



Would You Like a Chart with That?

Incorporating Visualizations into Conversational Interfaces

Marti Hearst University of California, Berkeley*

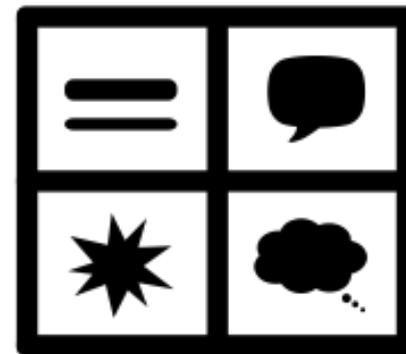
Melanie Tory Tableau Software

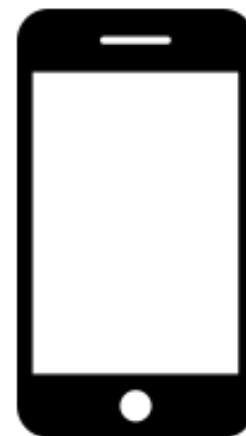
* Work conducted while Hearst was a visiting researcher at Tableau Research

Language vs Images: 2 Different Cognitive Channels

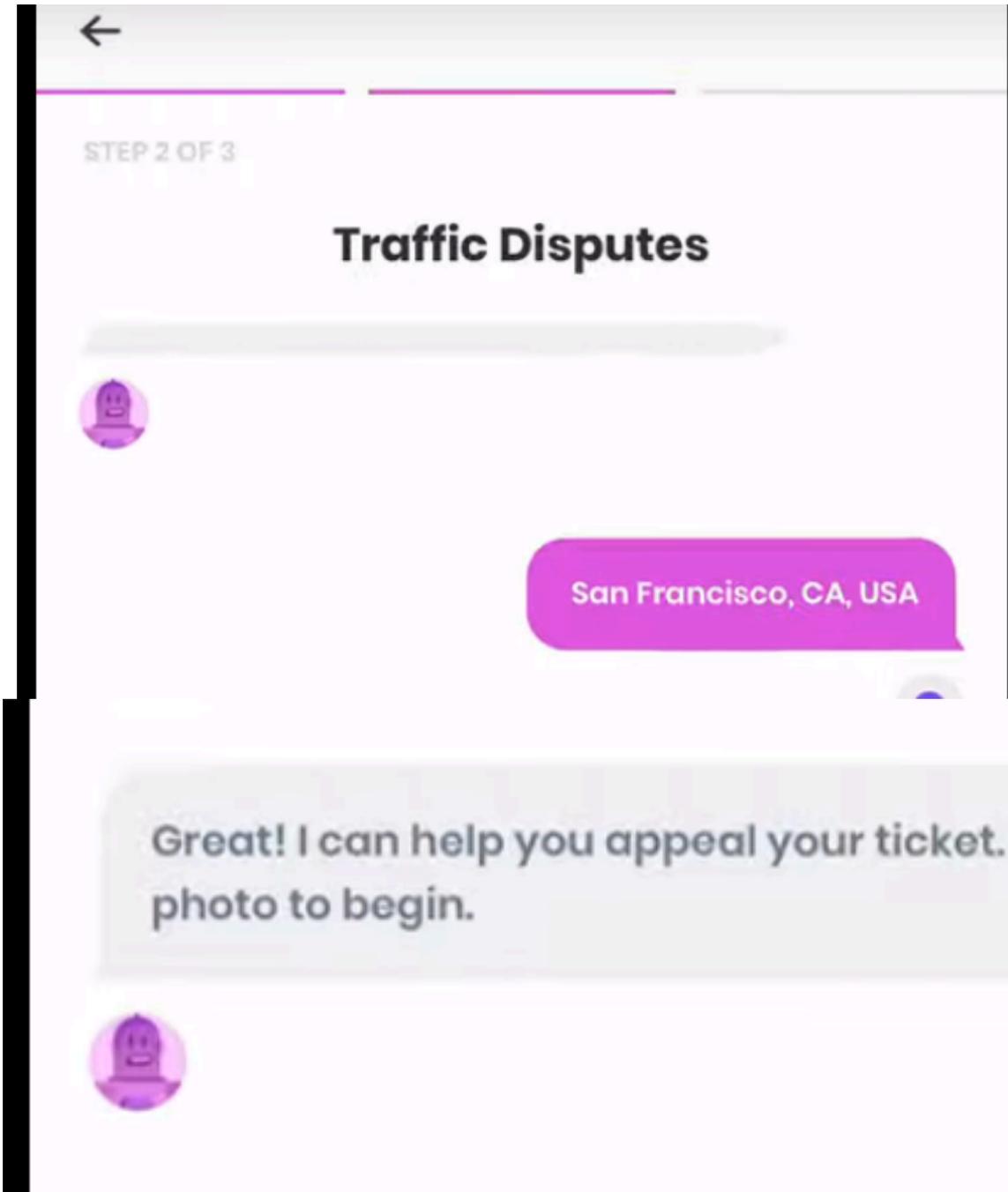
**All Language,
No Images**

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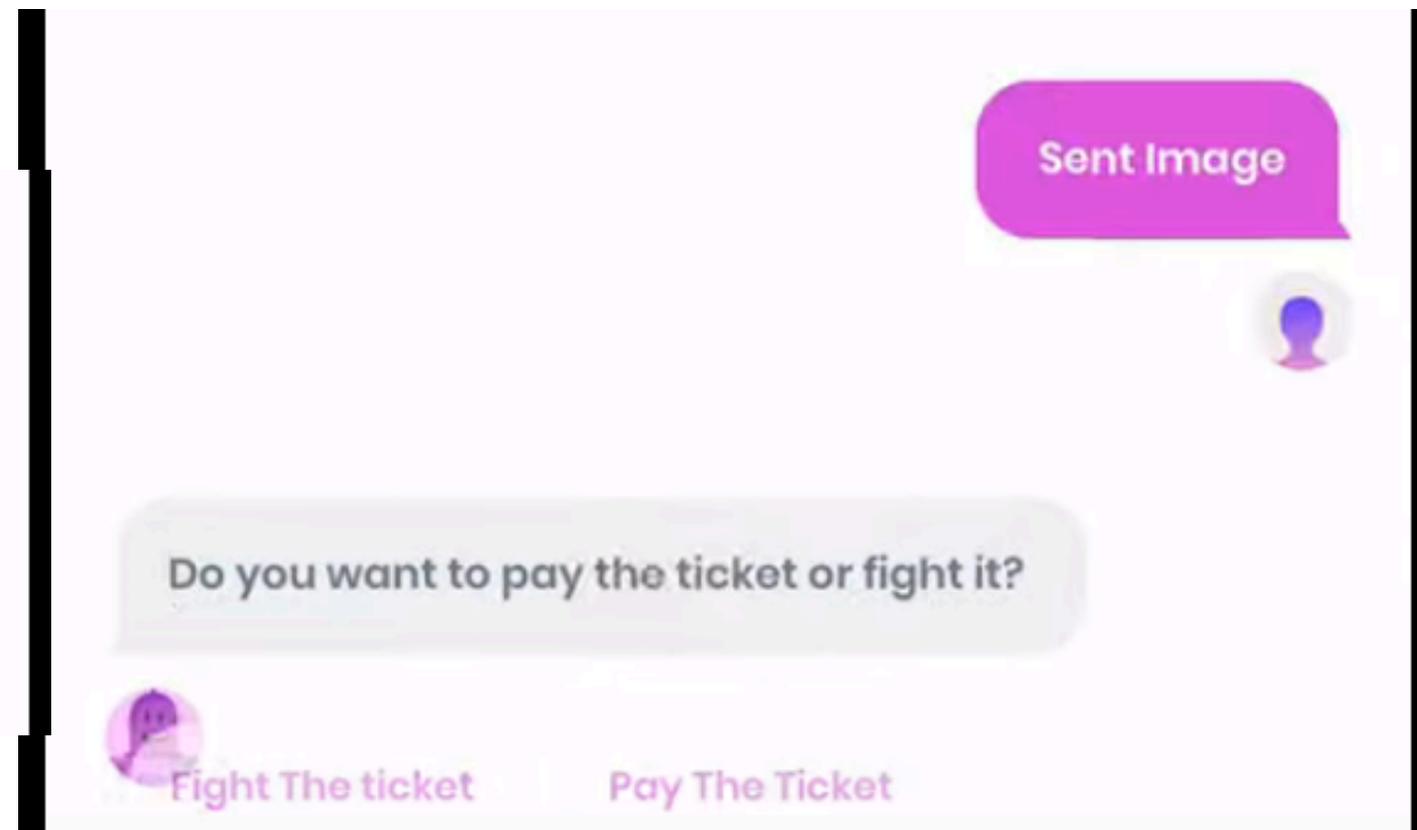




Chat interfaces have good affordances for small screens



Example: The Do Not Pay chatbot helps fill out complex paperwork.

