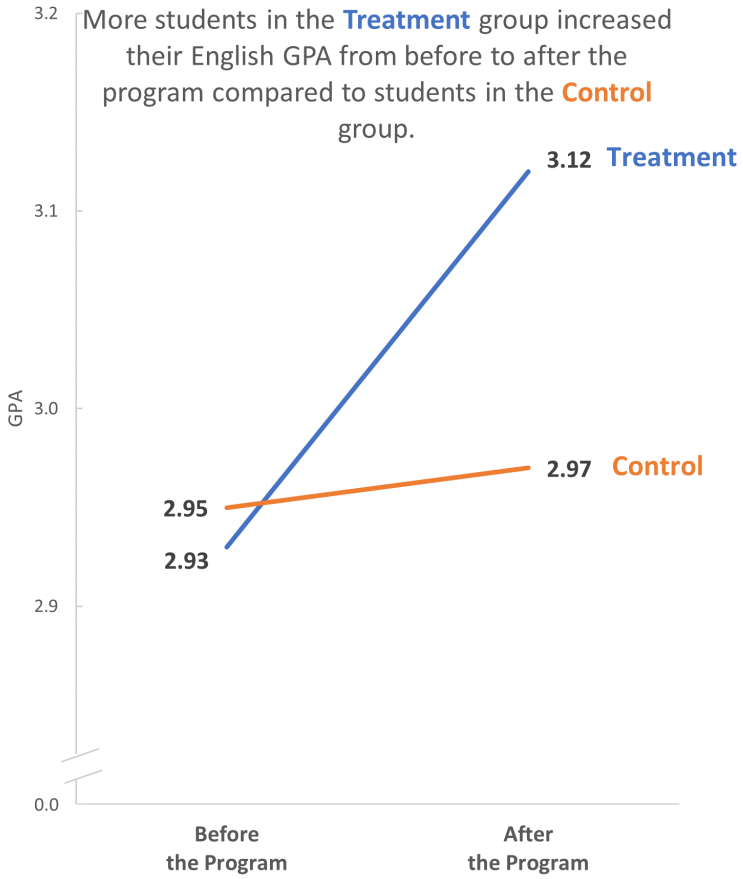
The American Evaluation Association

Evaluation Conference THURSDAY, NOVEMBER 1, 2018 Free to Attendees

"TITLE GOES HERE"



How Informational Titles Affect our Visualizations

By Dana Linnell Wanzer, Tarek Azzam, Natalie Jones, Darrel Skousen, Ciara Knight, and Agnieszka Rykaczewska

Informational titles are short and informative titles that help our audience quickly grasp the message of graphs and are a key recommendation for improving our data visualizations. However, we know little about how effective informational titles are, particularly in terms of how they affect users' accuracy of interpretation, the length of time and amount of effort it takes for them to understand the visualization, perceptions of credibility and aesthetics, and their overall usefulness.

This presentation discusses findings from a study that compared graphs with descriptive titles or with informational titles to determine how effective informational titles are for improving our visualizations.

CEC Evaluation Research and Practice Lab (ERP)

Enhancing the Effectiveness of Logic Models

Natalie Jones, Tarek Azzam, Dana Linnell Wanzer, Darrel Skousen, Ciara Knight, and Nina Sabarre

The effort we put into making data visualizations more interpretable pays off in more efficient engagement with the products of our evaluation endeavors.

– Evergreen & Metzner (2013)

Data Visualization Checklist

by Stephanie Evergreen & Ann K. Emery
May 2016

This checklist is meant to be used as a guide for the development of high impact data visualizations. Rate each aspect of the data visualization by circling the most appropriate number, where 2 points means the guideline was fully met, 1 means it was partially met, and 0 means it was not met at all. n/a should not be used frequently, but reserved for when the guideline truly does not apply. For example, a pie chart has no axes lines or tick marks to rate. If the guidelines has been broken intentionally to make a point, rate it n/a and deduct those points from the total possible. Refer to the Data Visualization Anatomy Chart on the last page for guidance on vocabulary and the Resources at the end for more details.

	Guideline	Rating
Text Graphs don't contain much text, so existing text must encapsulate your message and pack a punch.	**6-12 word descriptive title is left-justified in upper left corner** Short titles enable readers to comprehend takeaway messages even while quickly skimming the graph. Rather than a generic phrase, use a descriptive sentence that encapsulates the graph's finding or "so what?" Western cultures start reading in the upper left, so locate the title there.	2 1 0 n/a
	Subtitle and/or annotations provide additional information Subtitles and annotations (call-out text within the graph) can add explanatory and interpretive power to a graph. Use them to answer questions a viewer might have or to highlight specific data points.	2 1 0 n/a
	Text size is hierarchical and readable Titles are in a larger size than subtitles or annotations, which are larger than labels, which are larger than axis labels, which are larger than source information. The smallest text - axis labels - are at least 9 point font size on paper, at least 20 on screen.	2 1 0 n/a
	Text is horizontal Titles, subtitles, annotations, and data labels are horizontal (not vertical or diagonal). Line labels and axis labels can deviate from this rule and still receive full points. Consider switching graph orientation (e.g., from column to bar chart) to make text horizontal.	2 1 0 n/a
	Data are labeled directly Position data labels near the data rather than in a separate legend (e.g., on top of or next to bars and next to lines). Eliminate/embed legends when possible because eye movement back and forth between the legend and the data can interrupt the brain's attempts to interpret the graph.	2 1 0 n/a
	Labels are used sparingly Focus attention by removing the redundancy. For example, in line charts, label every other year on an axis. Do not add numeric labels *and* use a y-axis scale, since this is redundant.	2 1 0 n/a

Source: Evergreen & Emery (2016) Data Visualization Checklist

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	Subtitle and/or annotations provide additional information	2 1 0 n/a
	titles, subtitles, annotations, and data labels are horizontal (not vertical or diagonal). Line labels and axis labels can deviate from this rule and still receive full points. Consider switching graph orientation (e.g., from column to bar chart) to make text horizontal.	
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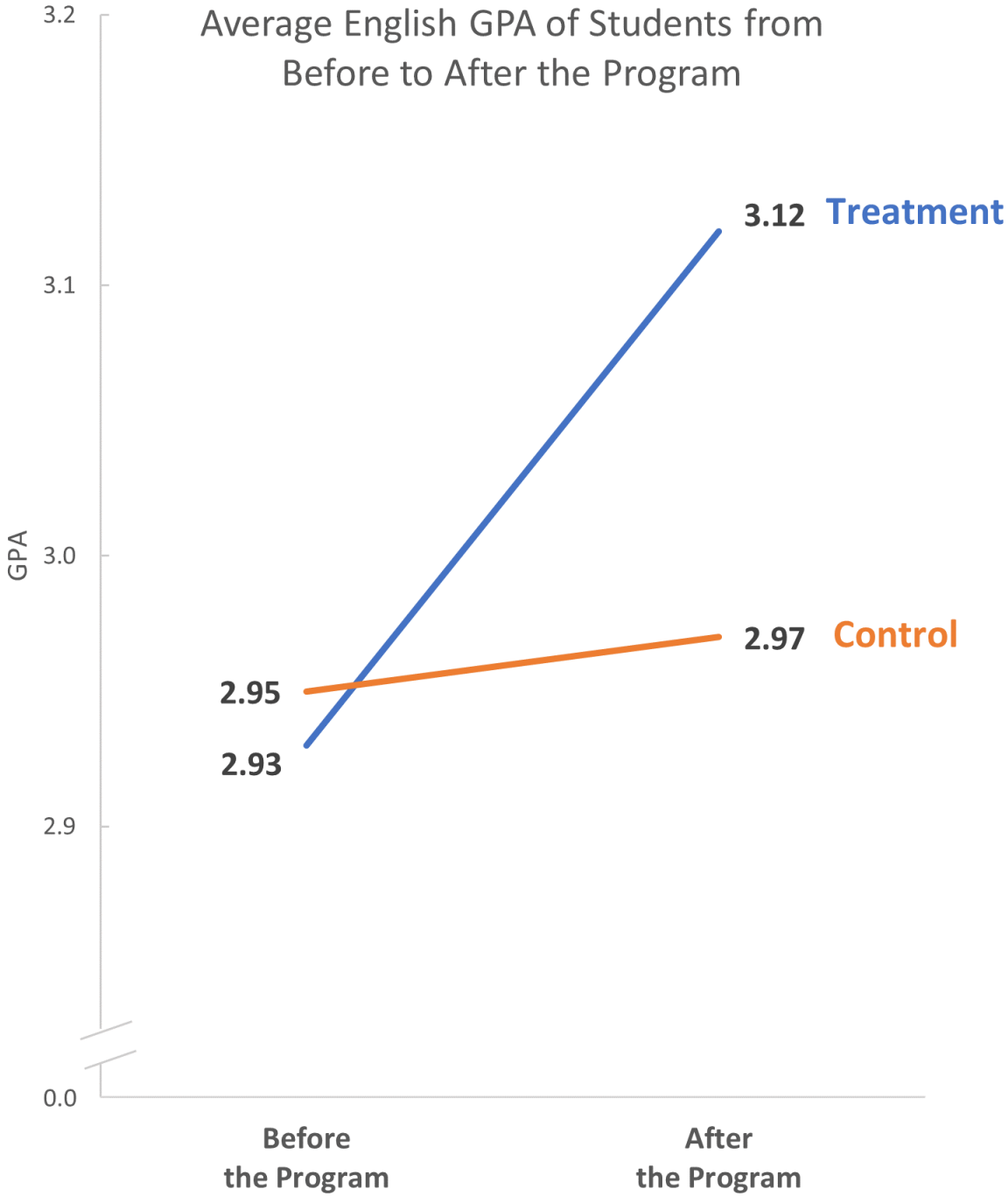
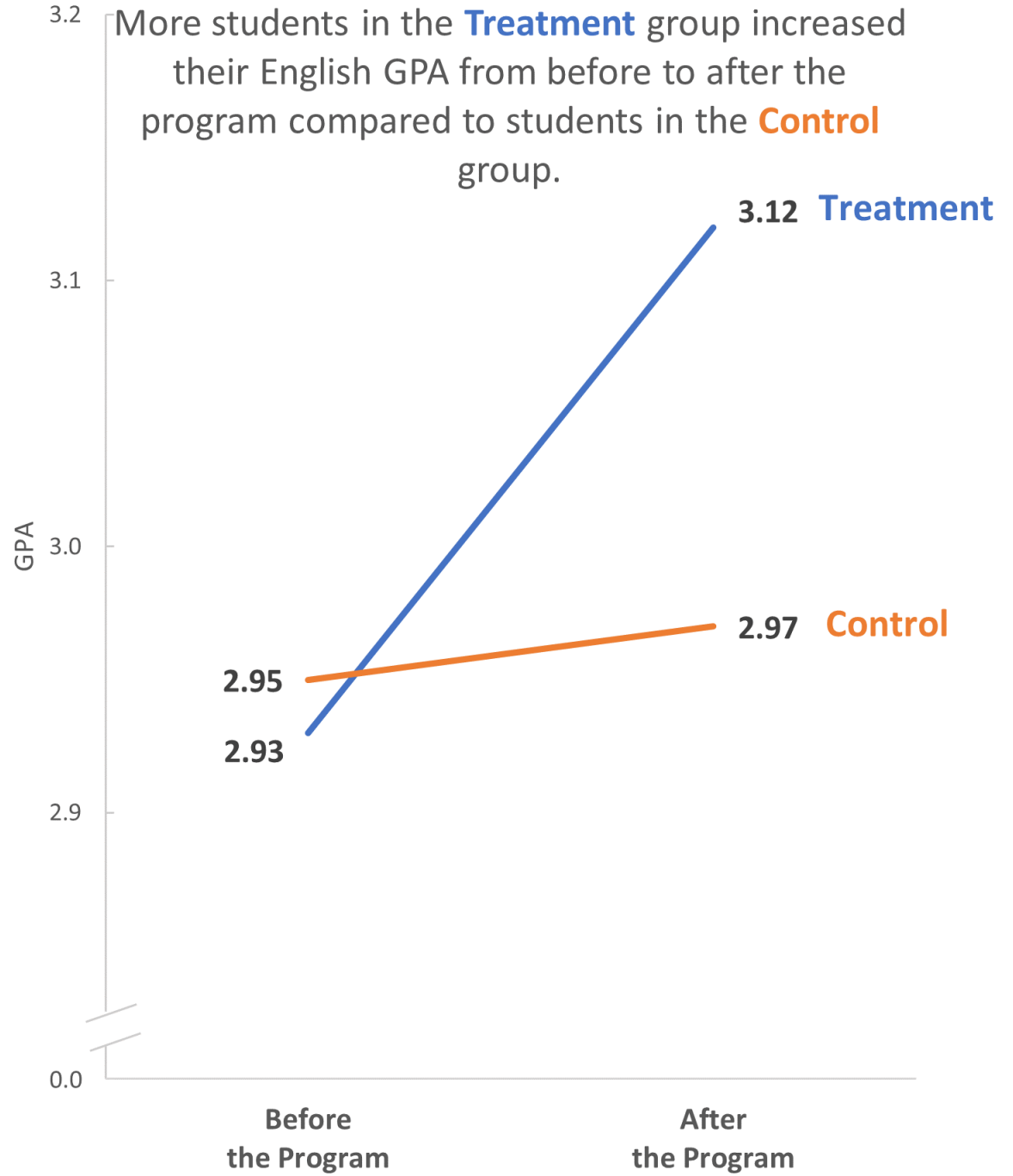
6-12 word descriptive title is left-justified in upper left corner
Short titles enable readers to comprehend takeaway messages even while quickly skimming the graph. Rather than a generic phrase, use a descriptive sentence that encapsulates the graph's finding or "so what?" Western cultures start reading in the upper left, so locate the title there.

Source: Evergreen & Emery (2016) Data Visualization Checklist


Average English GPA of Students from Before to After the Program
3.2
3.1
3.0
2.9
0.0
GPA
3.12
Treatment
2.97
Control
2.95
2.93
Before the Program
After the Program


More students in the Treatment group increased their English GPA from before to after the program compared to students in the Control group.
3.2
3.1
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Control
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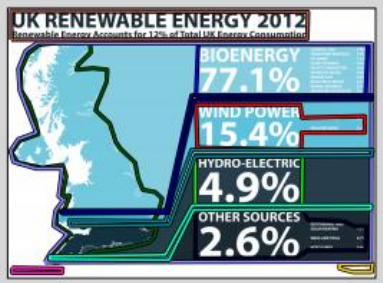
2.93
Before the Program
After the Program

Beyond Memorability: Visualization Recognition and Recall

Michelle A. Borkin*, *Member, IEEE*, Zoya Bylinskii*, Nam Wook Kim, Constance May Bainbridge, Chelsea S. Yeh, Daniel Borkin, Hanspeter Pfister, *Senior Member, IEEE*, and Aude Oliva

Experiment Design

Labeled Visualization Database

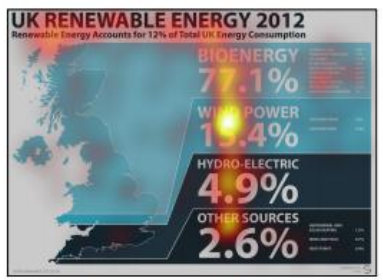


393 visualizations

Visualizations are taken from [8], and the label taxonomy described in Table 1 is applied.

Encoding

100 "target" visualizations

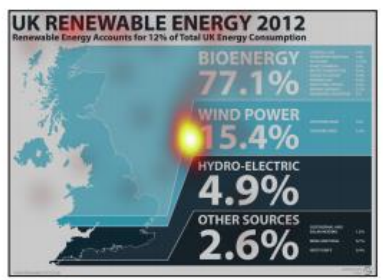


10 seconds / image

Output:
Eye-tracking fixation locations and durations.

Recognition

Same 100 targets + 100 "fillers"



2 seconds / image

Output:
Eye-tracking fixation locations and durations, and whether visualization is recognized.

Recall

Correctly recognized blurred targets

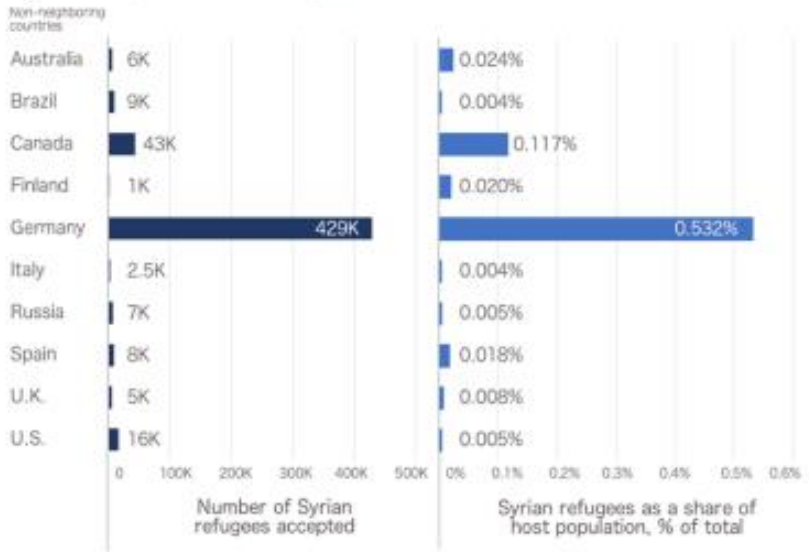
20 min - as many images as participant can complete

Output:
Text descriptions of what participant recalls about the visualization.

