

Redesigning Google Form Responses

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Abstract

This project was motivated by personal struggles with Google Forms, a free service provided by Google for form creation, sharing, and reviewing, but with limited tools for exploratory data analysis. These struggles prompted the question: *What interactions can be designed that improve data analysis that fit well with Google's simple to use interface?* This question was explored by reviewing prior visualization research, collecting an online survey to gauge use and satisfaction, ideating on possible solutions, generating three video prototypes (chart filter, highlighting table, and drag to combine), interviewing current Google Forms users on prototypes, and collecting survey data on prototypes. It was found that clicking on aspects of charts to filter the Summary of Responses and highlight entries in Google Sheets was intuitive and useful to most users. Dragging charts to combine data was a conceptual leap, but useful to some.

1 Introduction

There are hundreds of form platforms online, but arguably none as accessible as Google Forms. Google Forms is a free service provided by Google that allows users to create their own forms online and share them with an unlimited amount of participants. In May of 2015 it was reported that over 2.5 billion people have Google Accounts [Gallagher 2016]. This means that over 2.5 billion users already have account access to Google's form building and reviewing platform.

Google Forms has grown so popular since its release in January 2008 that it is often listed as a top form builder platform [Guay 2015, Gavin 2015, Robert 2011]. Sites list free usage and simplicity as strengths of the service. Lack of features are often described as limitations of the platform.

Survey Monkey, a leader in online form building since 1999 hosts a web page dedicated to comparing the two services ["How Survey Monkey is Better than Google Forms"]. It cites limited customer service, inability to track responses, and non-interactive data analysis as limitations of Google Forms. These limitations are all features that SurveyMonkey and other subscription services offer.

Given that Google Forms is a popular, accessible service and ABC Inc. has an estimated \$551 billion net worth [La Monica 2016], one might expect standard data analytic software available in the review responses feature. Conversely, data analysis in Google Forms is currently limited to opening in Google Sheets, individually viewing responses, and non-interactive predetermined charts with un-filterable data.

This paper reviews areas for improvement in Google Form's Responses feature from prior design studies and survey results. Additionally, it suggests a redesign and tests new prototyped interactions with current Google Forms users. Hopefully with these suggested design changes data visualization novices can more intuitively explore their Google Form responses.

2 Related Work

Taking a simplistic design and updating it to better fit user needs is becoming a more common practice in the data visualization field. A popularly cited article renovates hotel organization methods by researching what managers physically tracked, updating those features to a digital interface, and using the new platform to create insightful interactions [Weaver, Fyfe, Robinson, Holdsworth, Peuquet, Maceachren 2006]. *Redesigning Google Form Responses* uses similar methodology to design a new interface that assists and not overwhelms current users.

Several platforms already exist for form creation with varying features for data visualization. (See Table 1)

Table 1: Top Online Form Building Platforms

Name	Public	Price	Analysis Features
Survey Monkey	1999	\$0-\$85 monthly	<ul style="list-style-type: none">- Filter- Crosstab- Word Clouds/Text Analysis- Customizable Graphs- Individual Responses- Custom Views- Export to CSV, HTML, XHTML, or PDF- Change Layout
Jot Forms	2006	\$0-\$99 monthly	<ul style="list-style-type: none">- Filter- Customizable Graphs- Interactive Grid- RSS Feed of Responses- Export to CSV, Excel- Change Layout
Wu Foo (Survey Monkey bought in 2011)	2006	\$0-\$1,799 yearly	<ul style="list-style-type: none">- Filter- Form Analytics- Customizable Graphs- RSS Feed of Responses- Export to CSV, Excel, XHTML- Change Layout
Google Forms	2008	free	<ul style="list-style-type: none">- Predetermined Graphs- Individual responses- Export to Google sheets, CSV

Previous visualization papers were also essential for prioritizing design decisions. *How Information Novices Construct Visualizations* tests barriers for novices in

exploratory analysis. They find that selection of data attributes and visual templates as well as visual mapping specifications are crucial to the visualization creation process. Additionally, translating questions into data attributes, designing visual mappings, and interpreting visualizations were difficult for novices. They also found that users were most comfortable with visualization schemas they were already familiar with like bar, line, and pie charts [Grammel, Tory Storey 2010].

Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods shares some critical design principles on how people naturally understand data. Data should be displayed in a way that emphasizes easiest perceptual tasks first. This means that something like a line or bar or dot chart should be prioritized over a pie chart since position and length are easier to comprehend than angle, area and curvature [Cleveland, McGill 2016].

Knowledge Precepts for Design Evaluation of Information Visualizations proposes a framework for avoiding analytic gaps. Their research suggests exposing data and its domain parameters, providing tools to test correlations, and offering suggested ways of combining and representing data as a way to help users evaluate their data. [Amar, Stasko, 2005] .

Lastly, *The Impact of Social Information on Visual Judgements* provided a useful what-not-to-do for the new framework. This paper identifies that systematic bias often influence how viewers interpret visualizations and that group visualization comments do not often have a definite benefit over individual assessment. [Adar, Hullman, Shah 2011]. Updating the Responses feature to allow conversation by visualizations would not necessarily benefit the application.

3 Methods

3.1 Initial Survey

To determine how people use Google Forms and the Responses feature, a survey was disseminated across Stanford campus. Understandably, this is a limited user group, but useful to study because Stanford students are active users of Google Drive features and tend to be more technologically advanced than the average individual. Their responses are representative of active users who range from novices to more advanced data analyzers.

The survey was created using Google Forms (a method of generating data to test the Responses feature while also gathering user data as well.) It asked respondents age, educational domain, usage of Google Forms, usage of Google Forms responses feature, usability of Responses feature, and frequency of use of the “Open in Spreadsheet” option.

3.2 Prototype Ideation

Once the design goals were set and need was determined, a process of iteration took place brainstorming useful and intuitive interactions that would seamlessly fit into Google’s current API.

From previous research papers, survey feedback, competitor services and testing of the responses feature a list of design priorities were generated. They are listed below with the following design guidelines, the application should still be usable and effective for people with less data visualization experience, follow the visual effectiveness schema, allow for more user control, and take advantage of the capabilities of online data collection.

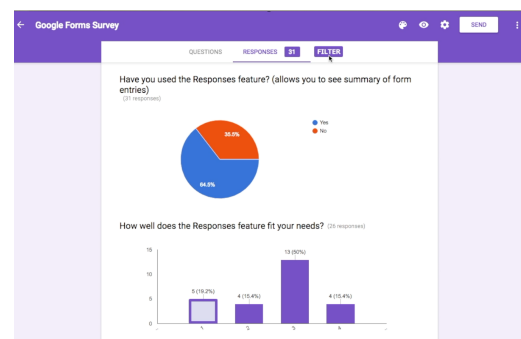
- Ability to contextualize chart features with full data subset
- Ability to compare and correlate separate fields
- Ability to associate individual responses with report
- Ability to create multiple reports
- Choice of data representation and ordering

These features were compiled together with three major interactions: **chart filter**, **highlighting table** and **drag to combine**. Other ideas for Google Form Responses are recommended such as tabs for saving different form views and the ability to change chart type and reorder visualizations. These changes, however, are more standard and have been implemented in services like SurveyMonkey, Jot Forms and WuFoo. This study tests new interactions and recommends changes that have already proven effective.

3.2.1 Chart Filter

The chart filter works by allowing the user to select parts of visualizations and then click “filter” to only see data that is representative of all selected parameters. This process is iterative so one can keep filtering summary sheets based on previous filters and close tabs that they do not wish to keep. This feature allows users to further understand data correlations and see how graph features affect the data as a whole.

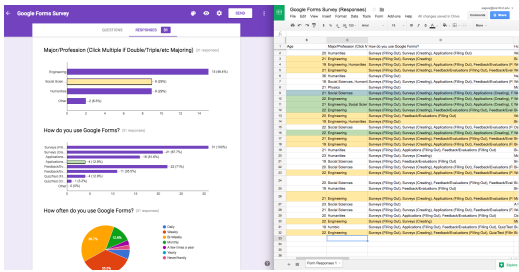
Figure 1: Chart Filter



3.2.2 Highlighting Table

The highlighting table works by having a live page with the Google Sheets data visible open while using the Review Response Summary Page. When a user selects aspects of a chart the relevant data in the table highlights. This helps users make connections between the data and the visualizations. It also highlights relevant individual responses. This feature can be turned on and off by clicking a button to open the table view, making it easy to ignore if it distracts the user from their needs. Allows for multiple color overlay on sheet.