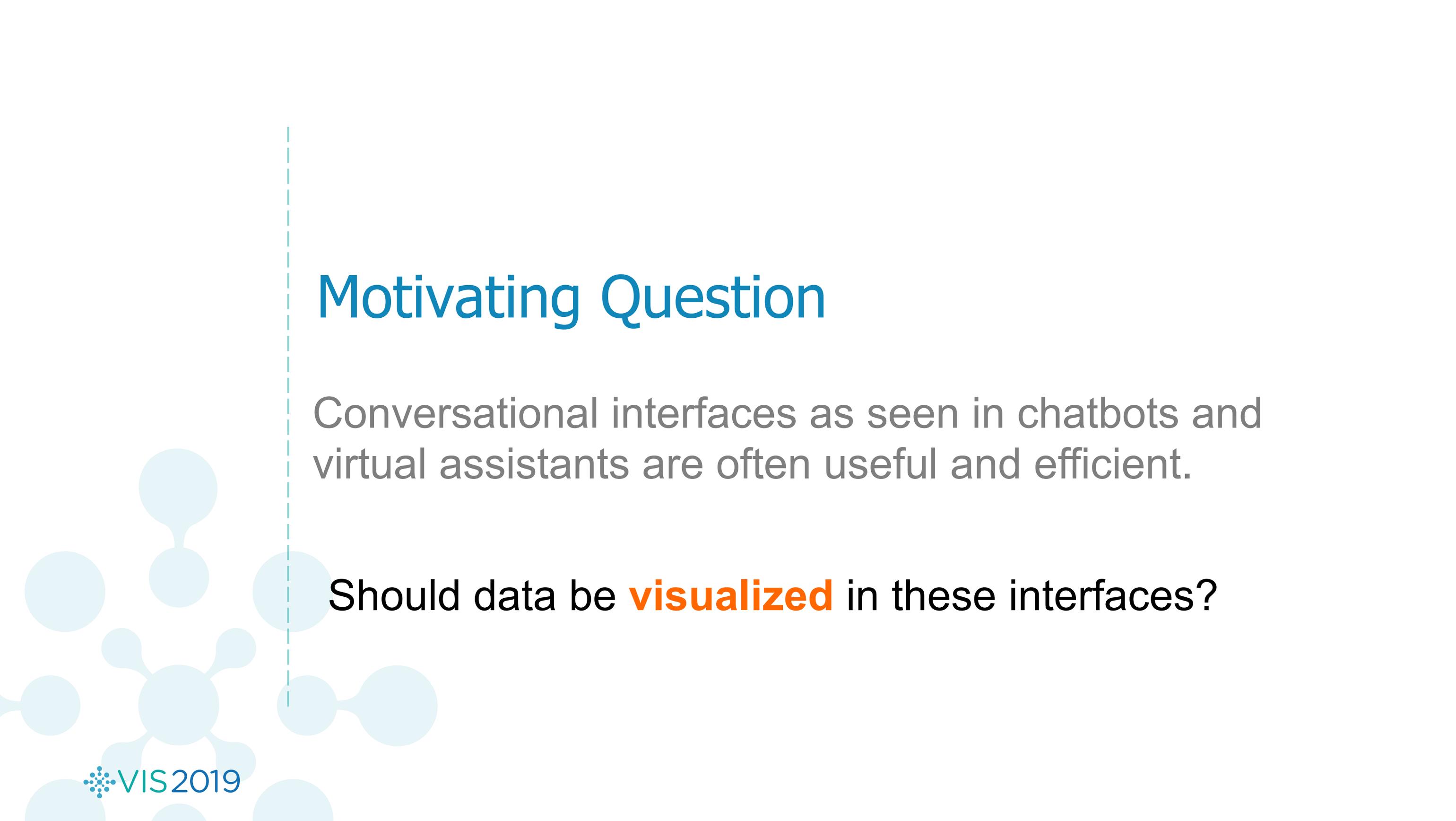


Chatbots Can Be Productivity Tools

Why people use chatbots, Brandtzaeg and Folstad, INSCI 2017

Reason	N
Productivity	100
Entertainment	29
Social/relational	18
Novelty/Curiosity	15
Other	12

Screening question: “Chatbots are automated online services that you interact with in text-based conversations, typically in instant messaging platforms such as Facebook Messenger, Kik, Slack, and Telegram. Have you used such chatbots? N=146



Motivating Question

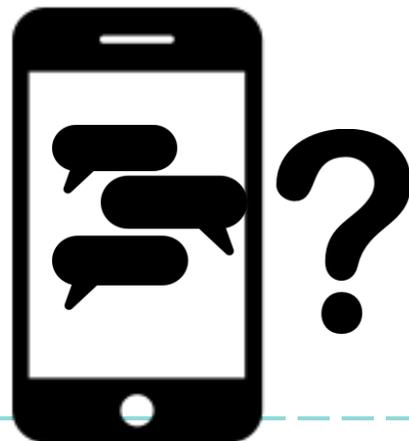
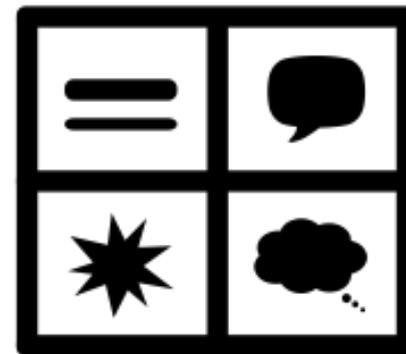
Conversational interfaces as seen in chatbots and virtual assistants are often useful and efficient.

Should data be **visualized** in these interfaces?

Language vs Images: 2 Different Cognitive Channels

**All Language,
No Images**

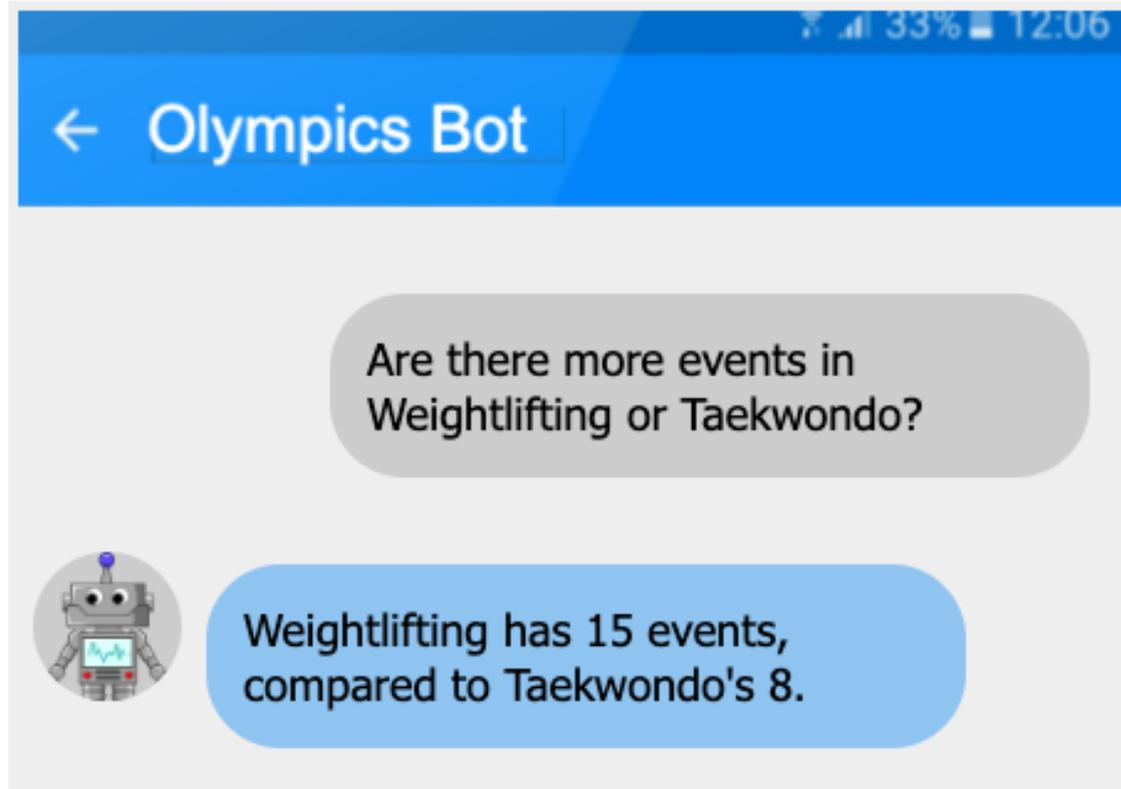
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Experiments to Determine Preferences

- Three kinds of questions:
 - Comparatives
 - Superlatives (e.g., most least)
 - Trend
- Showed designs both **with** and **without** visualizations

Comparison Question: Are there more events in x than y?