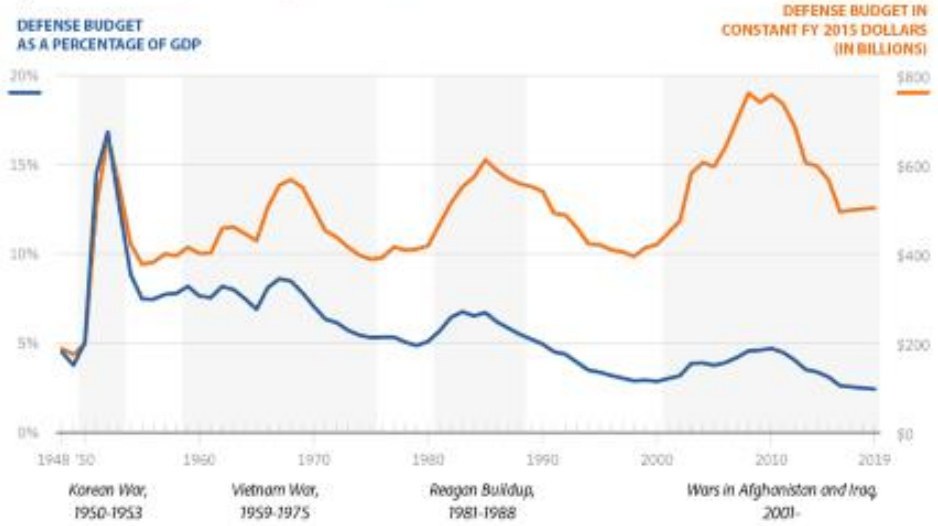
Frames and Slants in Titles of Visualizations on Controversial Topics

Ha-Kyung Kong[1], **Zhicheng Liu**[2], **Karrie Karahalios**[1,2]
[1]University of Illinois at Urbana-Champaign, [2]Adobe Research
hkong6@illinois.edu, {leoli, karrie}@adobe.com

a) [Syrian refugees visualization title]

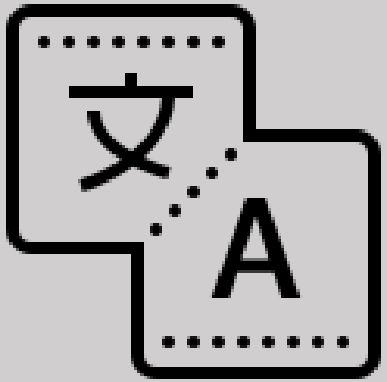


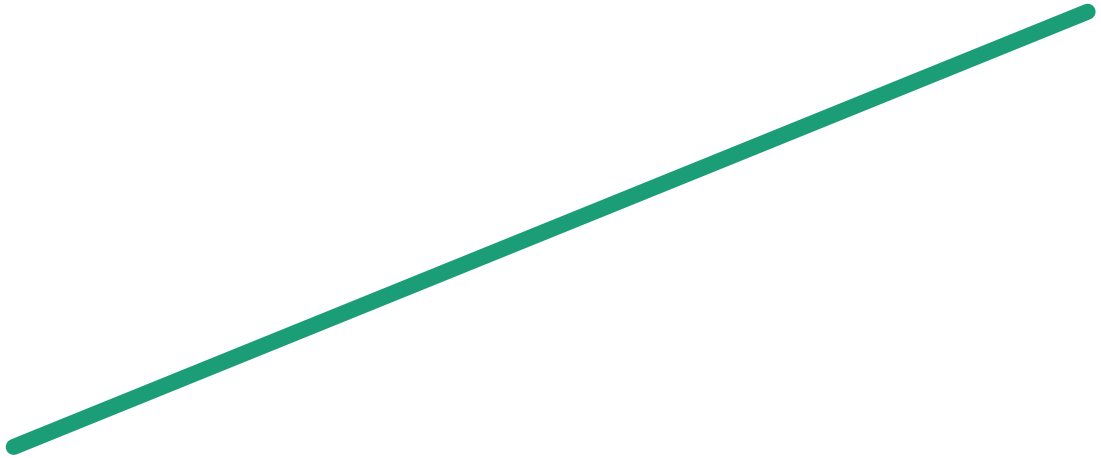
b) [Military budget visualization title]



Studies on the impact of titles on visualizations have been scarce despite the integral role titles play in visualizations. (p. 2)

What can good titles do?

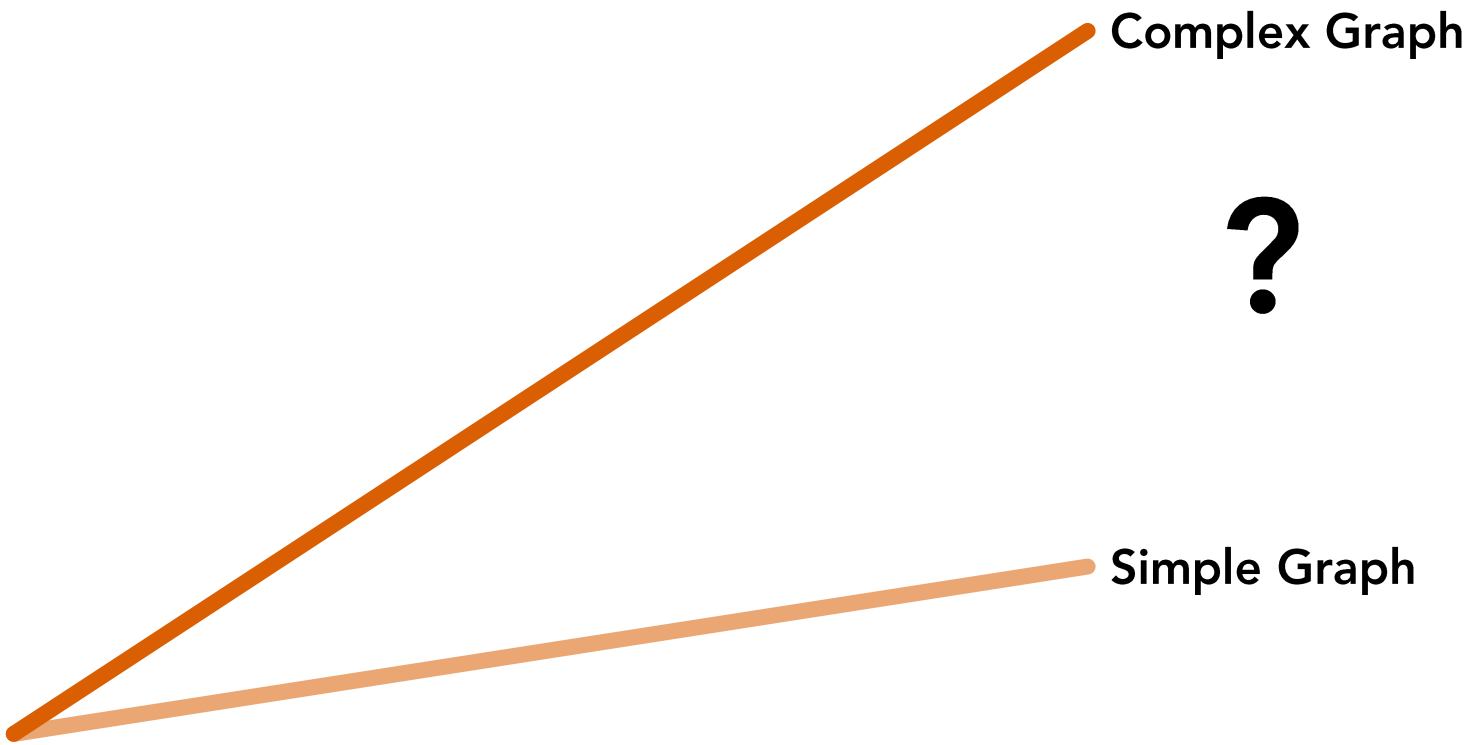




Descriptive

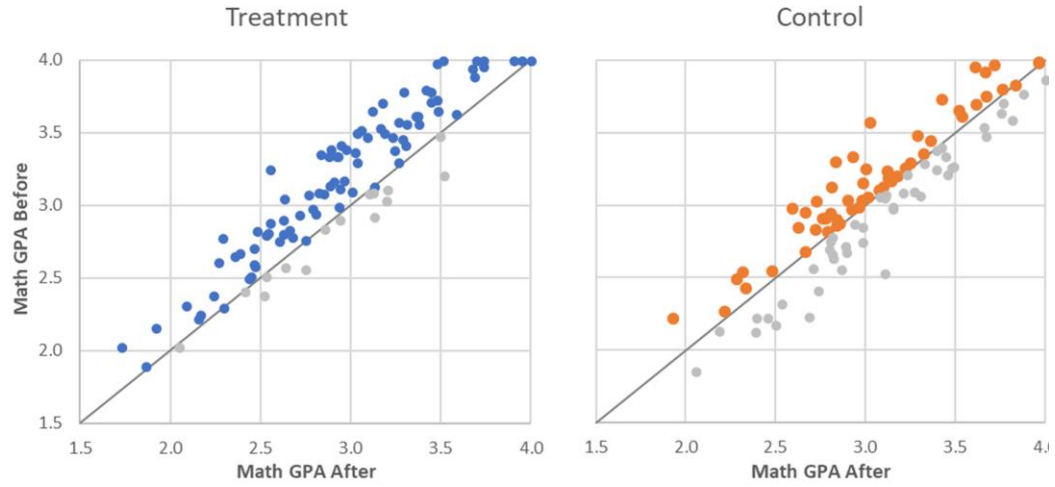
Informative

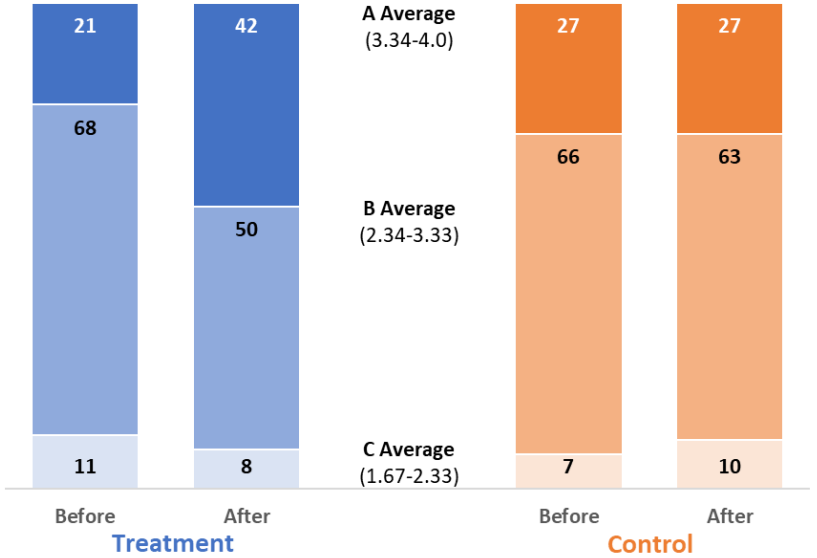
Pilot Study

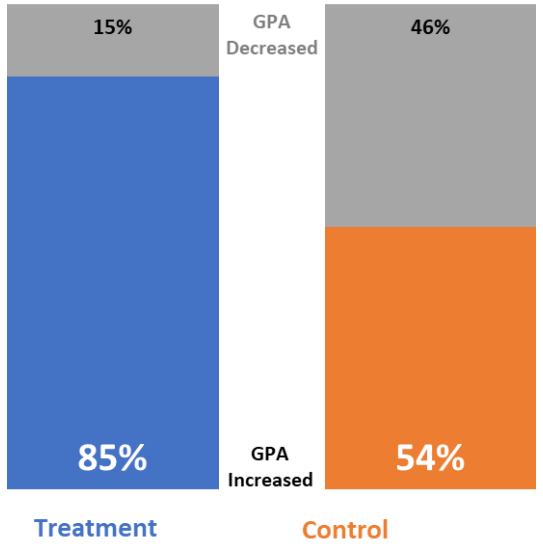


Descriptive

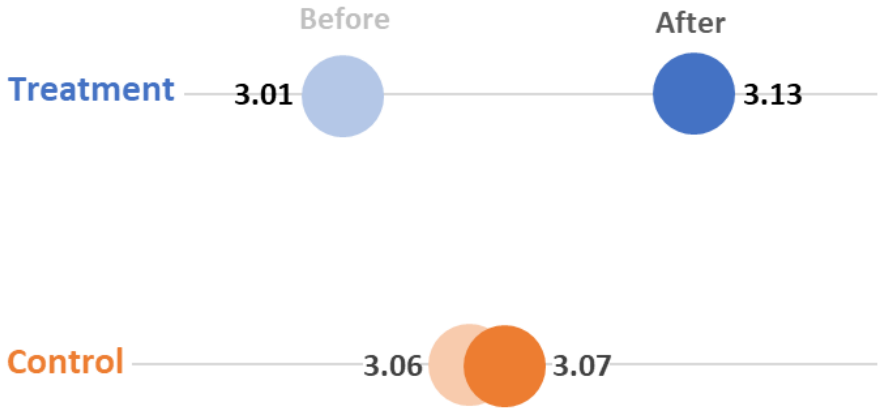
Informative

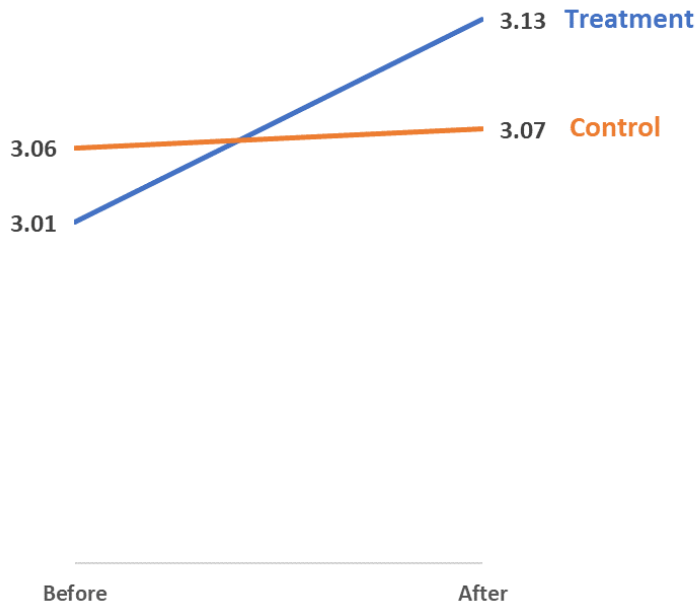


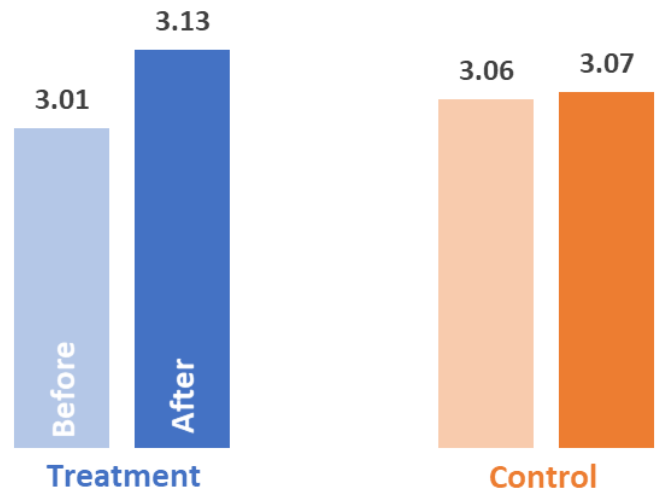




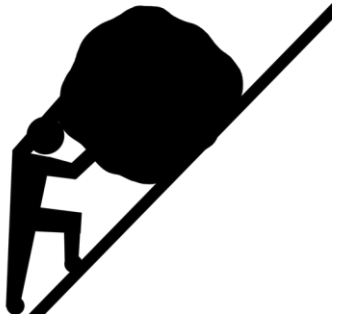
Note: Colored dots indicate an increase whereas grey dots indicate no increase or a decrease. The line indicates no change in GPA.







Visual Efficiency



Mental Effort

On a scale of 1 to 9, with 1 being “very, very, very little mental effort” and 9 being “very, very, very much mental effort,” please indicate the amount of mental effort it took to understand the graph.

