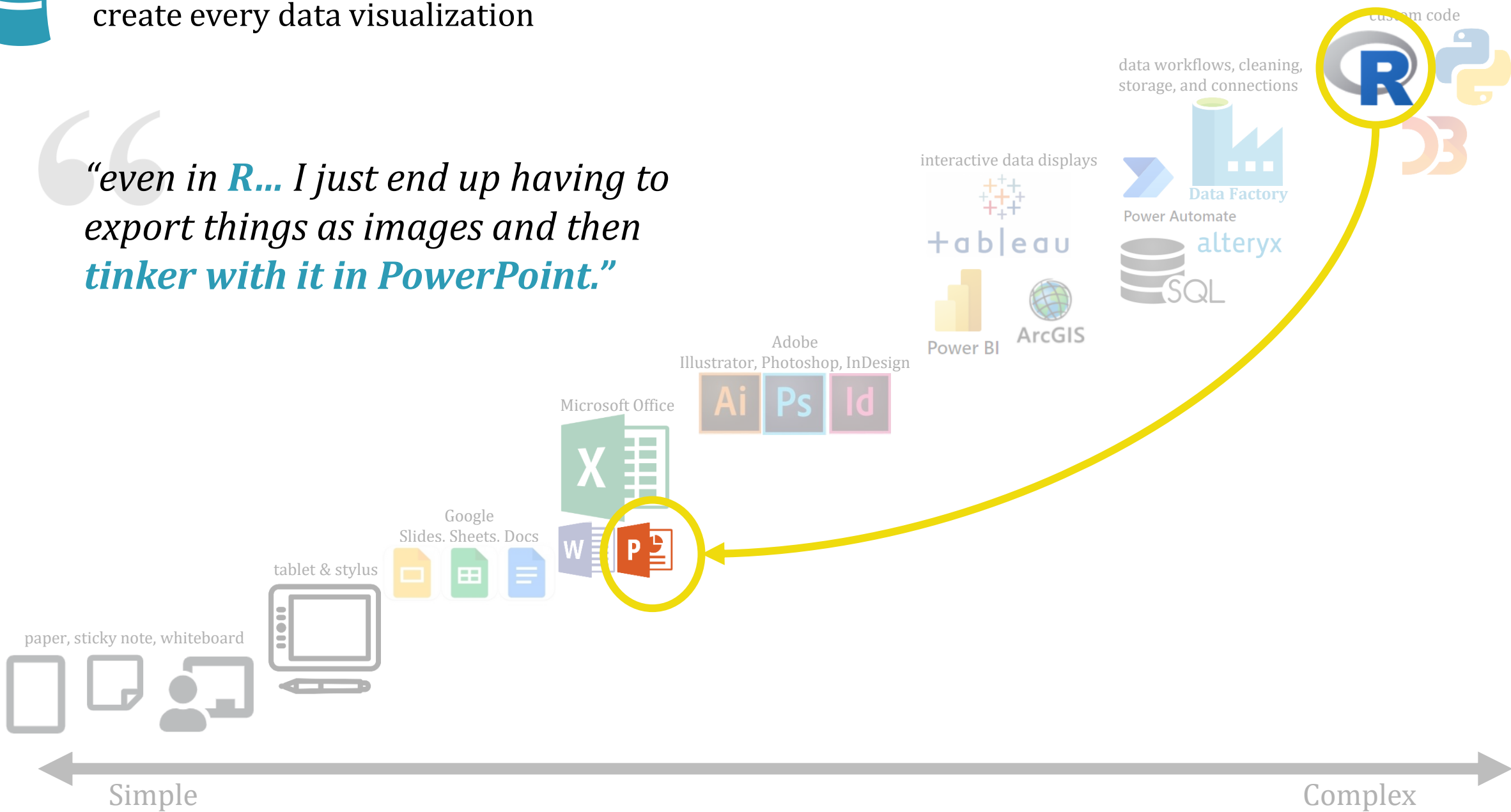
No single software tool can
create every data visualization

**Approaches**

- Use more than one tool

- Back to basics
  - focus on best practice design
  - focus on the visual and telling the story