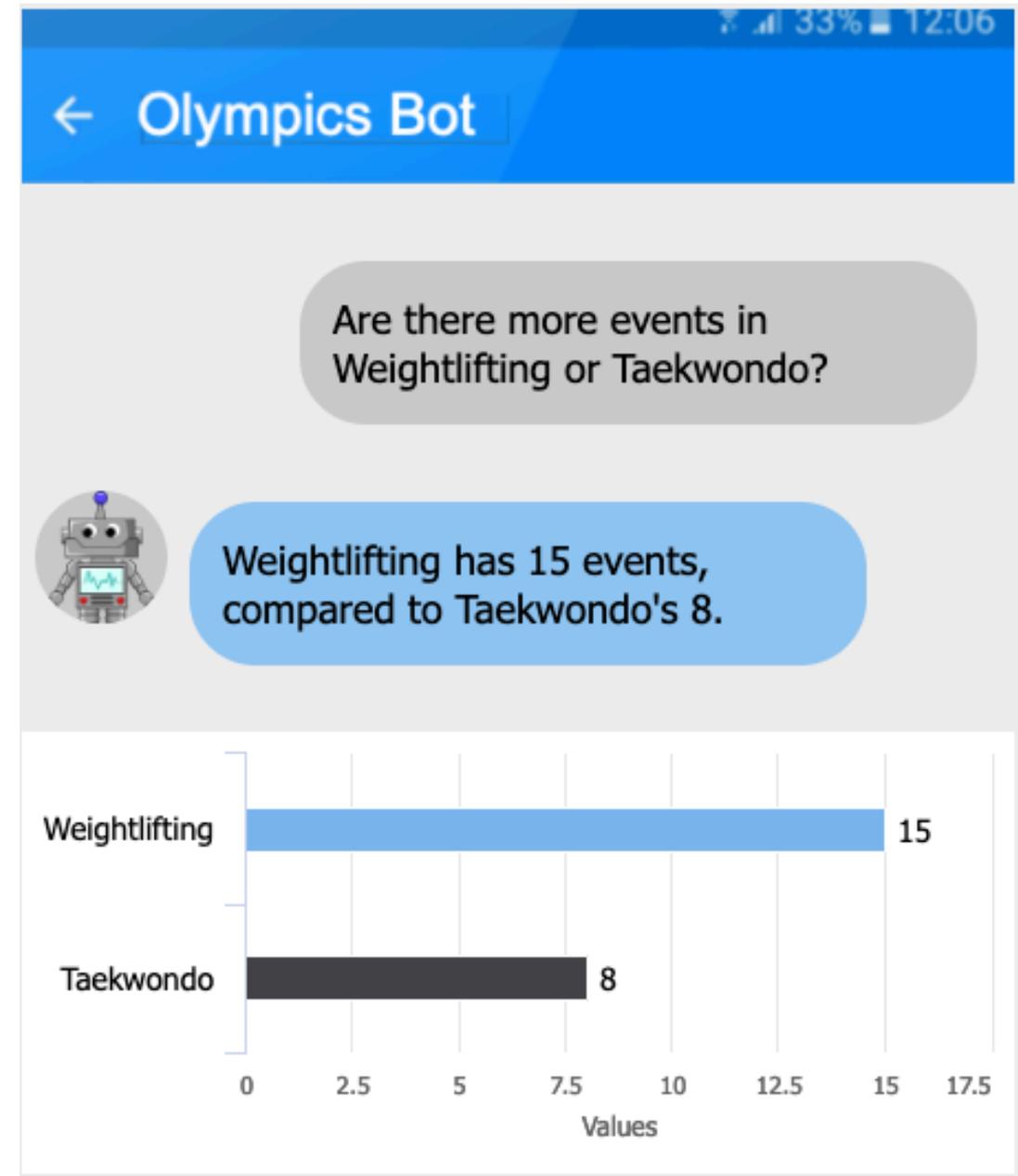


← Olympics Bot

Are there more events in Weightlifting or Taekwondo?

Weightlifting has 15 events, compared to Taekwondo's 8.

This screenshot shows a chat interface with a blue header containing a back arrow and the text "Olympics Bot". Below the header, a grey speech bubble contains the question "Are there more events in Weightlifting or Taekwondo?". A blue speech bubble with a robot icon on the left contains the answer "Weightlifting has 15 events, compared to Taekwondo's 8." The status bar at the top shows 33% battery and 12:06.



← Olympics Bot

Are there more events in Weightlifting or Taekwondo?

Weightlifting has 15 events, compared to Taekwondo's 8.

Event	Number of Events
Weightlifting	15
Taekwondo	8

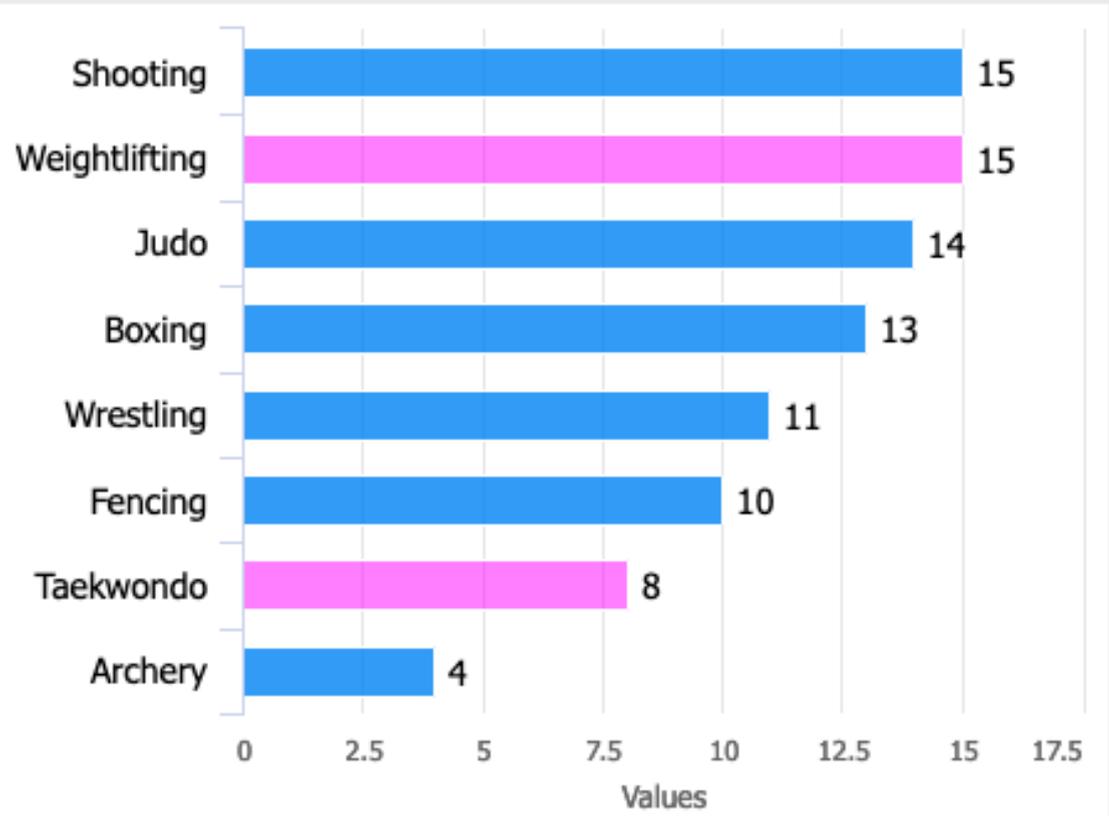
Values

This screenshot is similar to the first one but includes a bar chart at the bottom. The chart has a horizontal axis labeled "Values" ranging from 0 to 17.5 with increments of 2.5. There are two bars: a blue bar for "Weightlifting" with a value of 15, and a black bar for "Taekwondo" with a value of 8. The status bar at the top shows 33% battery and 12:06.

Are there more events in Weightlifting or Taekwondo?