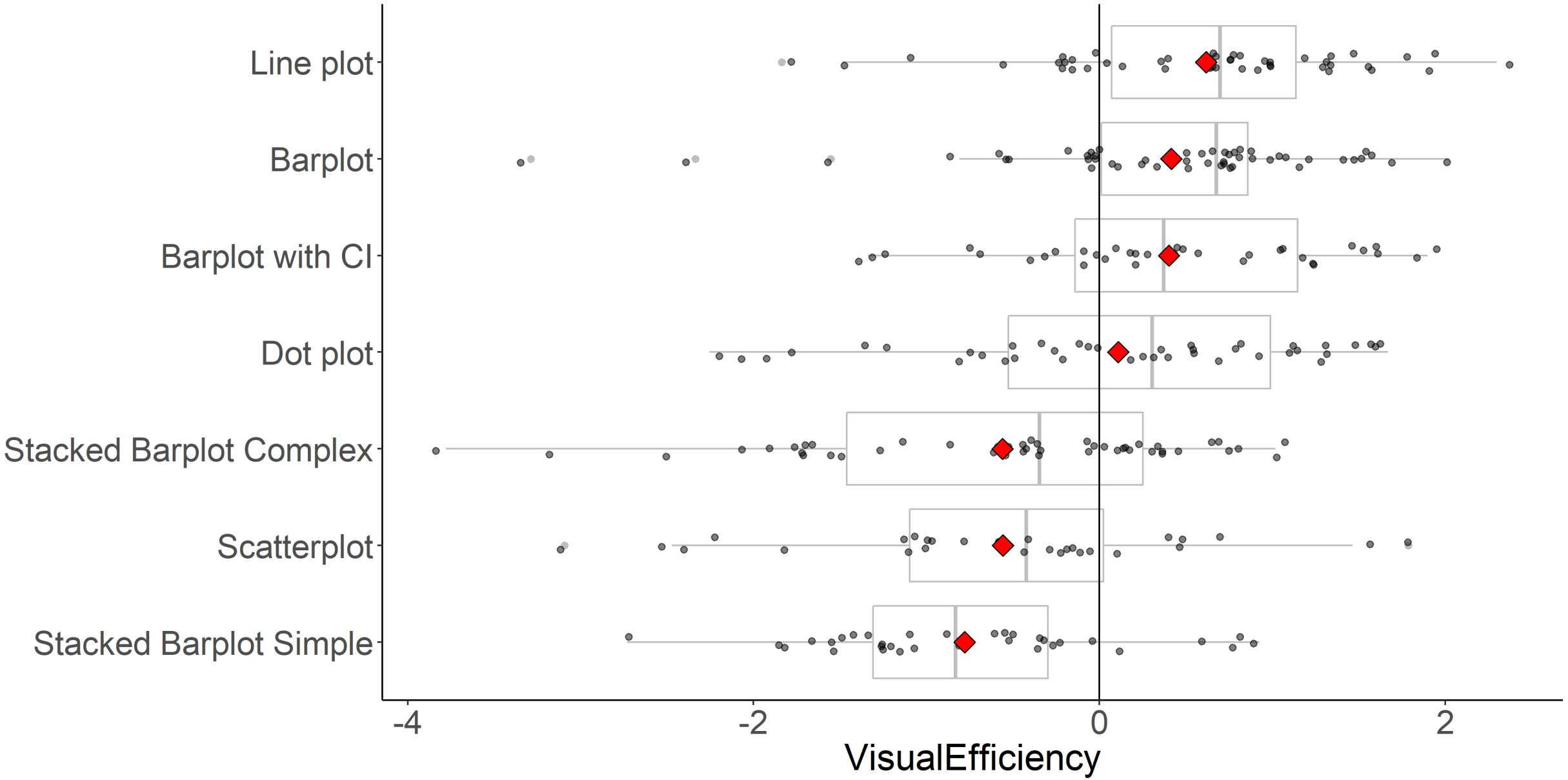
Accuracy

Eight multiple-choice items ranging in difficulty from easy to hard

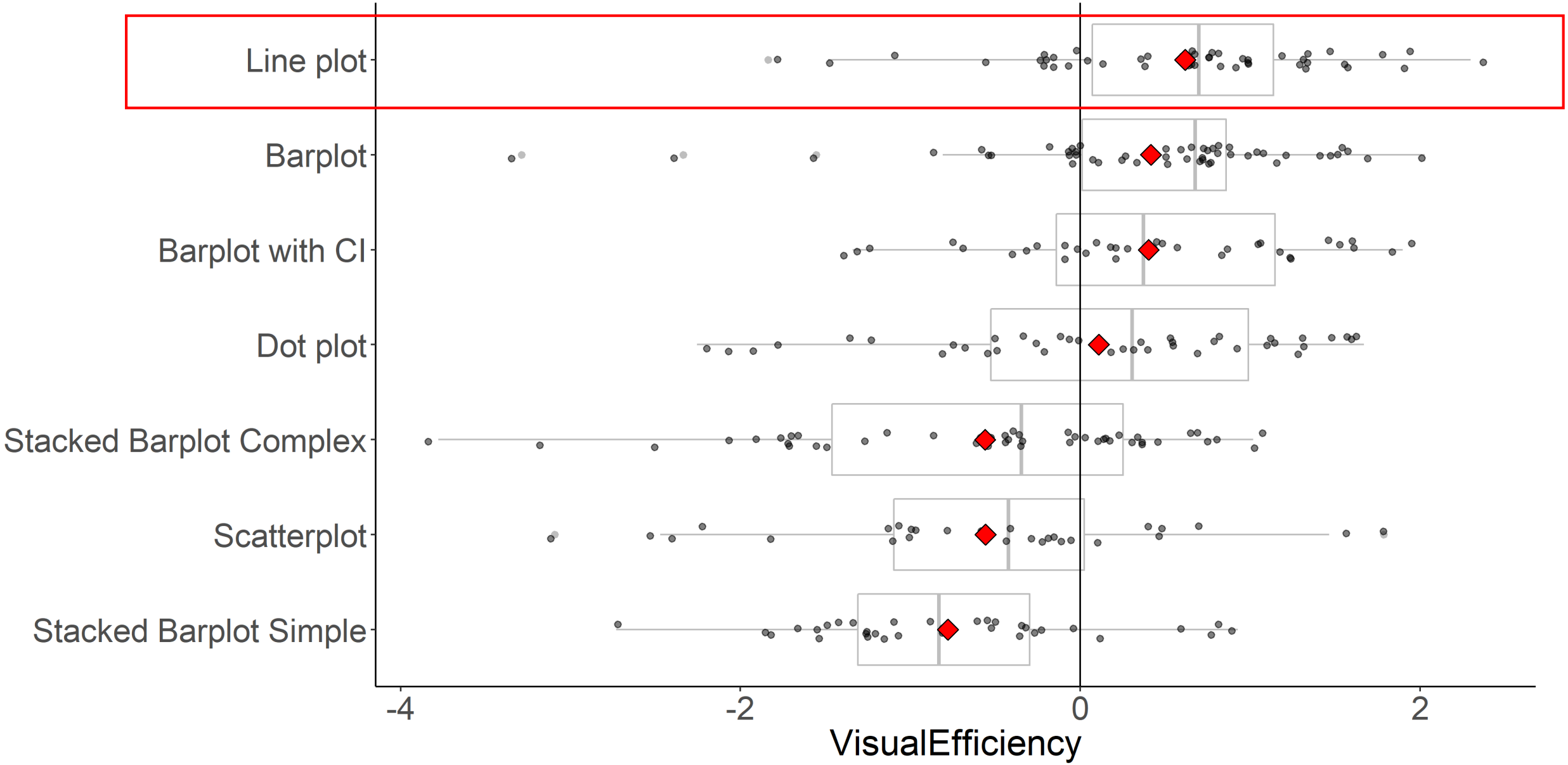
Response Time

Response time for the quiz

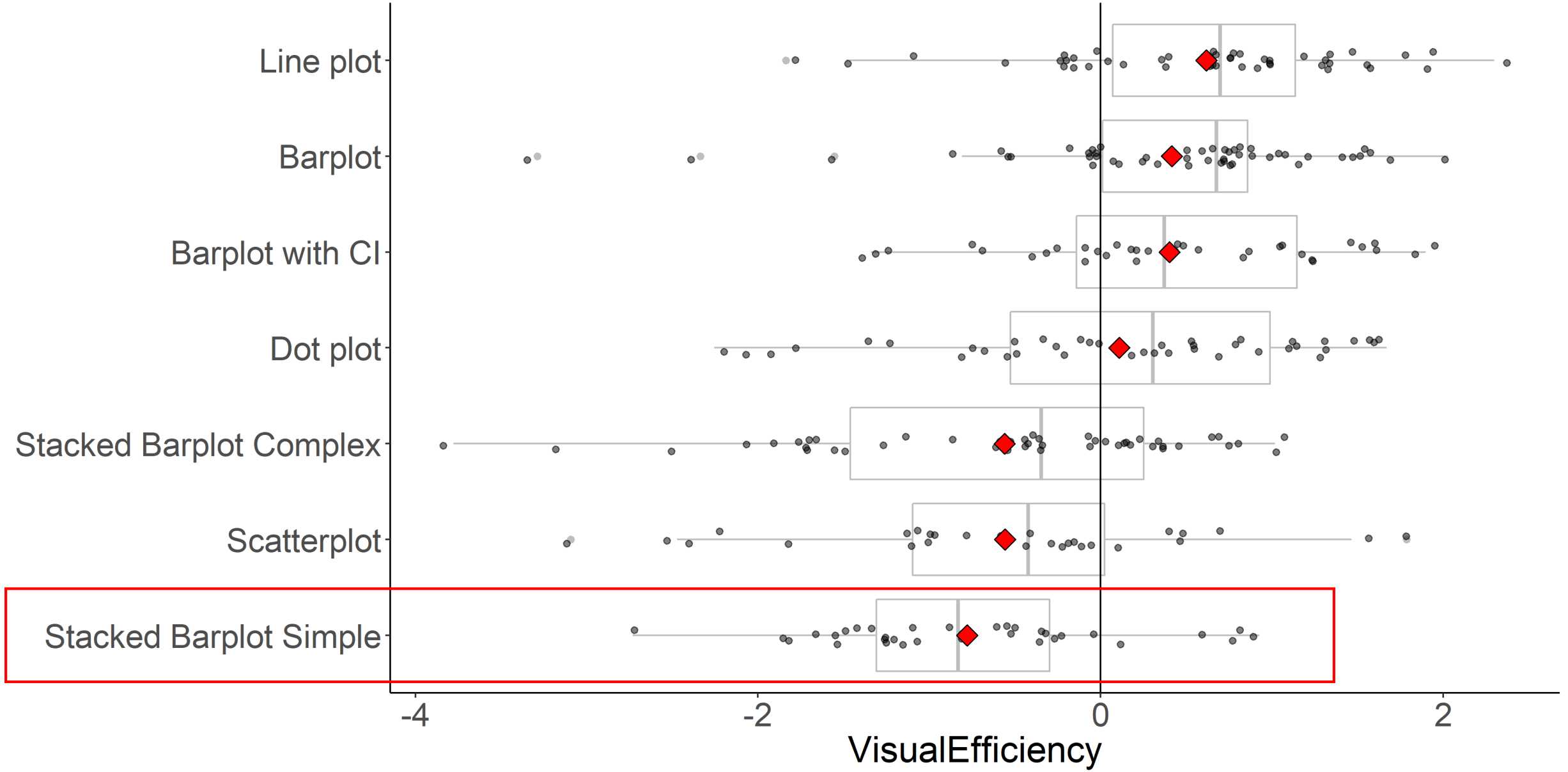
Visual Efficiency

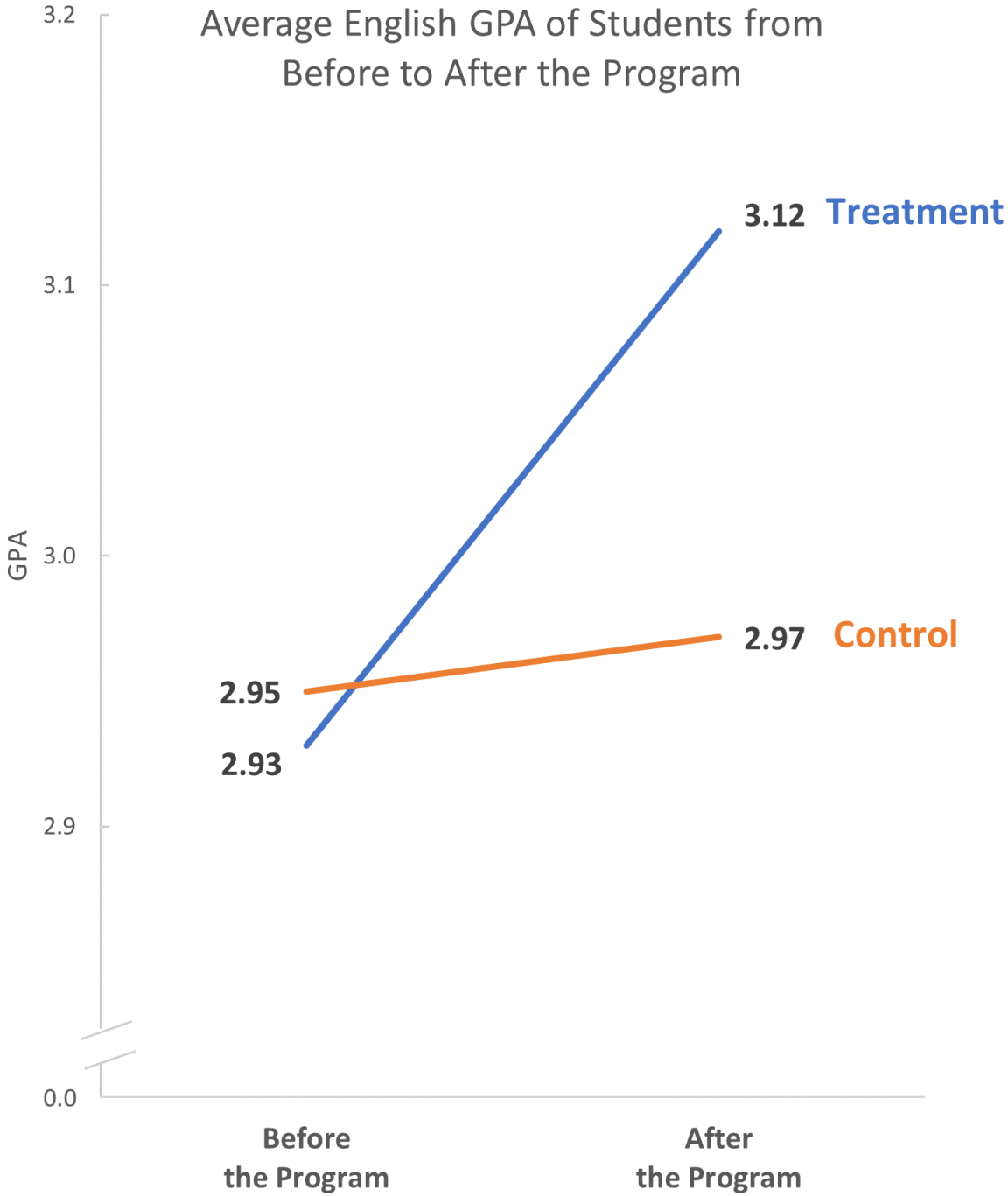


Line Plots had the highest visual efficiency.



Stacked Barplots had the lowest visual efficiency.




Average English GPA of Students from Before to After the Program
GPA
3.2
3.1
3.0
2.9
0.0
3.12
Treatment
2.97
Control
2.95
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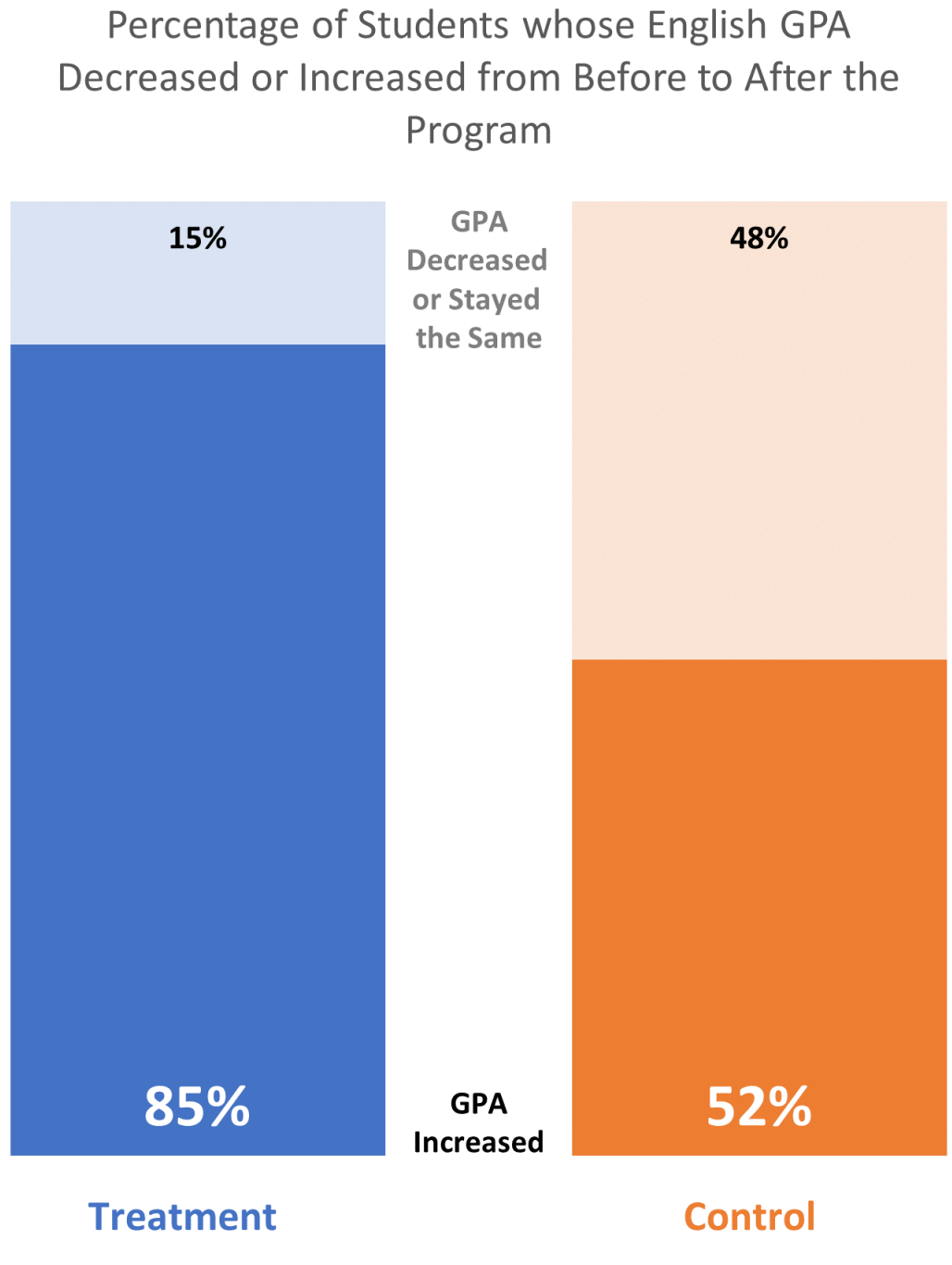
Before the Program
After the Program