> "I like to just sit down with a **piece of paper...**
>
> When I get in front of a blank... PowerPoint slide, it's like all the intelligence in my brain **just flies out the window...**
>
> I just feel like this really **big pressure,** like, you have to get the technical part of it right.
>
> And I think it's **easy to get caught up in the technical part and lose the story telling part.**"

No single software tool can
create every data visualization

> "*Actually, a lot of the technical part is just like beyond me, that's why this is a **team effort**.*"

- Use more than one tool

- Back to basics
  - focus on best practice design
  - focus on the visual and telling the story

- Collaborate
  - find others w/skill you need
  - get good at one tool

**No tool to rule them all...**

**Excel is an embarrassing king**

*Excel is king, and maybe people are embarrassed to use it*

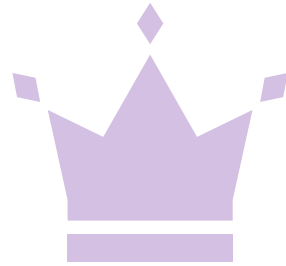*"The [client] wouldn't have it. They were **too embarrassed to use Excel**. [They decided to rebuild] it in Tableau."*

"*The **world runs on Microsoft,** just get over it.*

*And also, not everybody needs to create an interactive swoop-diddy-doopity thing. So, not everybody needs JavaScript.*

*And **everybody has Excel.**"*

**No tool to rule them all…**

**Excel is an embarrassing king**

**Financial cost of software licenses**

Financial cost of software licenses

- Tableau is expensive
  - small orgs & non-profits
  - international work



*"I don't think we could afford licenses for Tableau for everybody, and it wouldn't be an organizational priority, **because we have Excel,** we can just use that, we have other tools that come standard, we can just use those."*

# Financial cost of software licenses

- Tableau is expensive
  - small orgs & non-profits
  - international work

- Use Excel

- Statistics packages are expensive

- Use Excel

> "*SPSS is definitely my language of choice, but... unless I'm working for a university none of my employers have it.*
>
> *...**I don't have thousands of dollars for a statistics license...** but most of my clients don't need fancy statistics... So, most of them I can **just do right in Excel.** And it's fine.*"
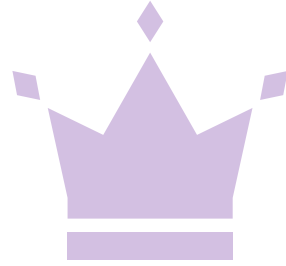
Financial cost of software licenses

- Tableau is expensive
  - small orgs & non-profits
  - international work

- Statistics packages are expensive

- **Capacity building**

- Use Excel

- Use Excel

- Use Excel

" *"It made sense to align with the tool that they would be using internally as part of the goal of this was* **capacity** *development."*

No tool to rule them all...

Excel is an embarrassing king

Financial cost of software licenses

**Software envy**

*Participants frequently expressed interest in learning newer, more expensive, or more difficult software*

Software envy

- Genuine limitations

> "I can't actualize what I'm thinking in my head and I have to go with a more moderate version of what I intended… **not having the programming skills** to be able to do what I want to be able to do."

> *"If I knew how to write code more,*
> I could probably do a lot more."

# Software envy

- Genuine limitations

- Curiosity about what others are doing

" *"I think it might be interesting to talk to some big data science people who do data visualization, because I think their process is a little bit **more sophisticated than evaluators** because they use things like Python to process big data. And I'm **kind of curious..."***

## Software envy

- Genuine limitations

- Curiosity about what others are doing

- Wished learned earlier

" *"[I] wish I had seen what* **tool kits** *were coming."*

*"I wish I had learned* **JavaScript years ago…"**

*"…learning* **R** *earlier on."*

*"I wish that I had known* **how important [ETL]** *was to the process, and had the opportunity to become more proficient with those earlier on."*

Software envy

custom code

data workflows, cleaning, storage, and connections

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interactive data displays

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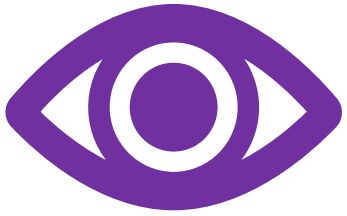
**Audience: Visual literacy**

**Stakeholders**

**Tools to create visuals**

# Thank you!

- Questions?

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Audience:
Visual
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# Key References

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