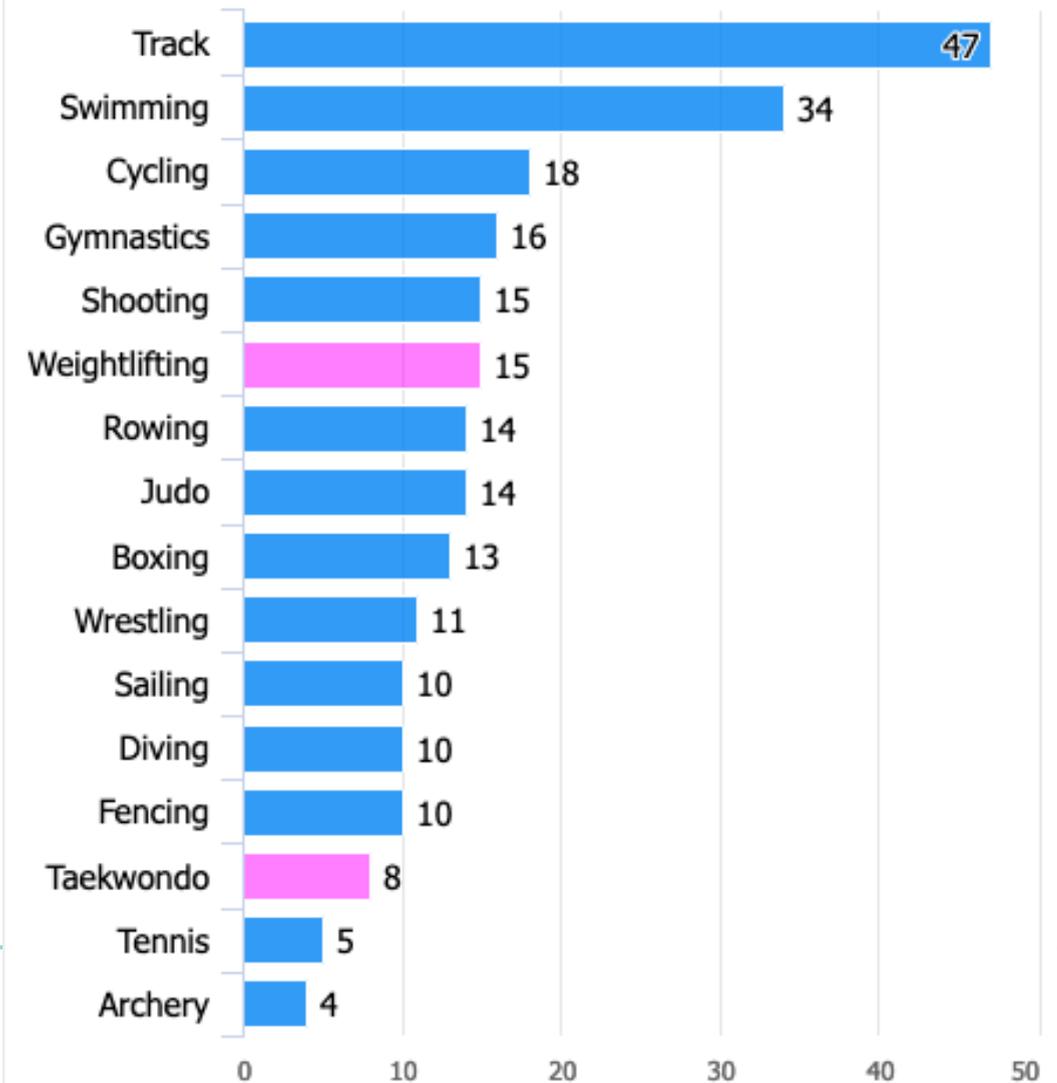
Weightlifting has 15 events, compared to Taekwondo's 8. Check out this chart:



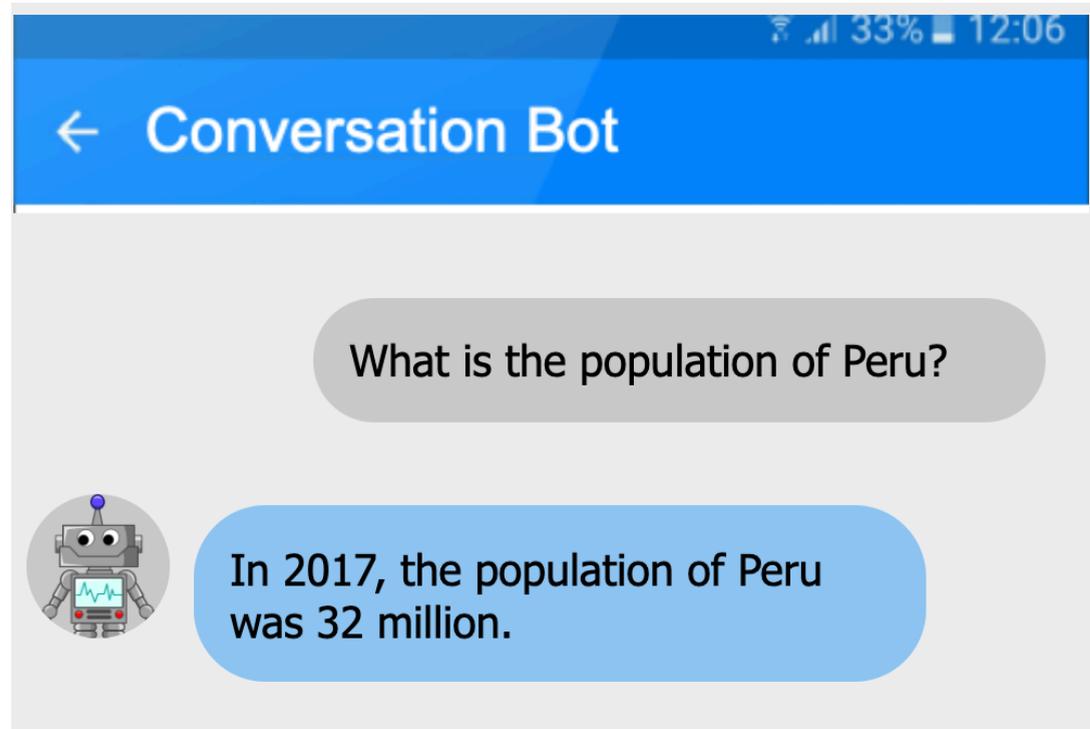
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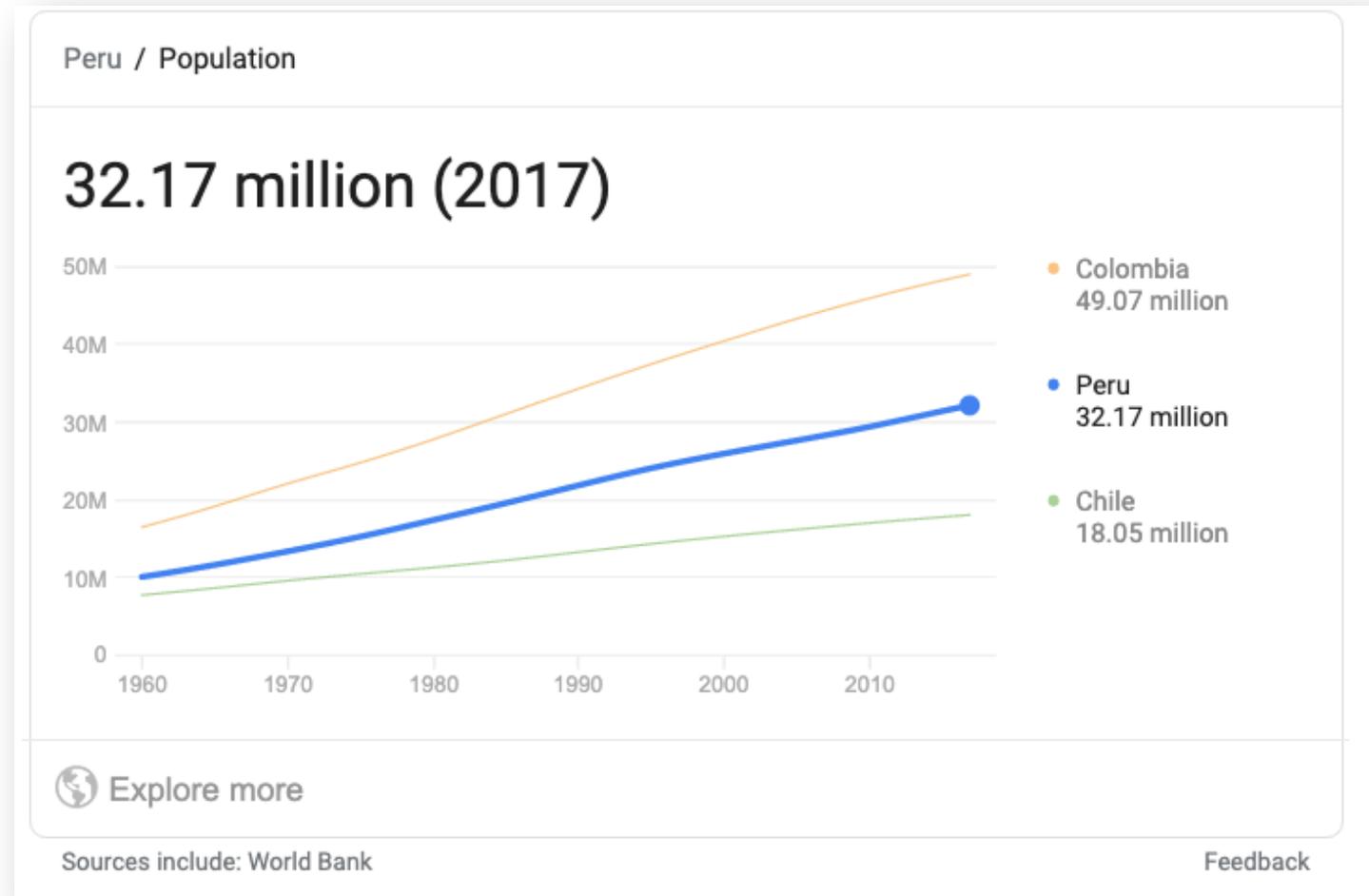
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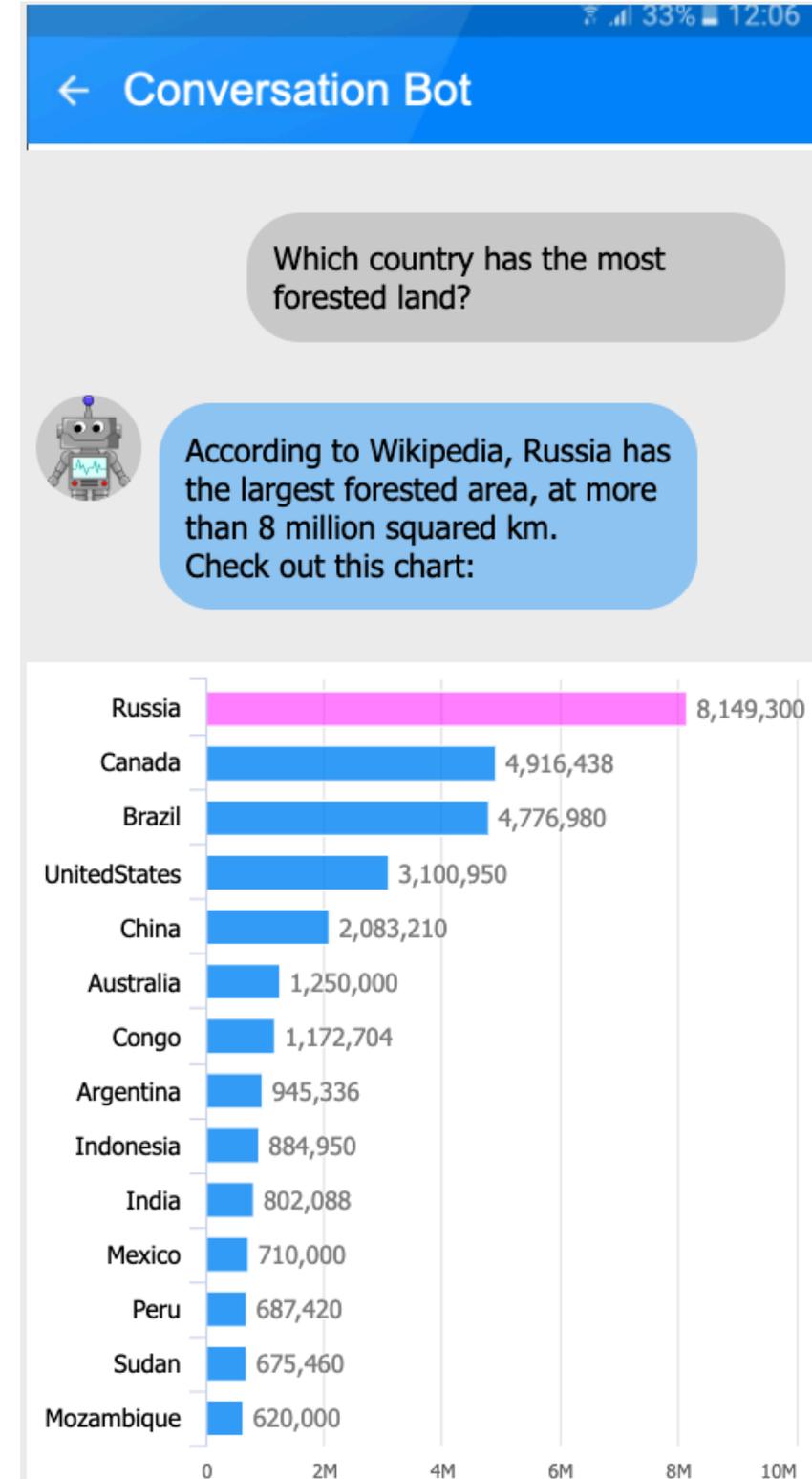
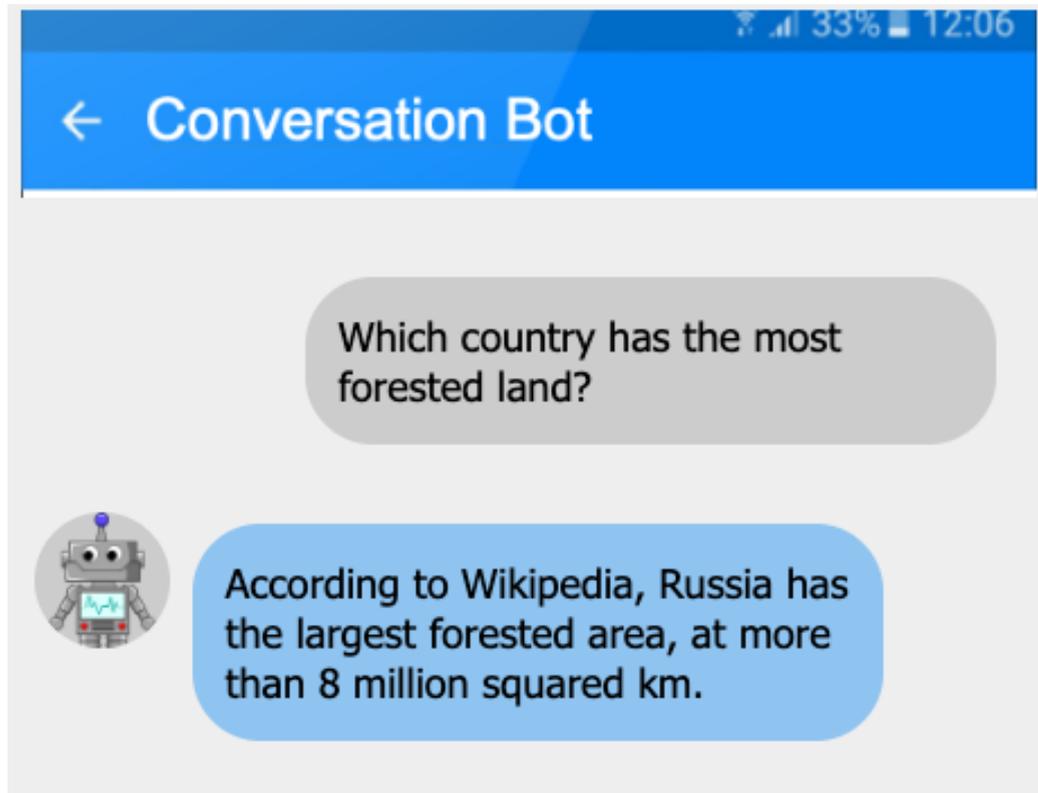
Trend Question: What is the population of Peru?



This is how Google answers:



Superlative Question: Which country has the most forested land?