Percentage of Students whose English GPA Decreased or Increased from Before to After the Program
15%
GPA Decreased or Stayed the Same
48%
85%
GPA Increased
52%
Treatment
Control

240

amazon mechanical turk

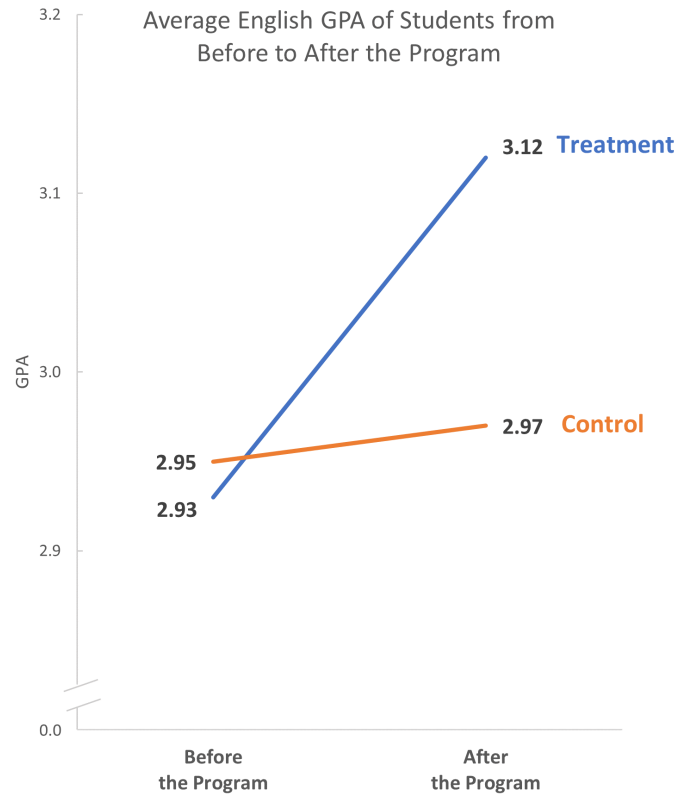
Message Content

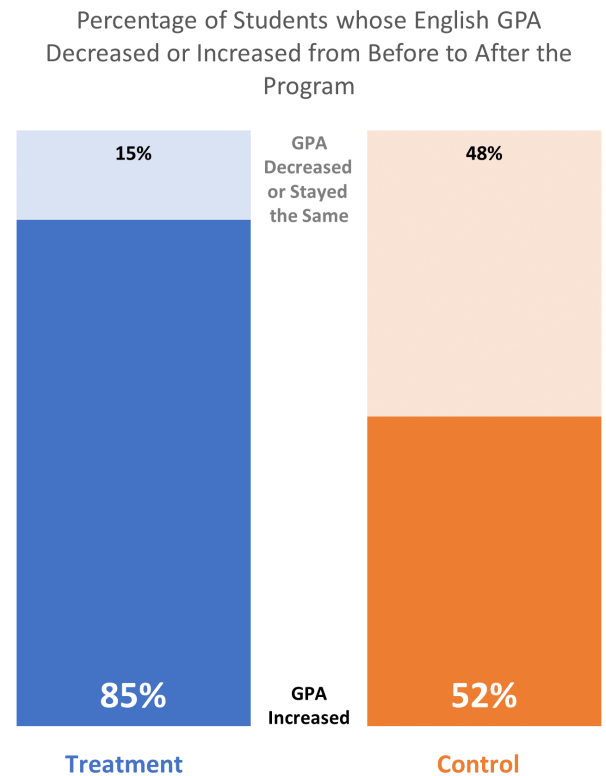
Title

Average English GPA of Students from Before to After the Program

More students in the **Treatment** group increased their English GPA from before to after the program compared to students in the **Control** group.

Graph





240

amazon mechanical turk

Message Content

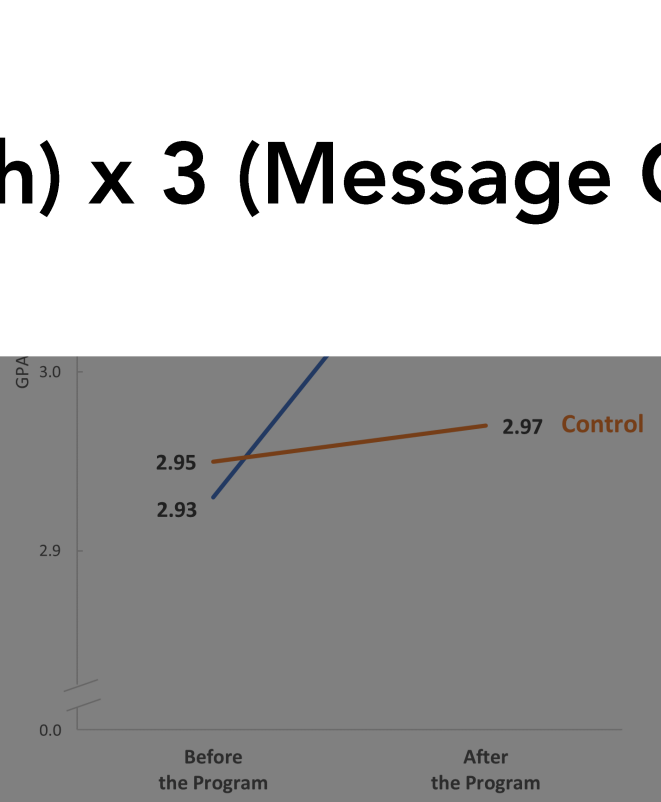
Title

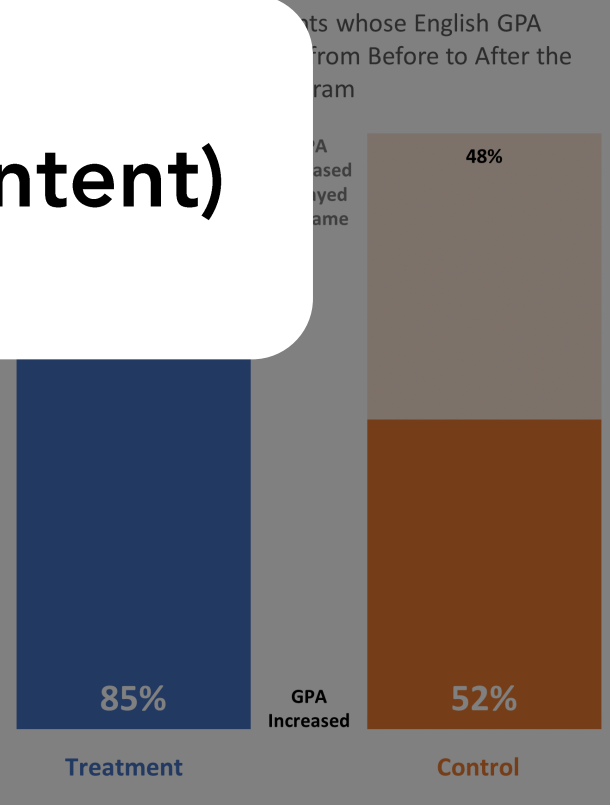
Graph

2 (Title) x 2 (Graph) x 3 (Message Content)

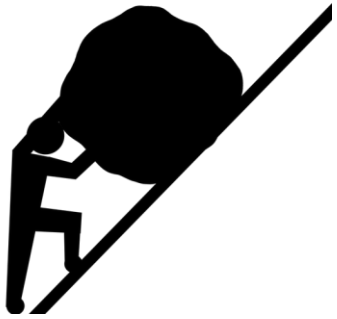
Averag
Be

More students in the treatment group increased their English GPA from before to after the program compared to students in the **Control** group.





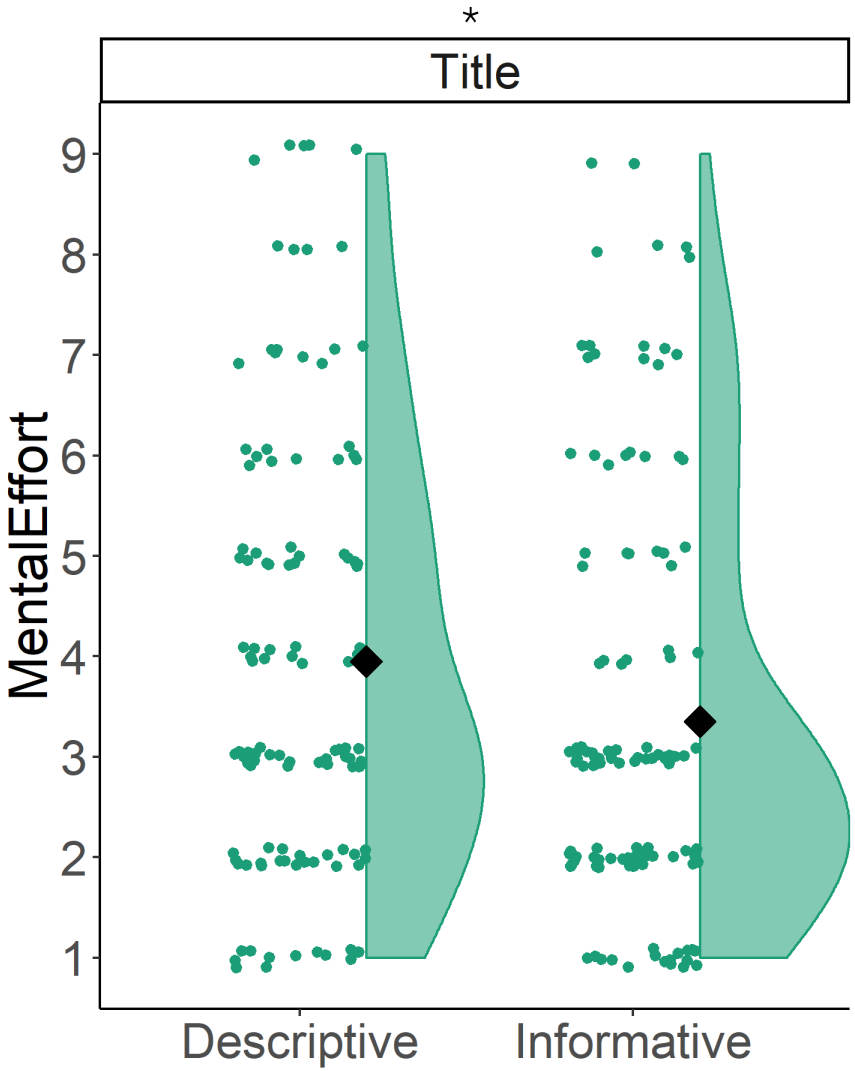
Visual Efficiency



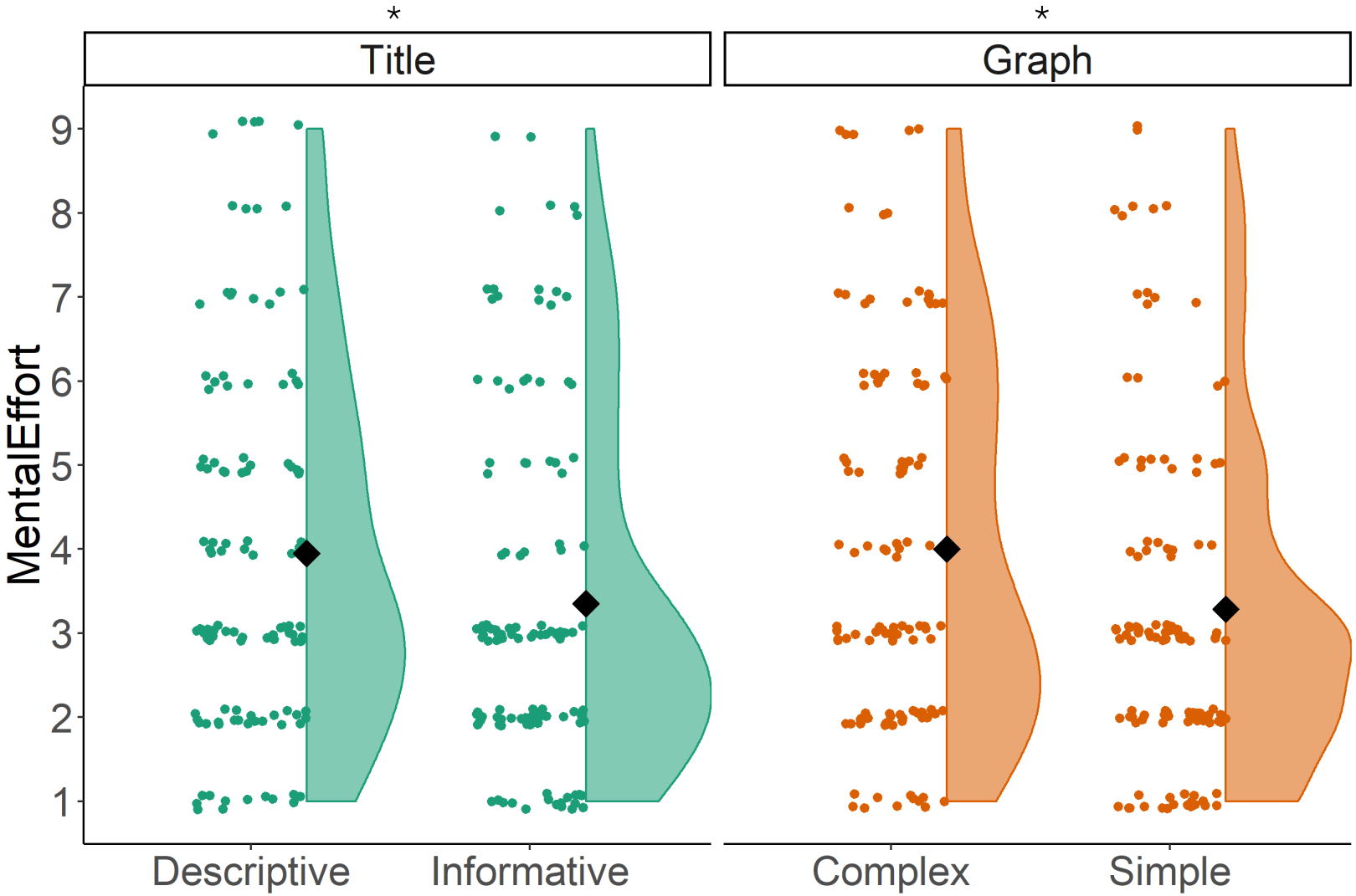
Mental Effort

On a scale of 1 to 9, with 1 being “very, very, very little mental effort” and 9 being “very, very, very much mental effort,” please indicate the amount of mental effort it took to understand the graph.

