Would You Like a Chart with That?
Incorporating Visualizations into Conversational Interfaces

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Language vs Images: 2 Different Cognitive Channels

All Language, No Images

All Images, No Language
Natural language interfaces for visual analytics are appearing.
Chat interfaces have good affordances for small screens

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

Great! I can help you appeal your ticket. Snap a photo to begin.

Do you want to pay the ticket or fight it?

Fight The ticket  Pay The Ticket
Chatbots Can Be Productivity Tools

Why people use chatbots, Brandtzaeg and Folstad, INSCI 2017

<table>
<thead>
<tr>
<th>Reason</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Productivity</strong></td>
<td>100</td>
</tr>
<tr>
<td>Entertainment</td>
<td>29</td>
</tr>
<tr>
<td>Social/relational</td>
<td>18</td>
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<tr>
<td>Novelty/Curiosity</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
</tr>
</tbody>
</table>

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?
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VIS2019
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?

Weightlifting has 15 events, compared to Taekwondo's 8.
Are there more events in Weightlifting or Taekwondo?

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

- Shooting: 15
- Weightlifting: 15
- Judo: 14
- Boxing: 13
- Wrestling: 11
- Fencing: 10
- Taekwondo: 8
- Archery: 4

Track: 47
Swimming: 34
Cycling: 18
Gymnastics: 16
Shooting: 15
Weightlifting: 15
Rowing: 14
Judo: 14
Boxing: 13
Wrestling: 11
Sailing: 10
Diving: 10
Fencing: 10
Taekwondo: 8
Tennis: 5
Archery: 4
Trend Question:
What is the population of Peru?

This is how Google answers:

In 2017, the population of Peru was 32 million.
Superlative Question:
Which country has the most forested land?

According to Wikipedia, Russia has the largest forested area, at more than 8 million squared km.
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

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.
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.
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: 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

Barack Obama

Michelle Obama

Google sheets

Implications

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