Method

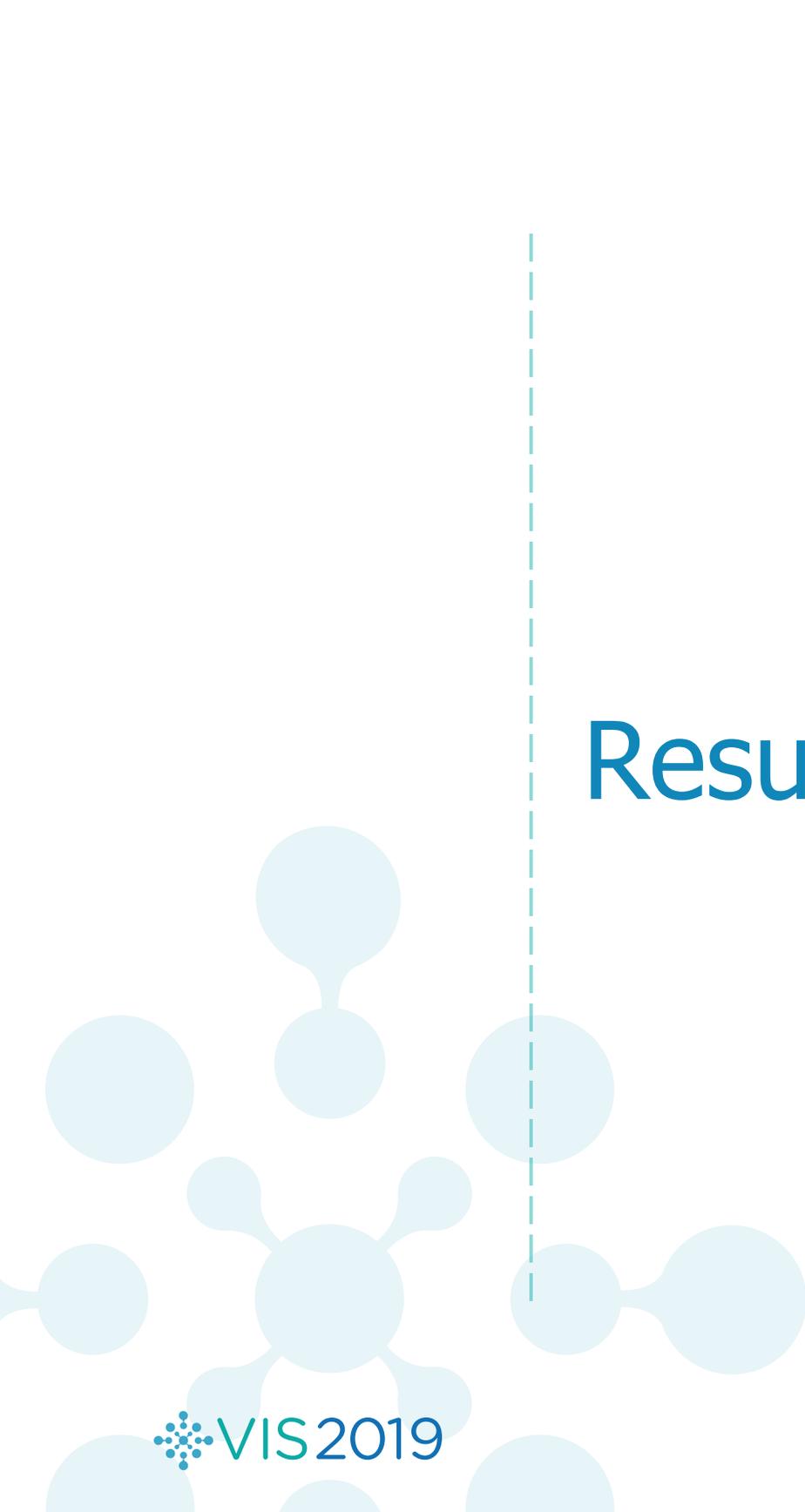
- Hired Crowdworkers (AMT)
- Defined a set of questions and answers
- Compared 4 visualization types within participants
 - 2 text based
 - 2 text + visualizations
- Each participant completed only two tasks
 - Select their preferred response out of 4
 - Responded to Likert-scale questions

- Pretesting determined:**
- **Text question variations**
 - **Likert scale responses**

3 Subjective Response Questions

Strongly Disagree ... Disagree ... Neutral ... Agree ... Strongly Agree

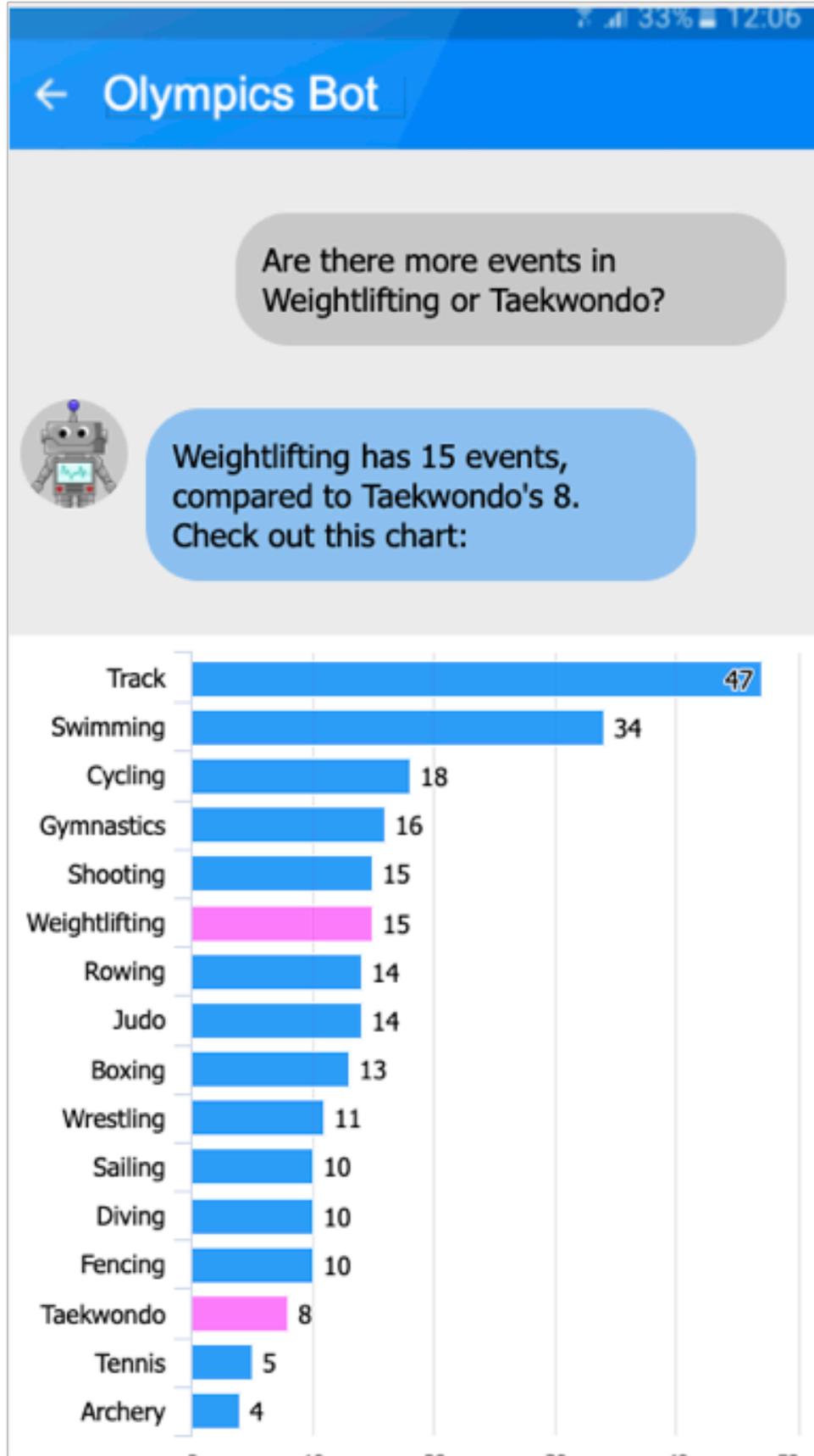
1. The view I selected provides exactly the information I asked for and nothing else.
2. The view I selected provides additional information beyond what I asked for that is potentially relevant.
3. I made my selection in part because I like charts and graphs.



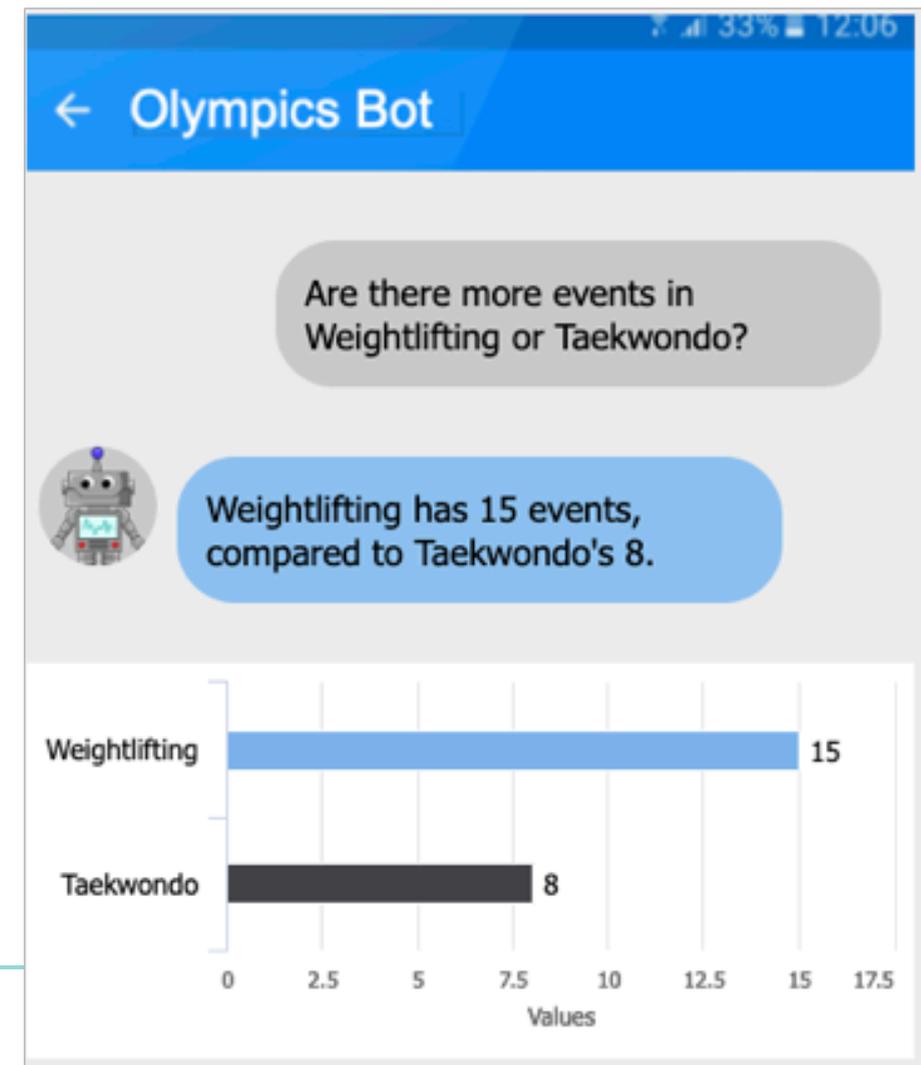
Results

41% of participants did not want to see viz's in chat.