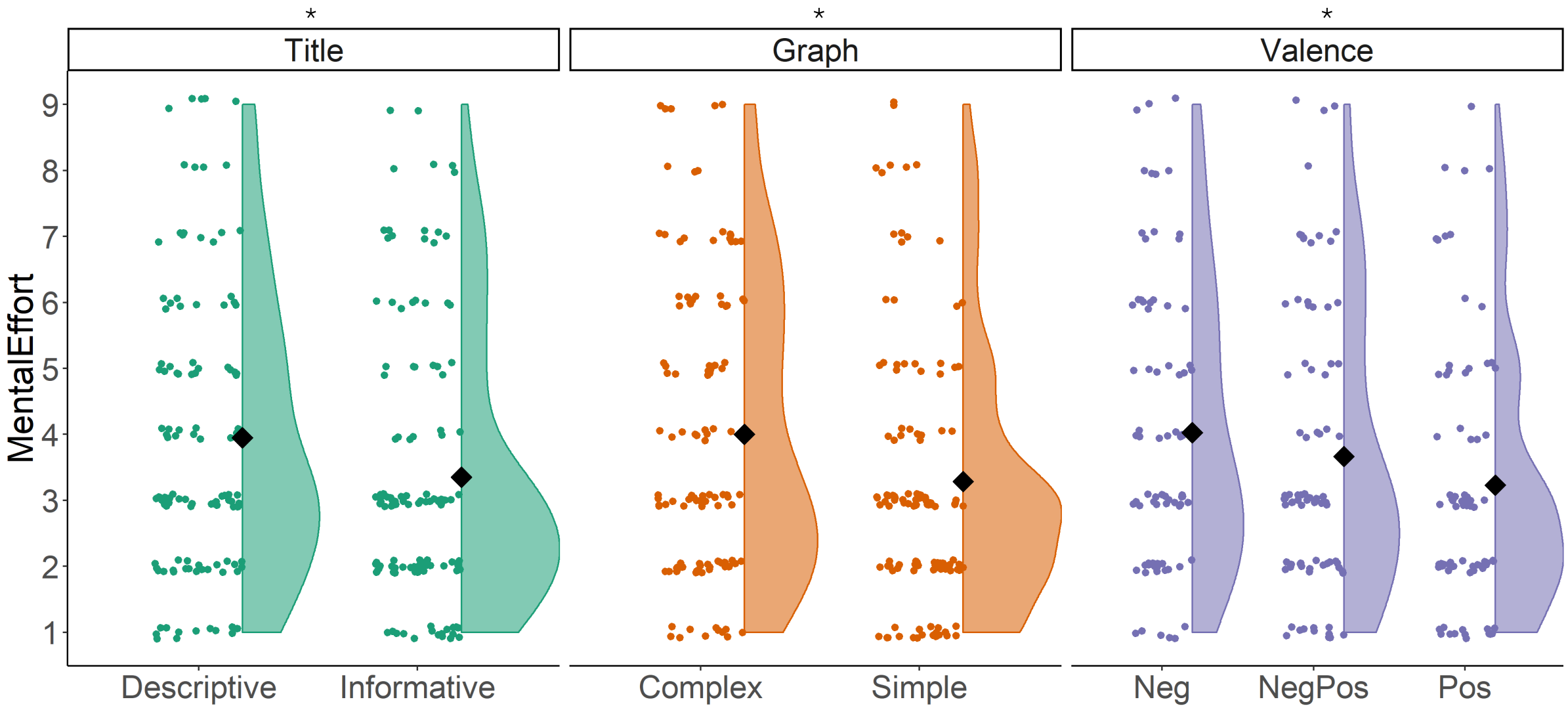
Informative titles required less mental effort than descriptive titles.



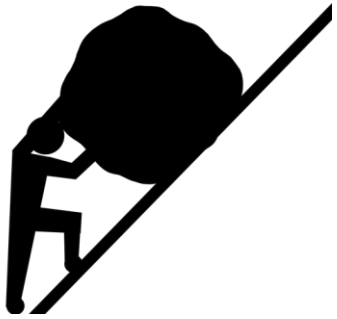
The simple graph (line) required less mental effort than the complex graph (stacked bar).



Viewing positive results required less mental effort than viewing negative results.



Visual Efficiency



Mental Effort

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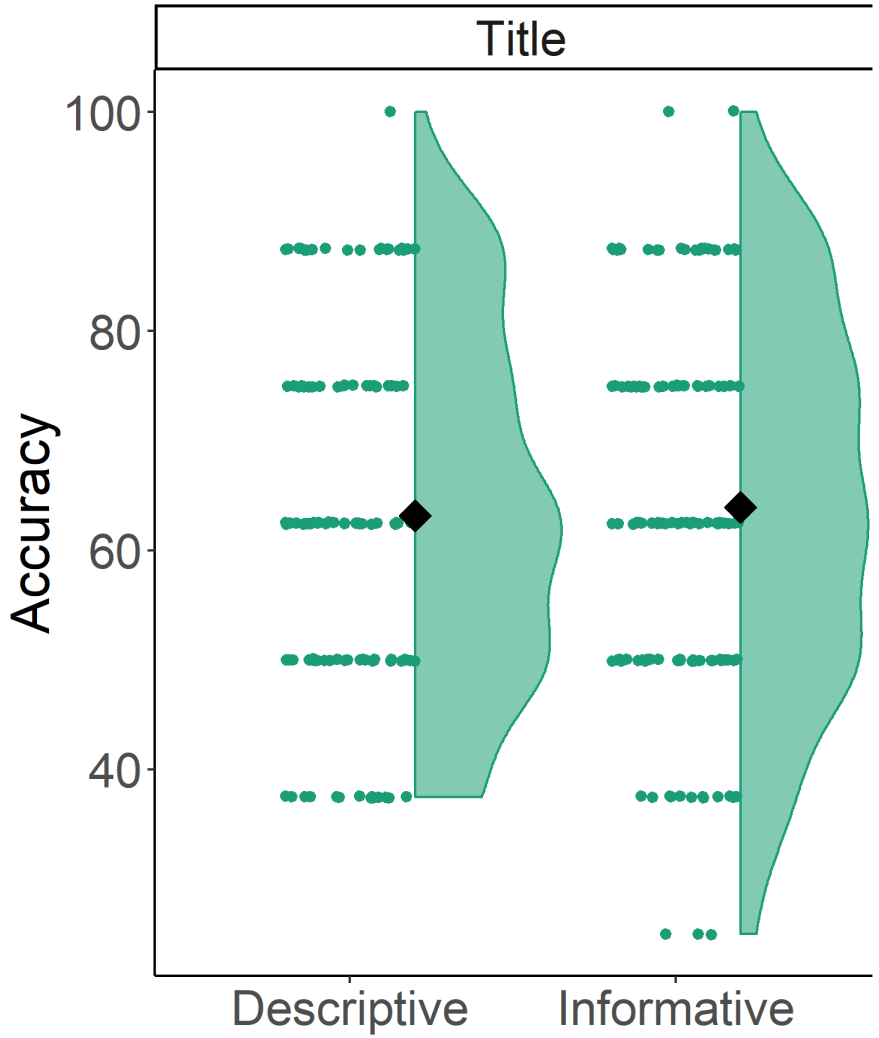
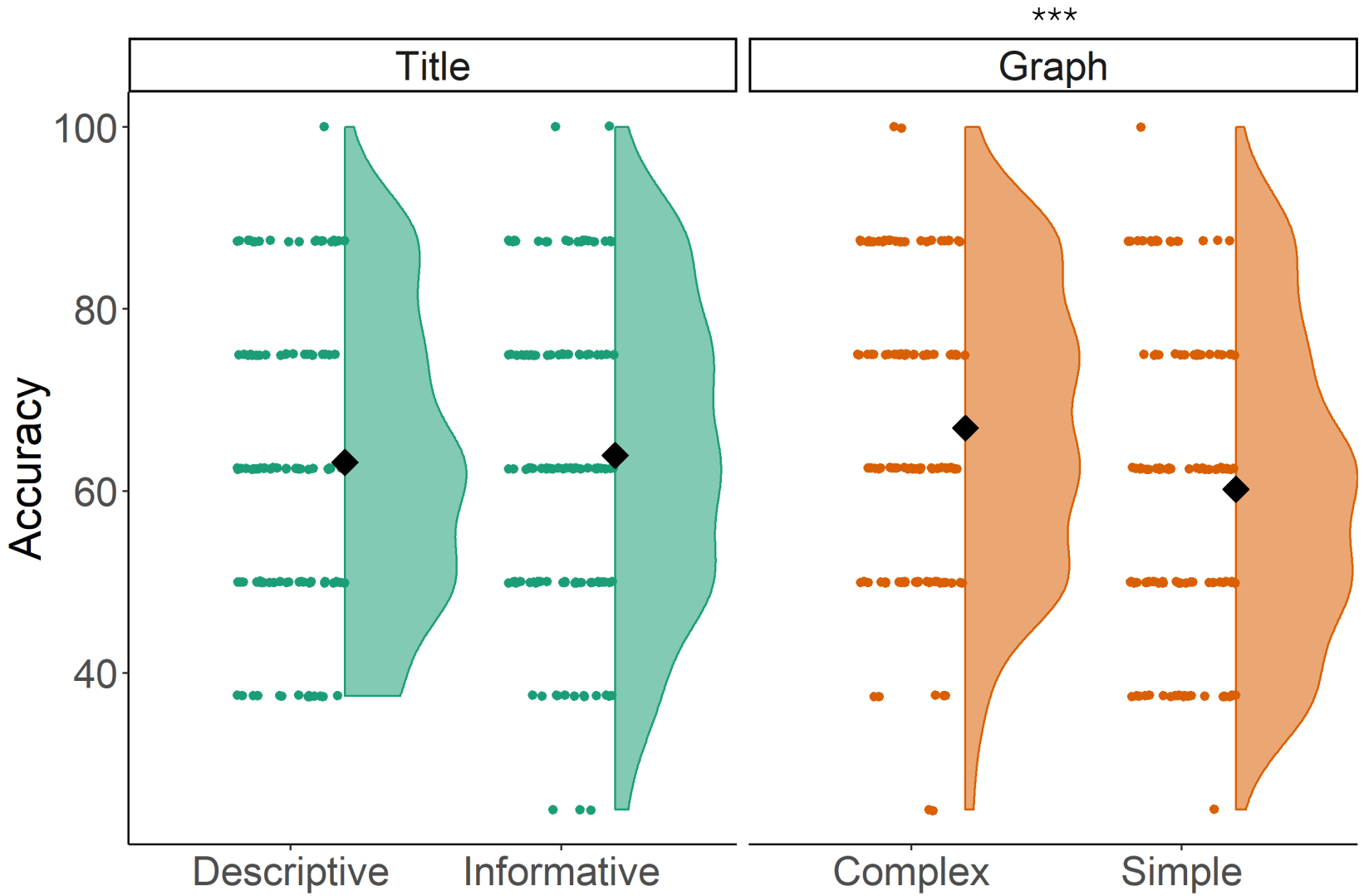
Accuracy

Eight multiple-choice items ranging in difficulty from easy to hard

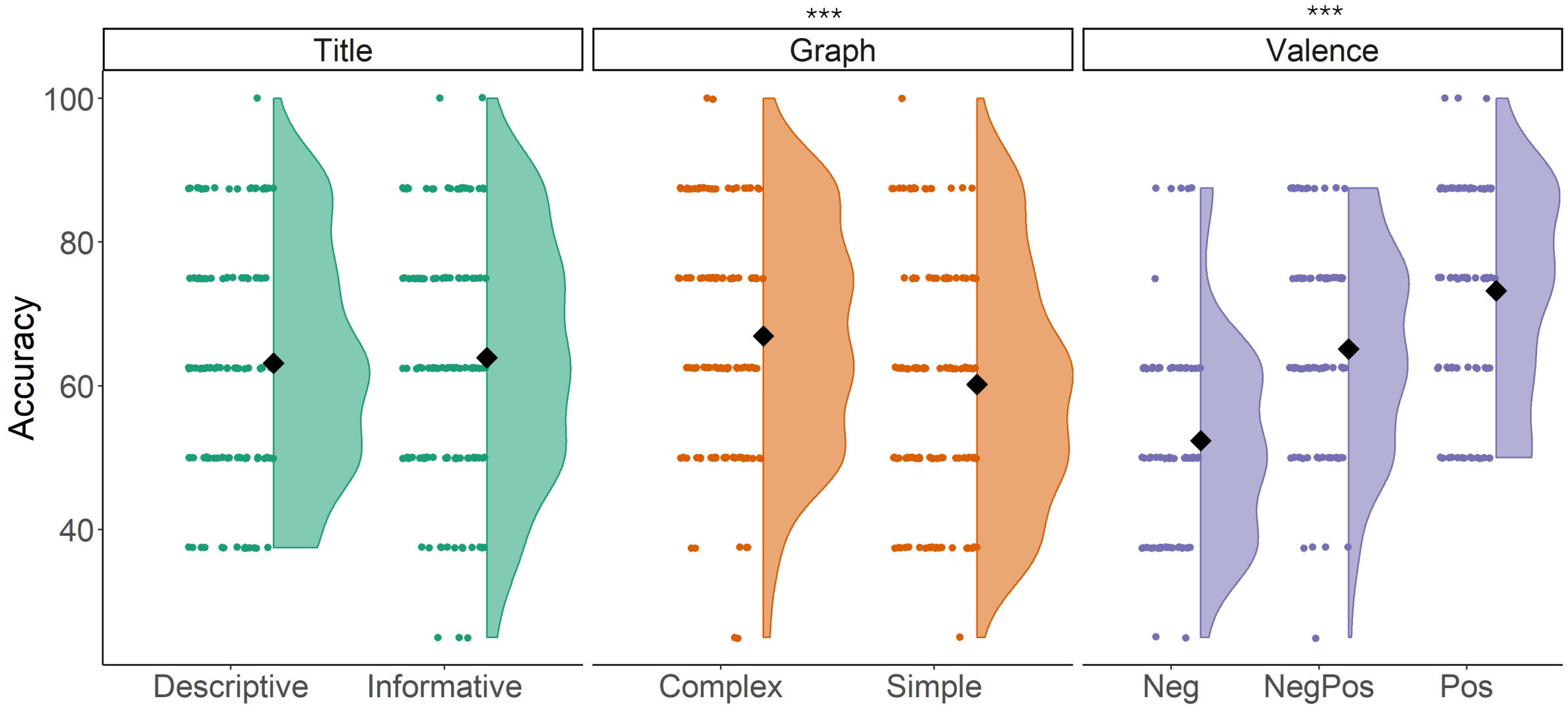
There were no differences in accuracy by title.



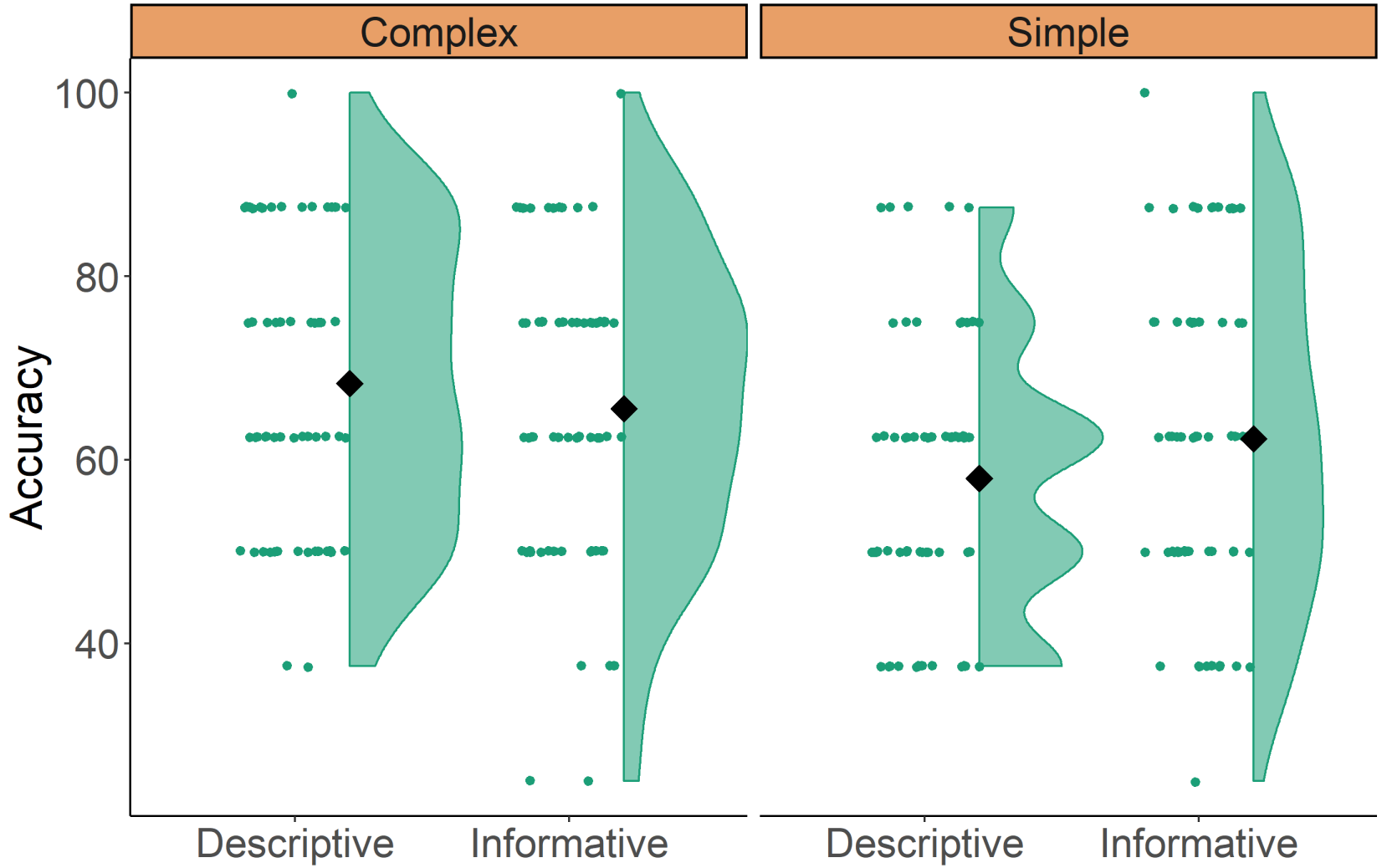
The simple graph had lower accuracy than the complex graph.



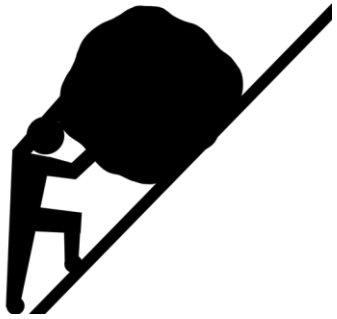
Viewing positive results resulted in higher accuracy than viewing negative results.



Informative titles had higher accuracy with simple graphs.



Visual Efficiency



Mental Effort

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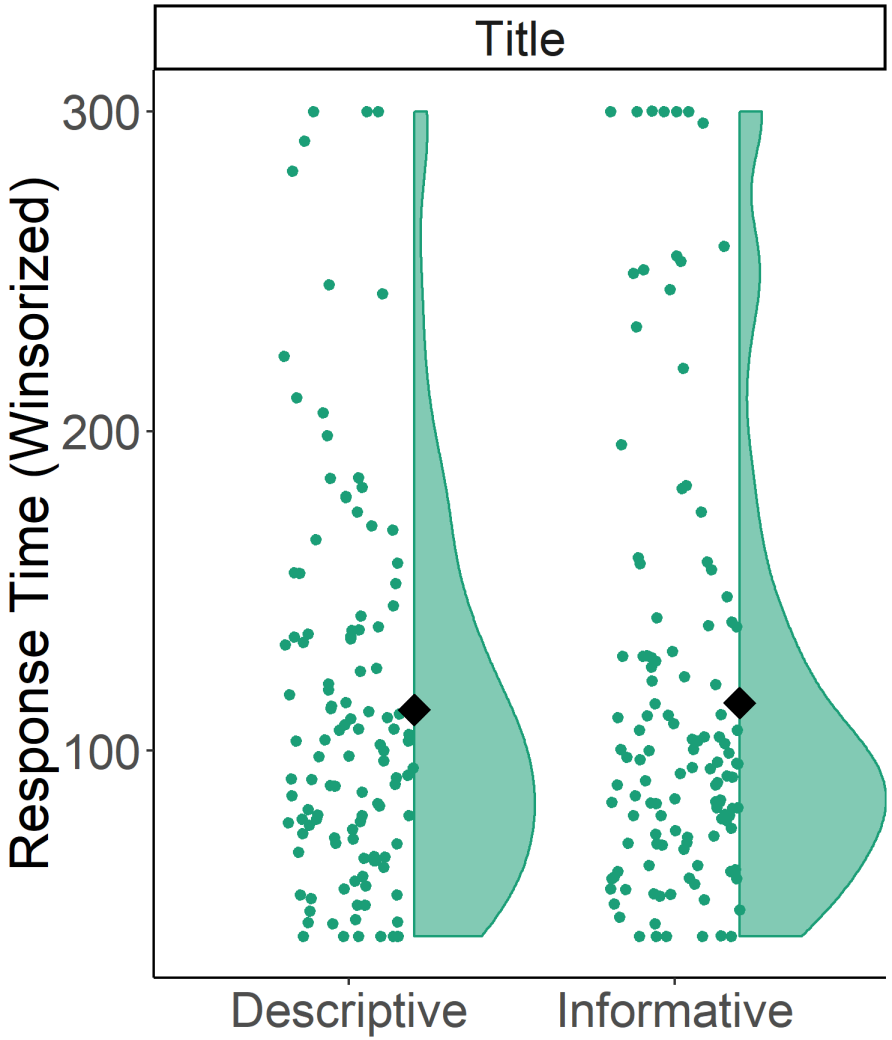
Accuracy

Eight multiple-choice items ranging in difficulty from easy to hard

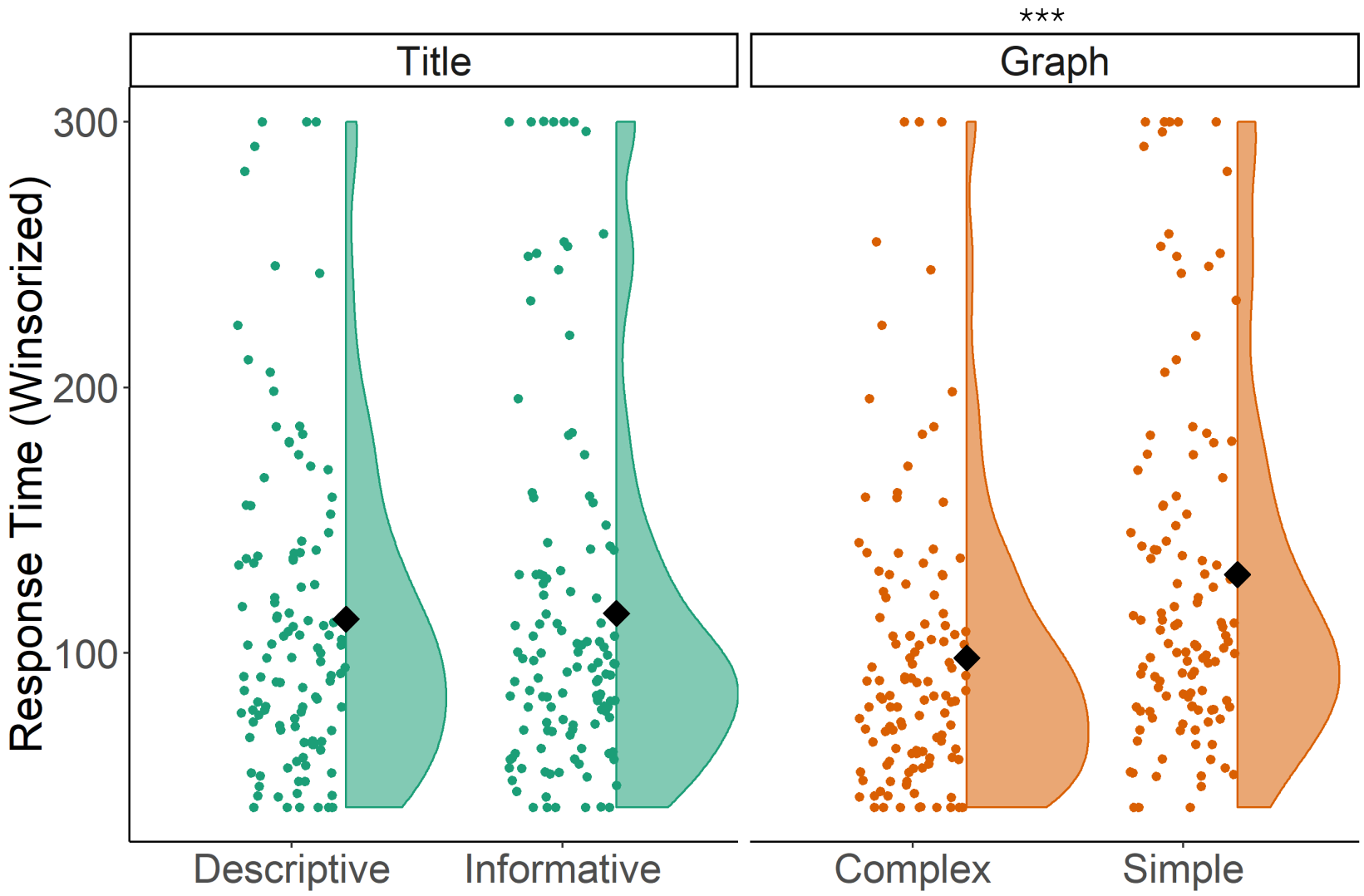
Response Time

Response time for the quiz

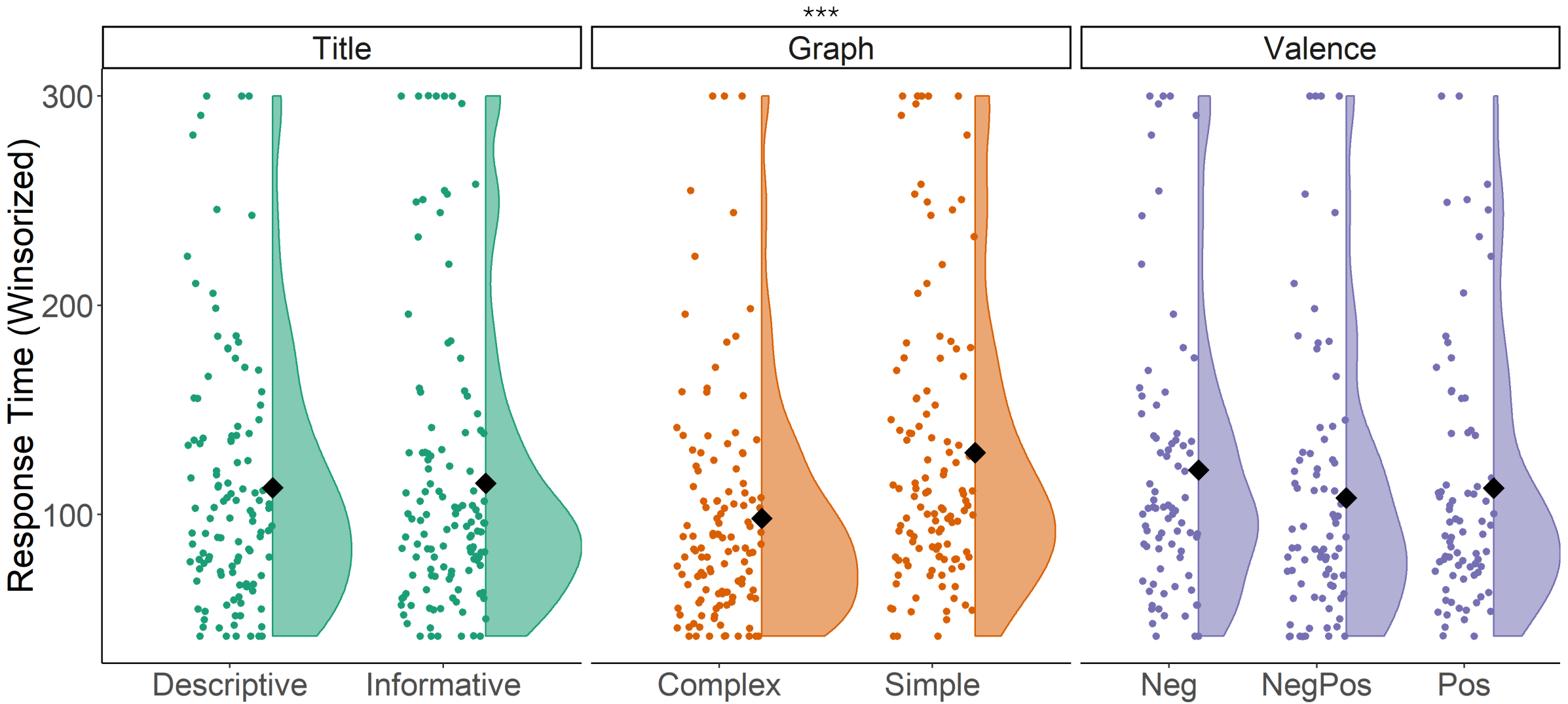
There were no differences in response time by title.



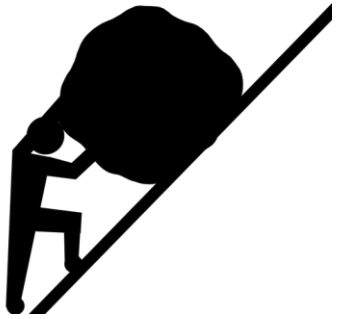
The simple graph required greater response time than the complex graph.



There were no differences in response time by valence of message content.



Visual Efficiency



Mental Effort

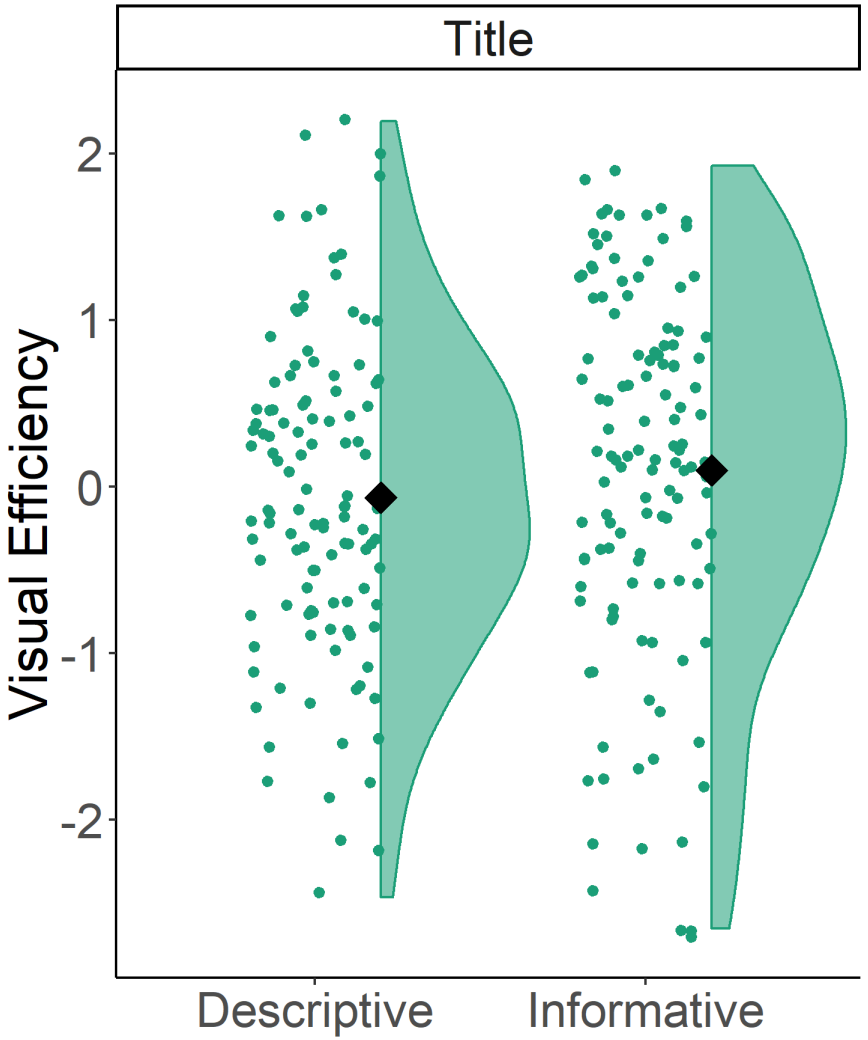
Accuracy

Response Time

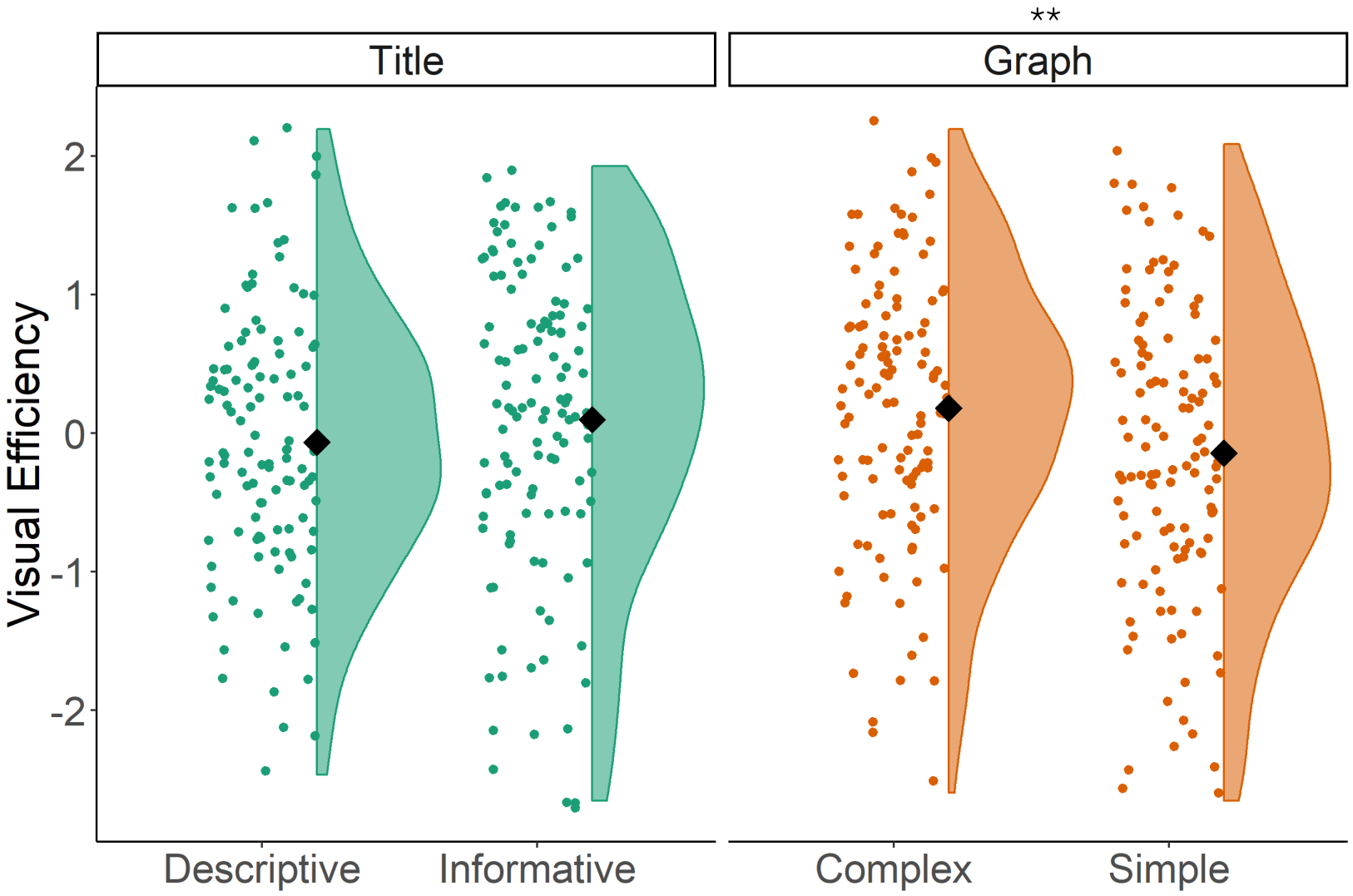
$$\frac{\sqrt{Z_{Accuracy} - Z_{Mental\ Effort} - Z_{Response\ Time}}}{3}$$

Huang, Eades, & Hong (2009). Measuring effectiveness of graph visualizations: A cognitive load perspective. *Information Visualization*, *8*(3), 139-152.