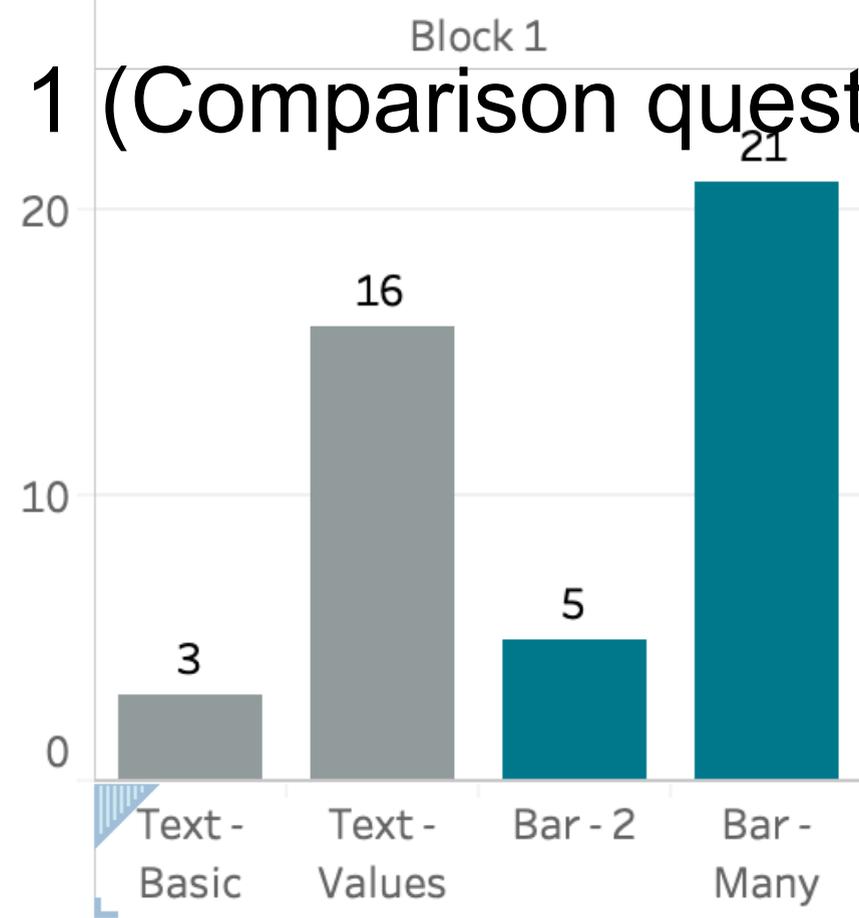




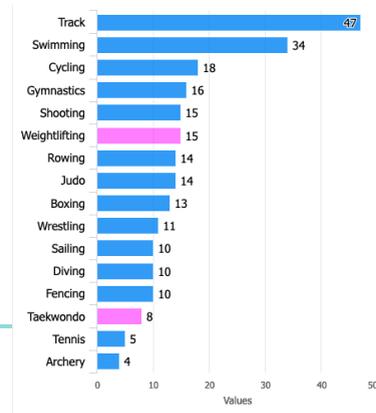
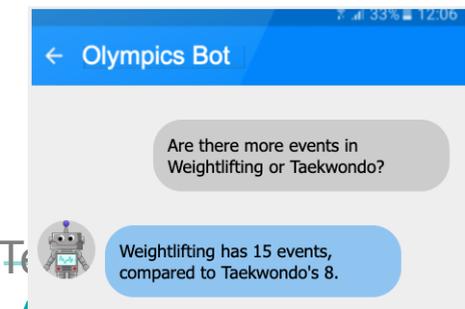
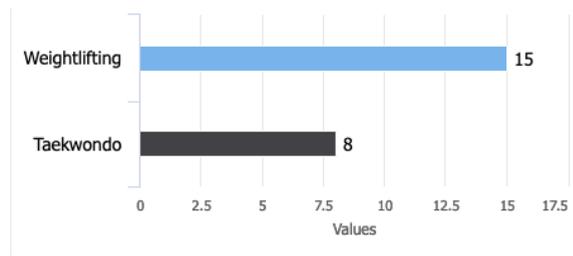
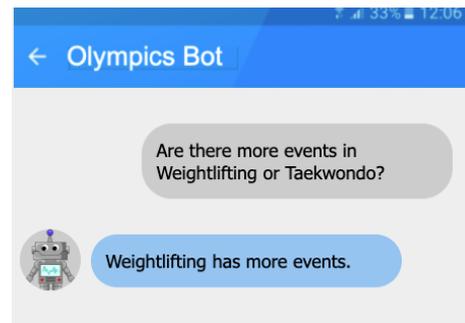
Those who wanted to see visualizations tended to prefer more context over less.

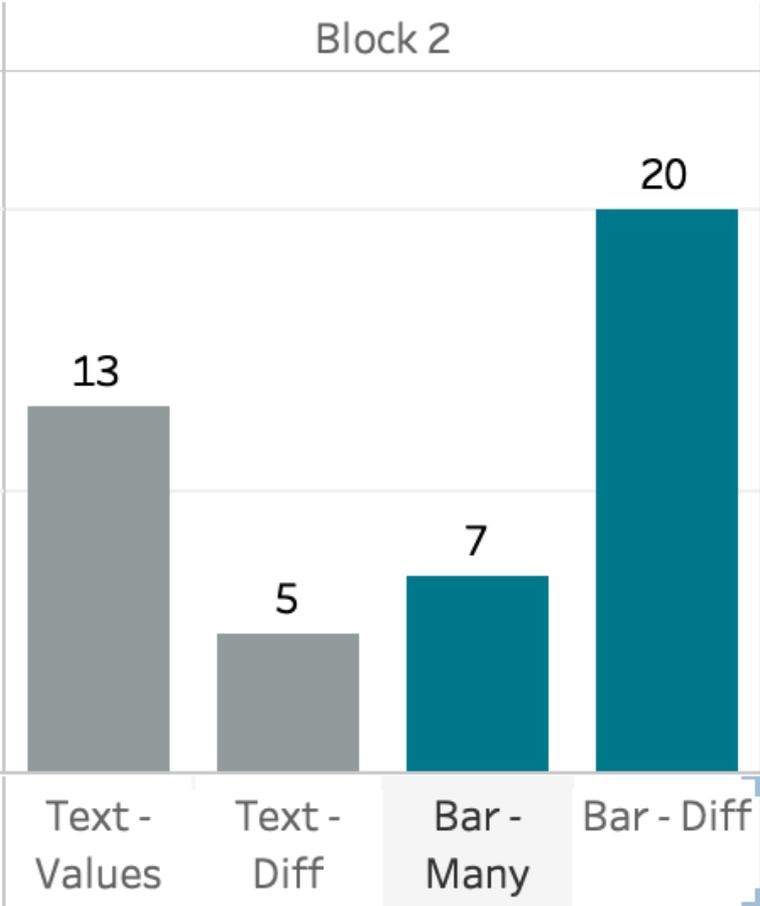


Study 1 (Comparison questions)

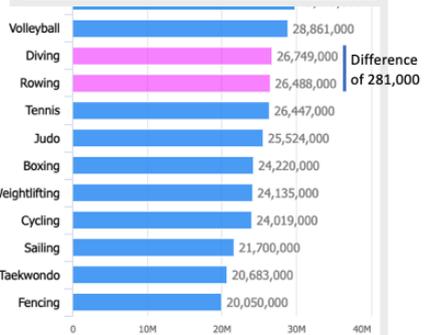
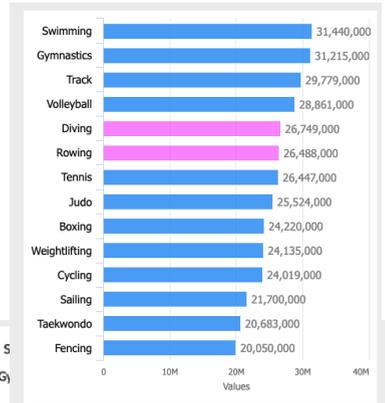
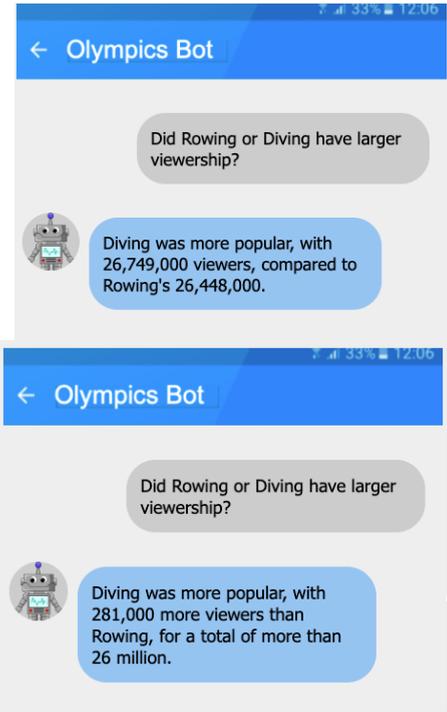


Observed a distinct and reproducible split between those who think text is enough and those who want the additional information provided by charts.