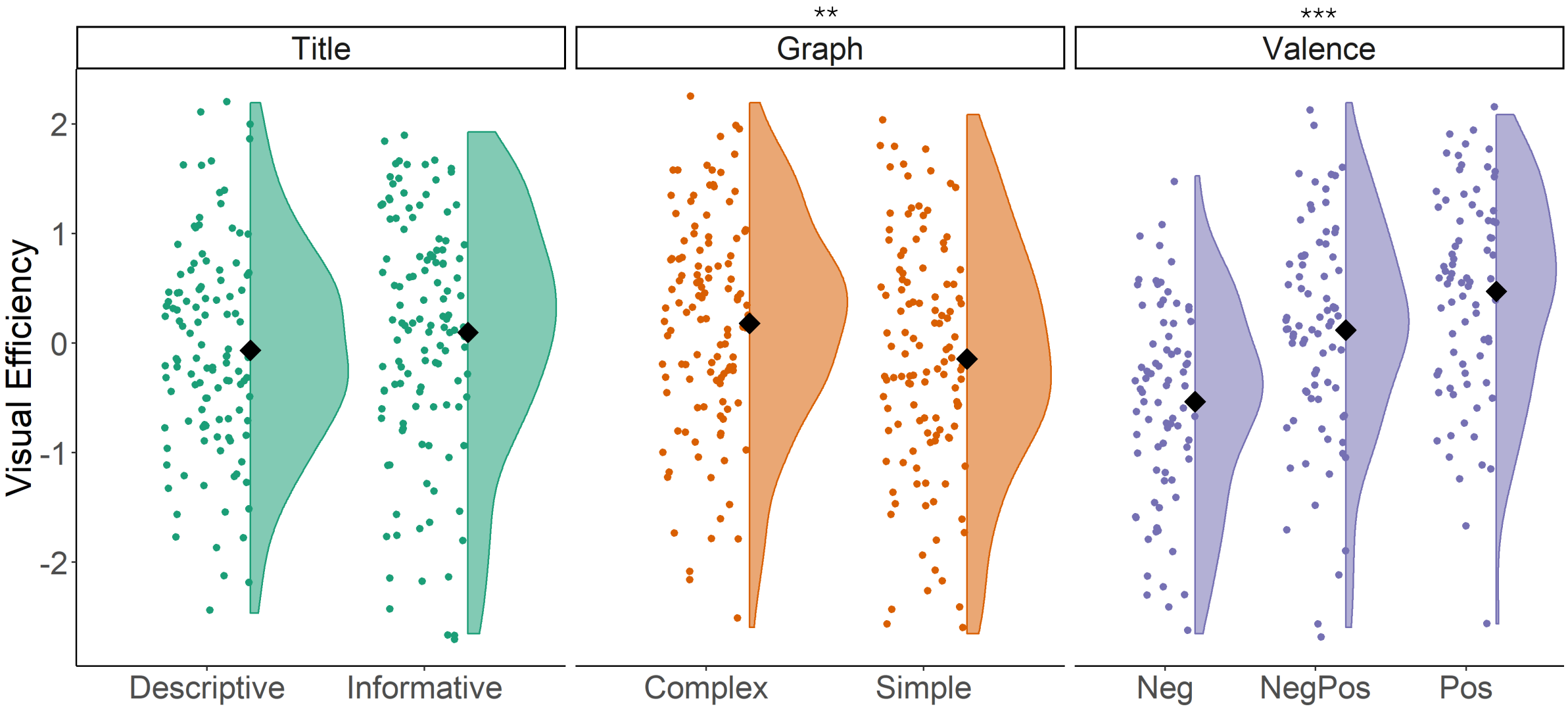
There were no differences in visual efficiency by title.



The simple graph had lower visual efficiency than the complex graph.



Viewing positive results resulted in greater visual efficiency than viewing negative results.

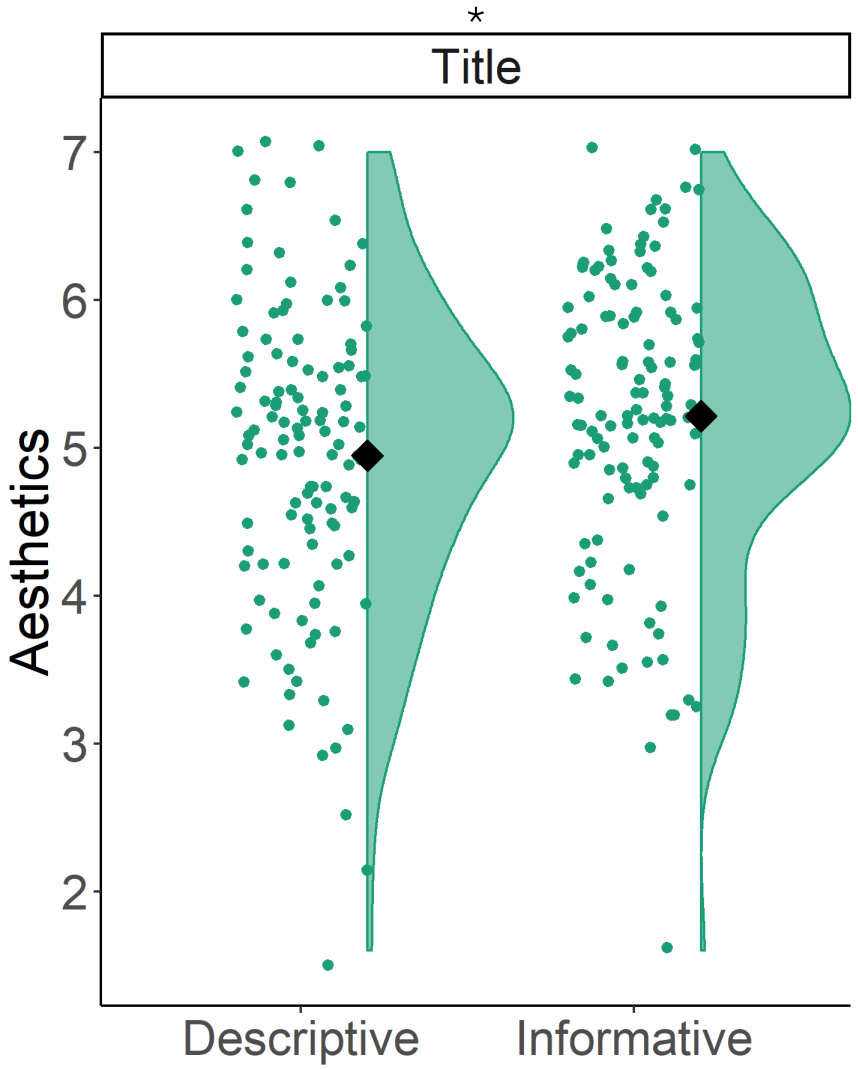


Other Outcomes

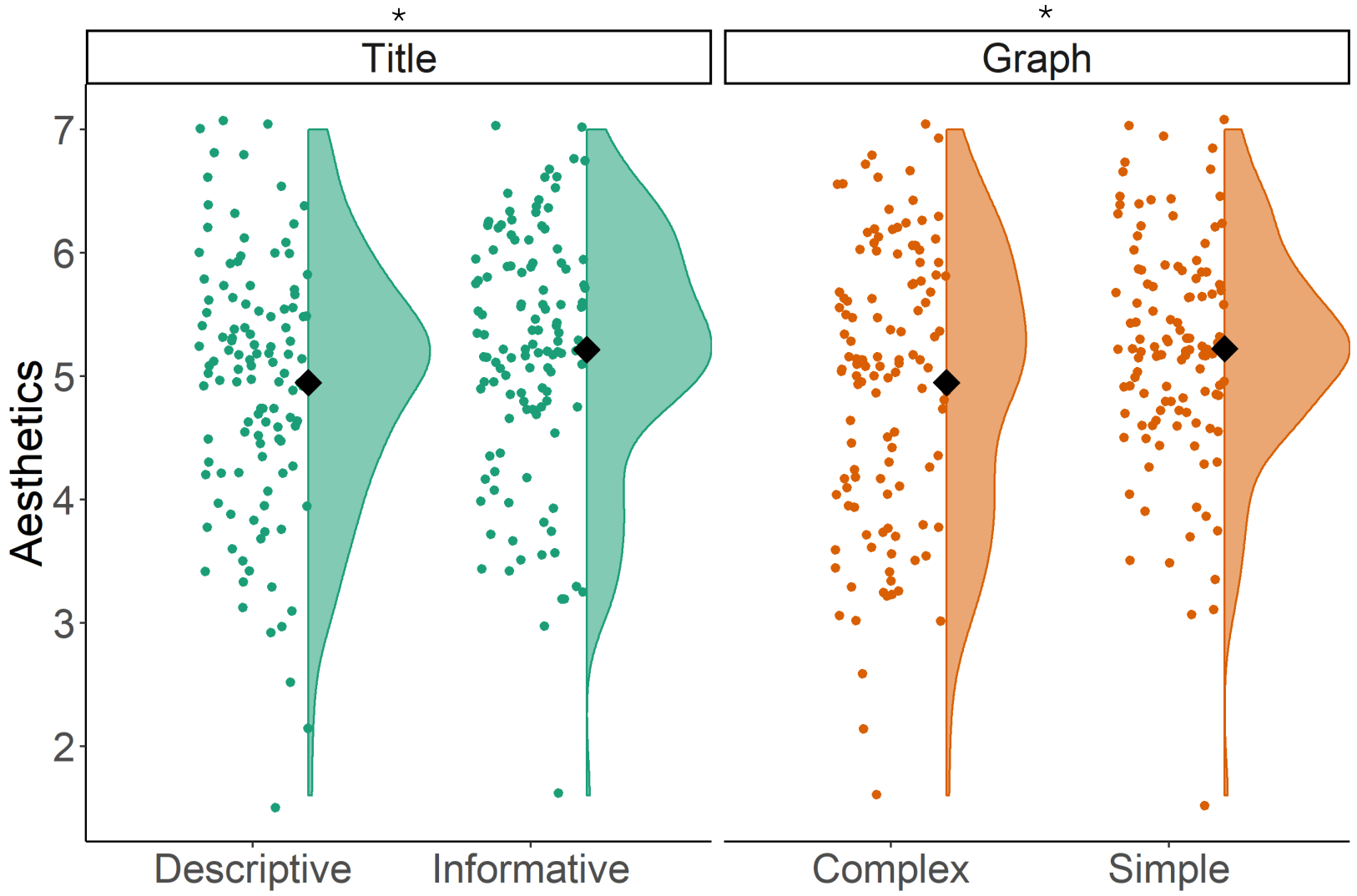
Aesthetics

5 items on how beautiful, clear, engaging, simple, enjoyable they thought the results were

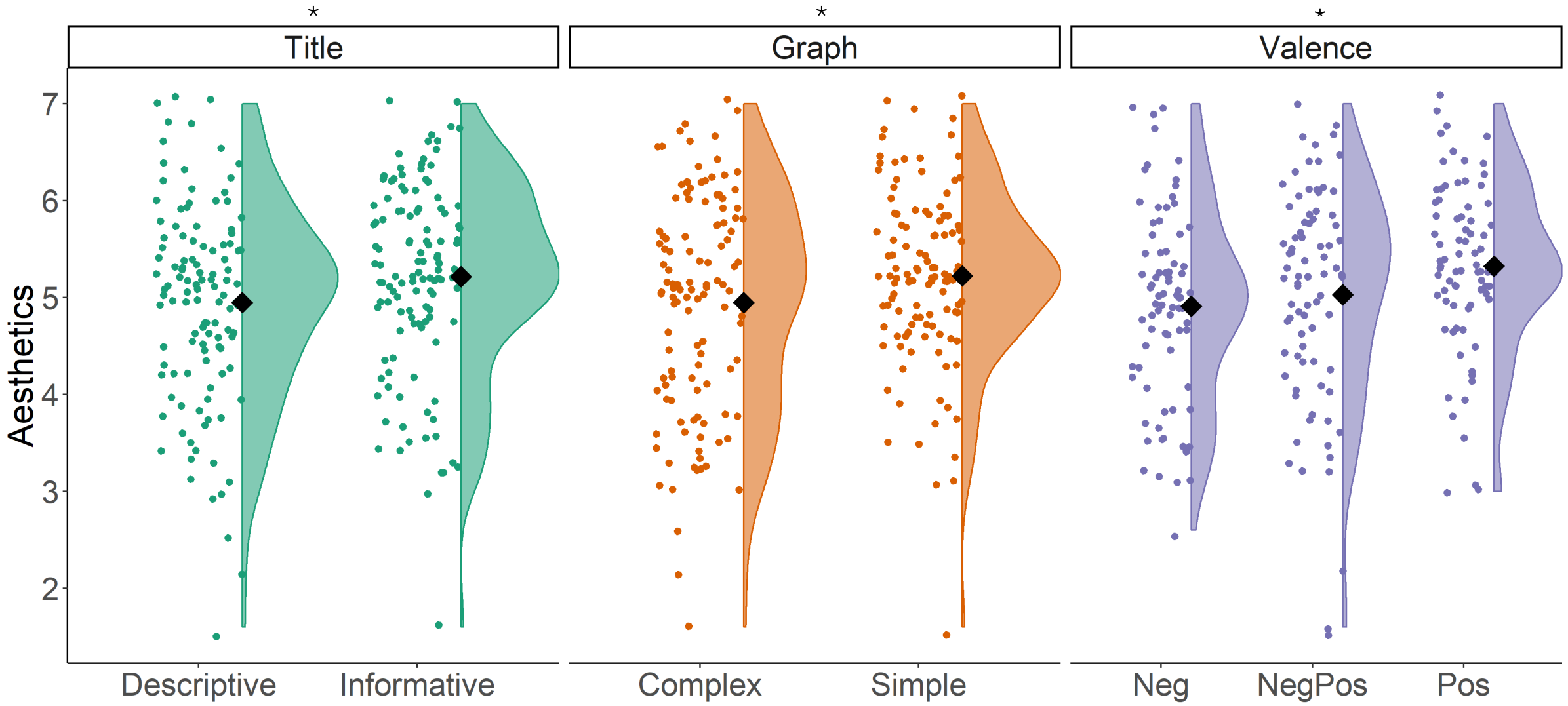
Informative titles were rated more aesthetically pleasing than descriptive titles.



The simple graph was rated more aesthetically pleasing than the complex graph.



Positive results were rated more aesthetically pleasing than viewing negative results.



Other Outcomes

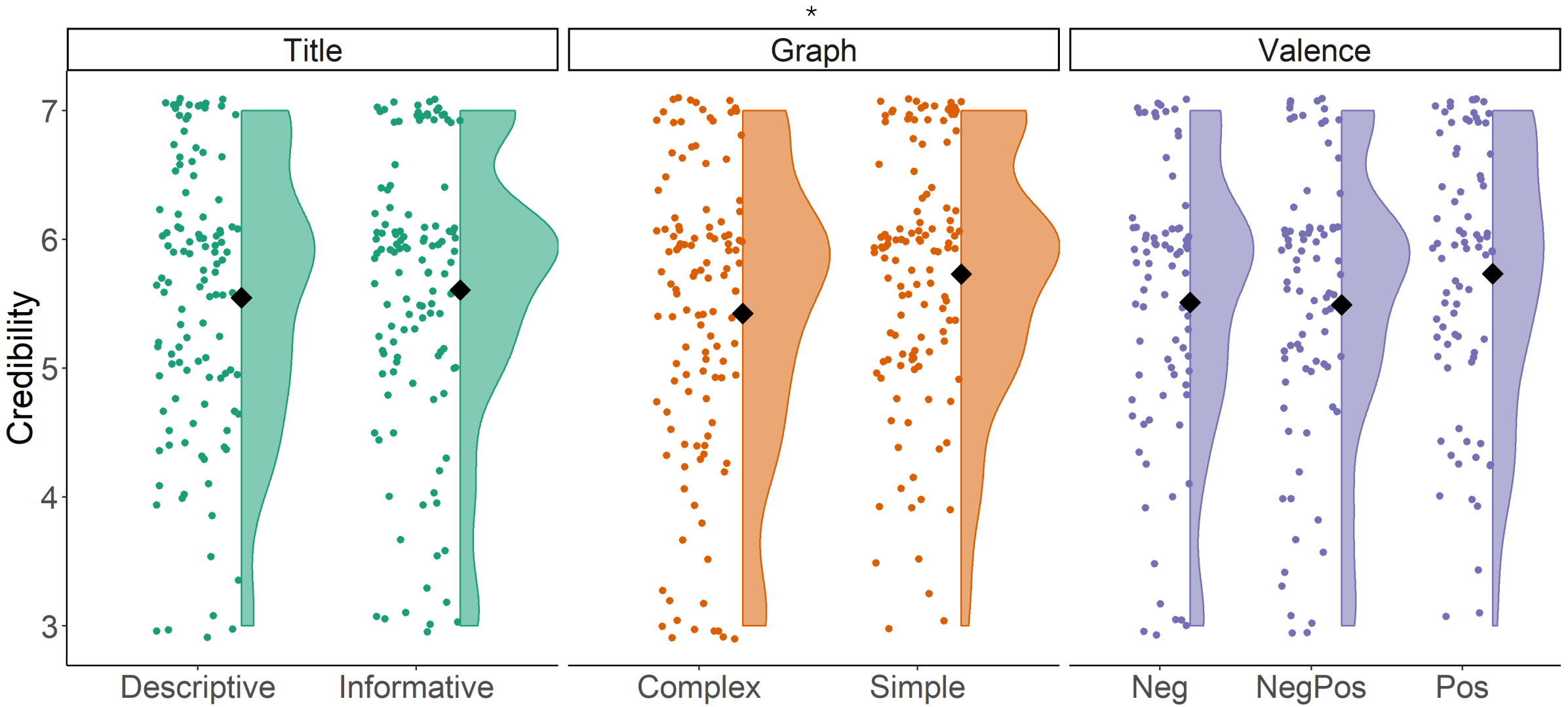
Aesthetics

5 items on how beautiful, clear, engaging, simple, enjoyable they thought the results were

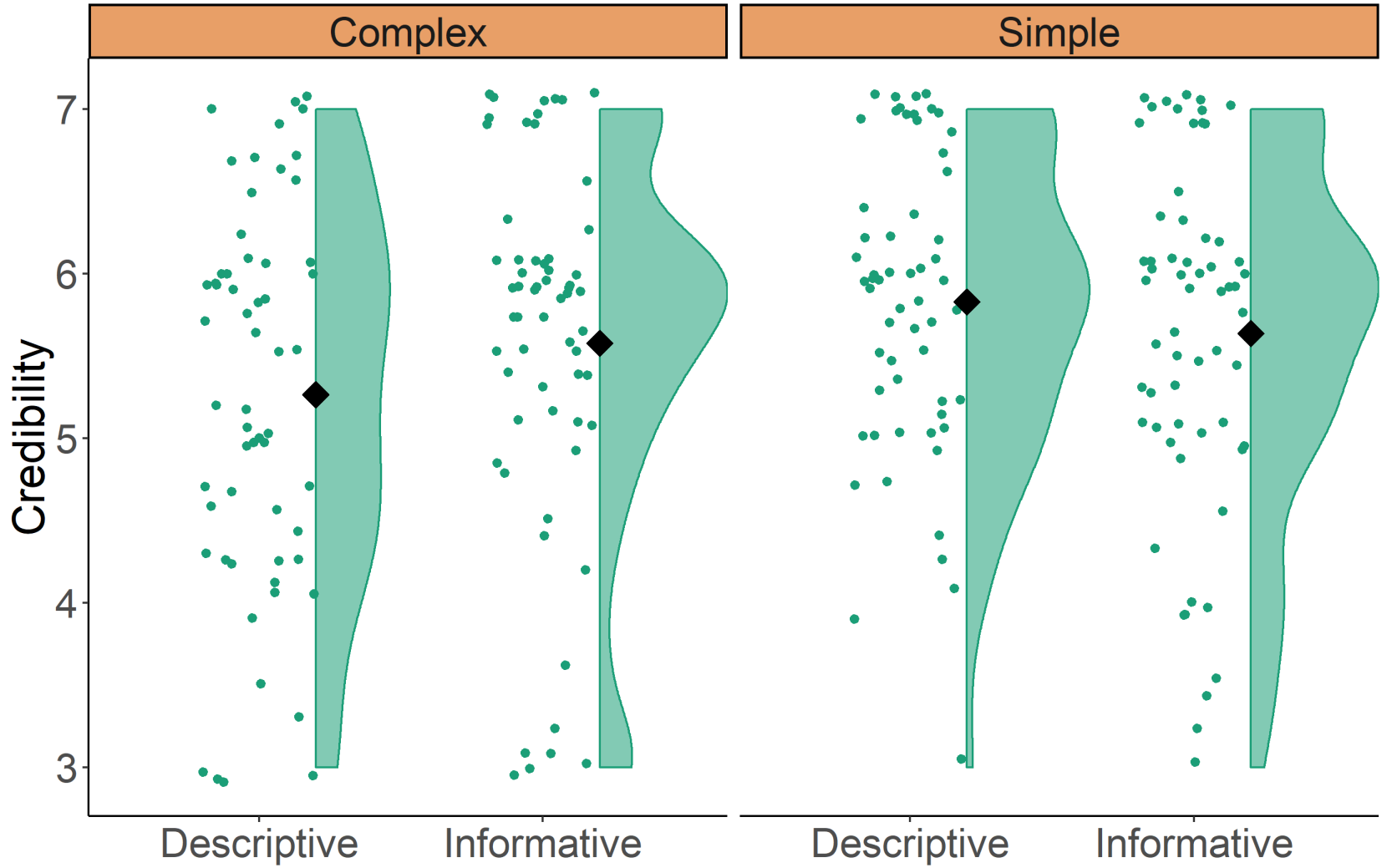
Credibility

6 items on how credible, believable, accurate, trustworthy, unbiased, complete they thought the results were

The simple graph was viewed as more credible than the complex graph.



Informative titles were viewed as more credible with complex graphs but less credible with simple graphs.



Other Outcomes

Aesthetics

5 items on how beautiful, clear, engaging, simple, enjoyable they thought the results were

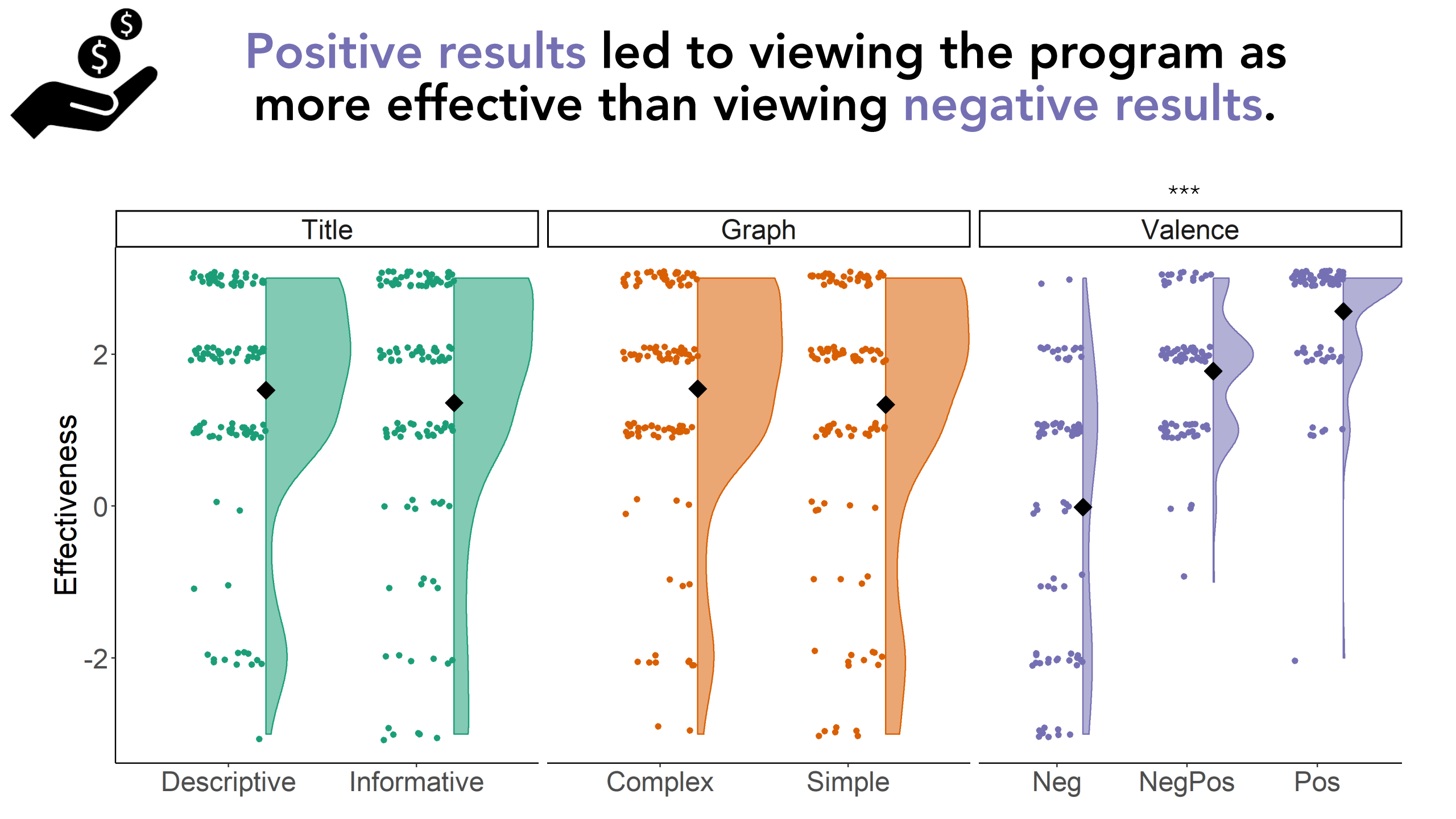
Credibility

6 items on how credible, believable, accurate, trustworthy, unbiased, complete they thought the results were

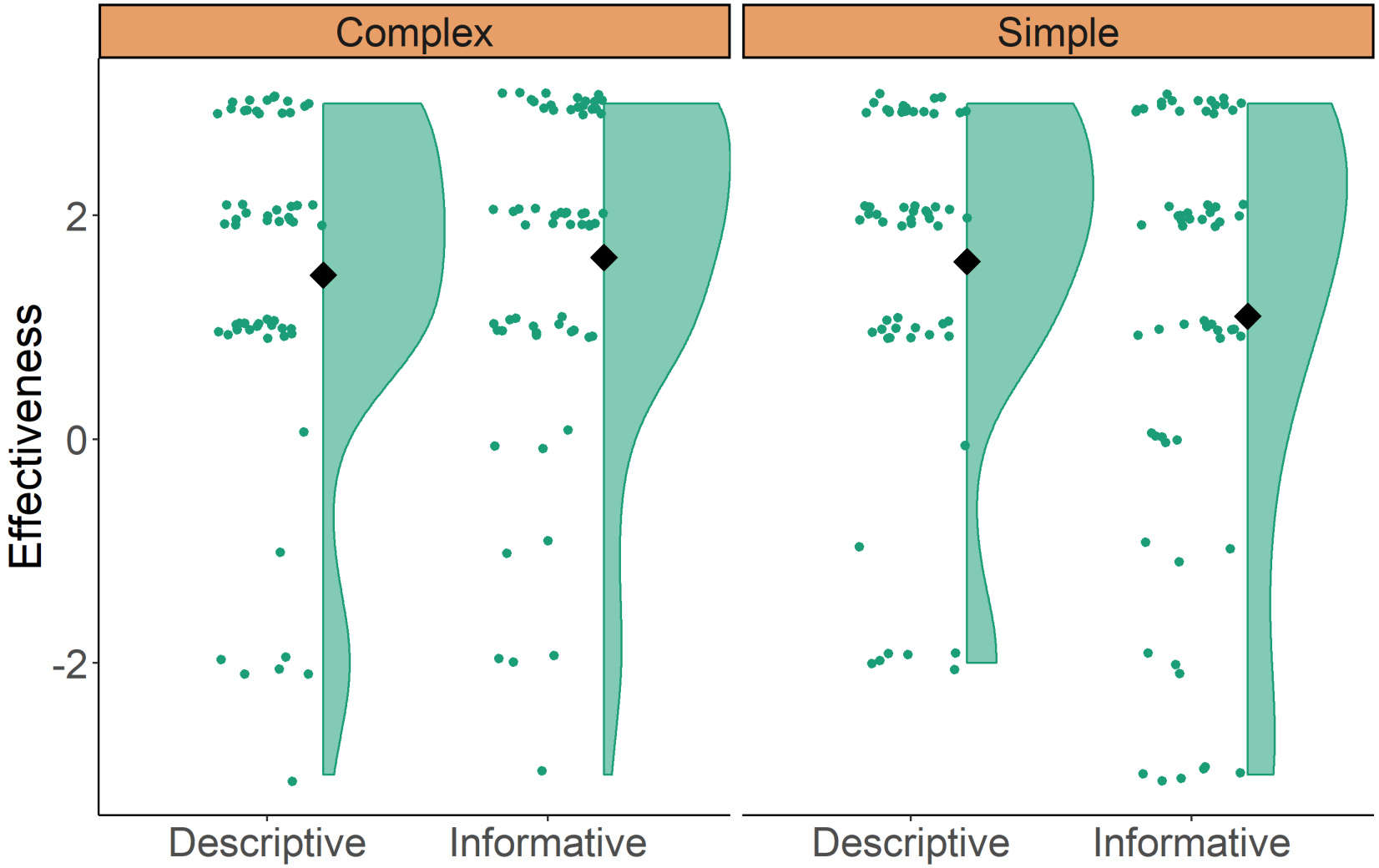
Effectiveness

3 items on whether they thought the program was effective, whether they would recommend the program to others, and whether they would increase funding for the program

Positive results led to viewing the program as more effective than viewing negative results.



Informative titles led to viewing the program as more effective with complex graphs but less effective with simple graphs.



Informative Titles…

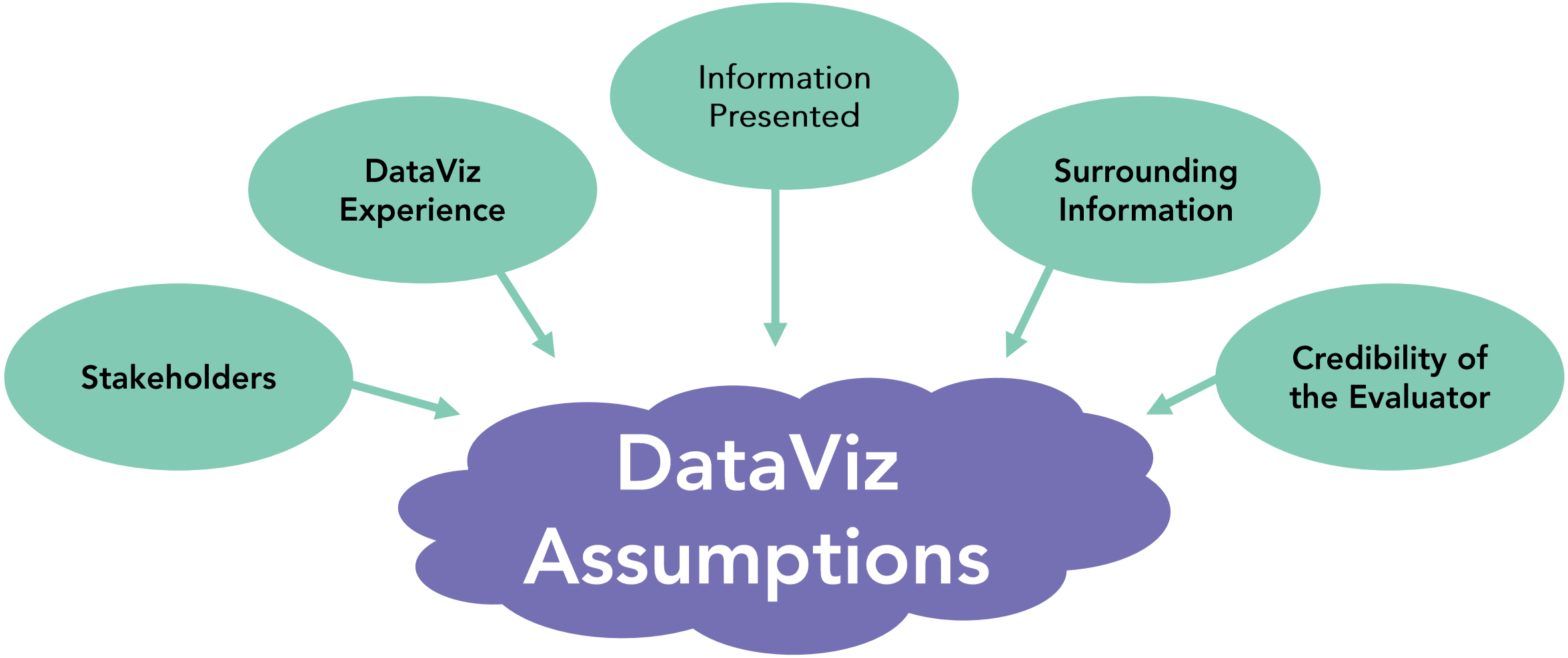
- Take less mental effort
- Lead to greater accuracy when paired with simple graphs
- Are more aesthetically pleasing
- Are more credible when paired with complex graphs

  (less credible for simple!)
- Result in viewing the program as more effective when paired with a complex graph

  (less credible for simple!)


DataViz
Assumptions

Contextual Factors



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@DanaWanzer