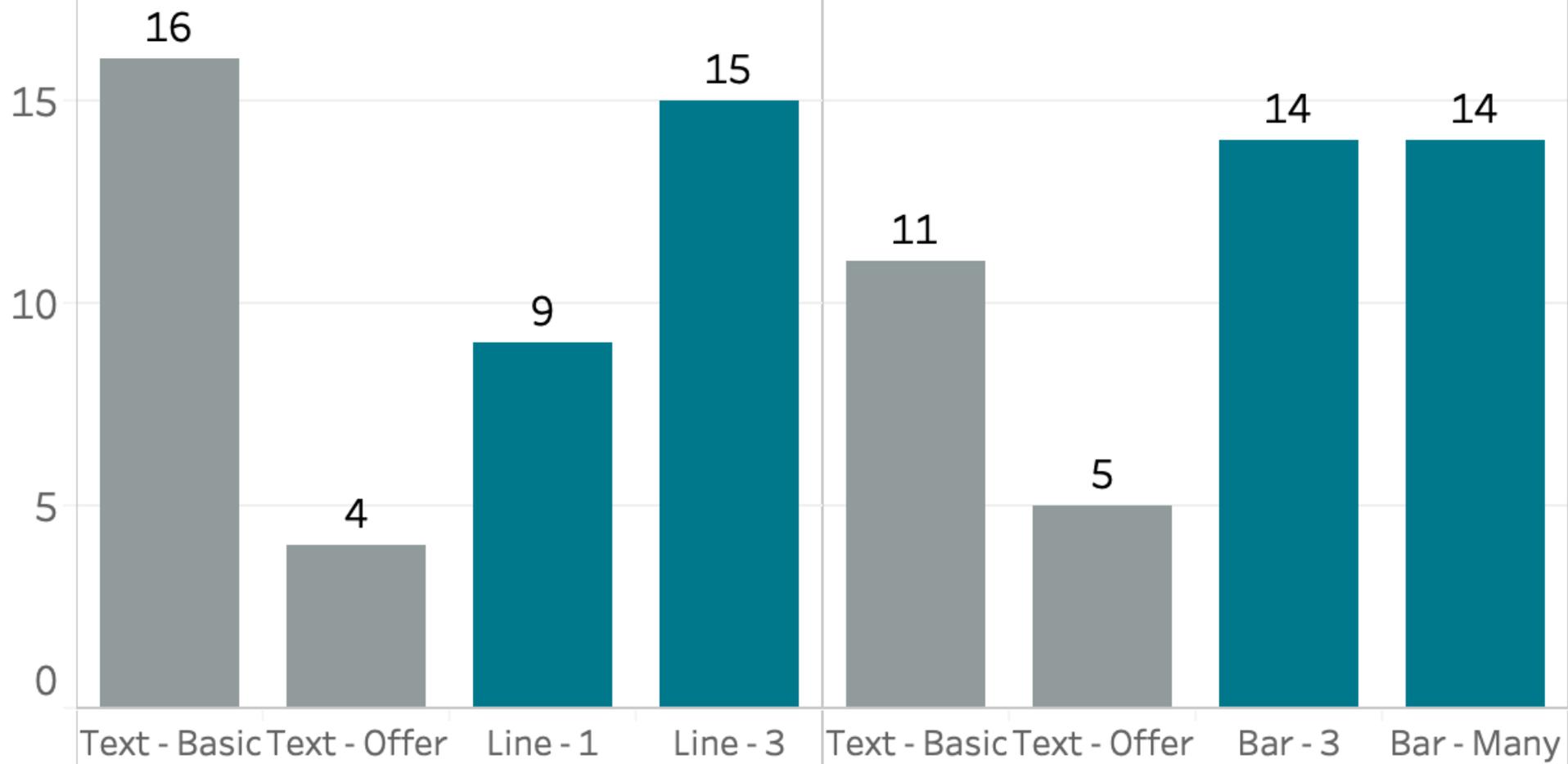




Observed a distinct and reproducible split between those who think text is enough and those who want the additional information provided by charts.



Study 2 (Trend and Superlative Questions)



Study 2:
Very similar pattern
to Study 1,
suggesting a robust
finding.

Main difference is 5
people who switched
from text to chart.

Reasons for Choices?

Choose **Charts**:

- Usually preferred more bars over a few:
 - “At first I thought I wanted a simple answer ... But after seeing [more bars], I realized I really liked getting the answer in context.”

Choose **Text**:

- Liked the simplicity; felt the charts were extraneous:
 - “It’s precise and gives me enough details without too many details or too few.”
 - “It was the easiest to understand and the answer was not overly complicated.”

Why did people switch from text to chart?

[Before switching]

“The line graphs offer too much information.”

[After switching]

“In this situation, I think [Bar-3] is better because it shows us a graph. I think this is necessary because we are comparing stats rather than asking for a specific one.”

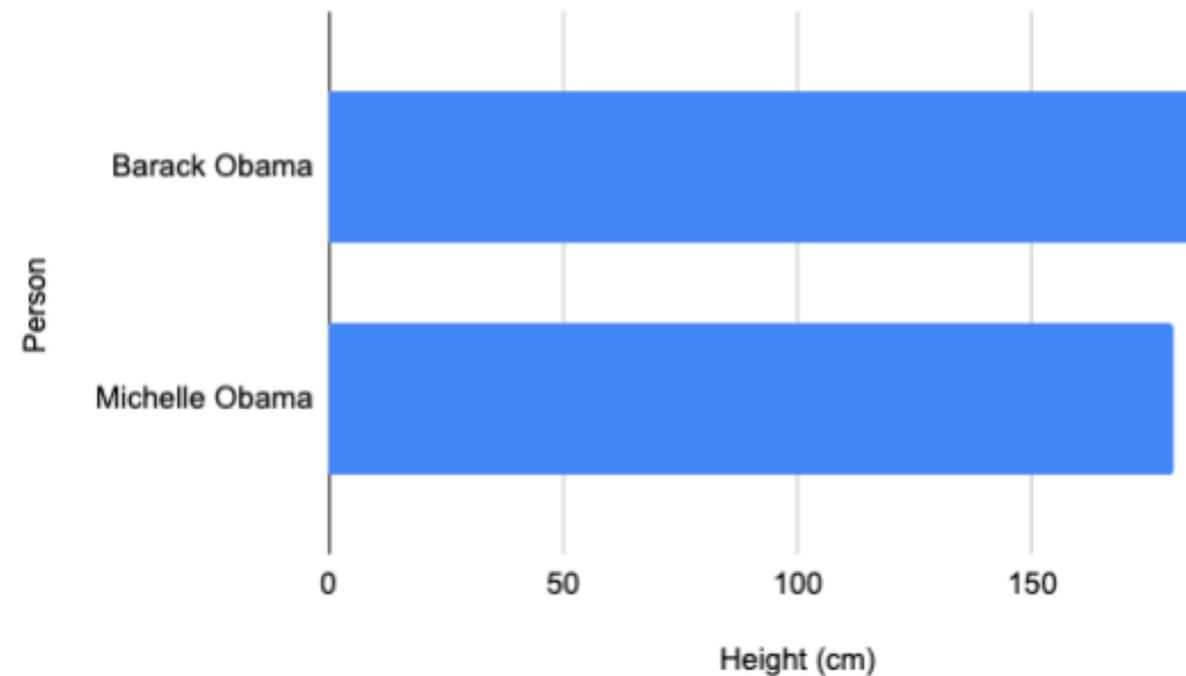
Conclusions

- Core Results:
 - **Found a strong bifurcation in personal preferences for seeing charts vs not in a chatbot conversational context (60/40 split).**
 - **Those who do want to see charts want to see additional context beyond directly answering the question.**
- Additionally:
 - Found preliminary evidence that certain question types cause preference to change from no-chart to chart; in particular, a superlative (“most”) question.
 - Further research needed to uncover additional nuances about personal preferences vs context

Implications: Make charts more approachable?

Who is taller, Barack or Michelle Obama?

Height (cm) vs. Person



Implications

- Need ways to make charts approachable
- May need to personalize the experience