Figure 2: Highlighting Table



engineering talent to improve the feature is already present at Google. Also, it was very important that the changes were streamlined into a format that made users comfortable.

In order to prototype, screenshots were taken on the Responses Summary page of the initial survey. Changes to the interface were created in Pixelmator by cutting and shifting parts of the page. Animations were made by deleting layers in Pixelmator to make new content appear, similar to a stop motion video. This was done while screen videoing in Quicktime player. Lastly, video was edited in iMovie to make transitions more seamless and the timing more reflective of realtime interactions.

3.2.3 Drag to Combine

Drag to combine works by dragging one chart over another to create a new chart that shows data pairings of each. The goal is to make the mental barrier to complex models less difficult to verbalize and then create. If users are interested in how two fields relate they can simply drag the two charts together to see the data combined without having to create and design the charts themselves.

3.3 Prototype Testing

3.3.1 Interviews

The prototypes were tested with individual interviews of five Stanford Students ranging in ages from 19 to 22. They were asked for their experience using Google Forms (novice, moderate or advanced, expert), working with data subsets, and their major. This group drew conclusions from the initial survey Summary Responses page and spoke through their thought process out loud into a microphone. After they went through all the responses they were shown the prototyped interactions one by one and asked whether or not each interaction would be helpful for understanding the data they just reviewed and whether it would be useful in their own use of Google Forms. Each tester was asked to give examples of how they would use such a feature and whether or not it would be worth implementing.

Figure 3A: Drag and Combine (Before)

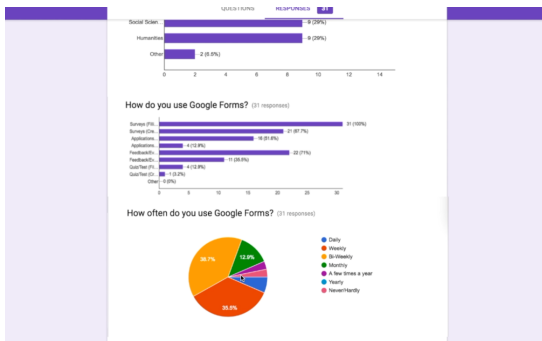


Figure 3B: Drag and Combine (After)

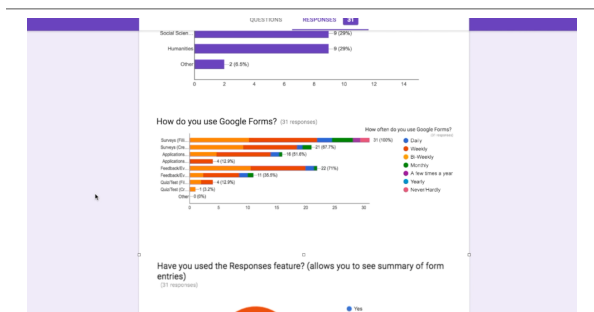


Table 2: Participants

No.	Age	Visualization Experience	Major
1	22	Novice	English
2	20	Moderate	Computer Science
3	20	Advanced	Undeclared
4	19	Advanced	Undeclared
5	21	Novice	Chemical Engineering

3.3 Prototype Creation

The goal of this study was to generate and test new ideas for the Google Form’s service, not to generate a fully functional prototype. The thought being that design is lacking from the current functionality of Google Form Responses, but the

3.3.2 Survey

A survey was also sent out on Stanford’s campus that asked users whether or not they had used Google Form’s responses feature before, in what capacity they have used the application, and how many hours per week they spend analyzing data. It then showed videos of each interaction and asked to rank helpfulness and to explain in what capacity it would be useful. This survey was completed by 21 participants.

4 Results

4.1 Initial Survey

The results of the first survey are divided into interface and data observations. Interface observations include limitations in the interface for understanding the data. Data Observations are the findings from the data itself.

4.1.1 Interface Observations

Table 3: Preliminary Form Observations

Could not filter by age. Could not change age into a different type of chart. (See Appendix)
Could not check to see if major affected type of charts people made. (See Appendix)
Could not see the “other” fields. (See Appendix)
Could not change from pie chart. (See Appendix)
Could not filter by people who have and have not used the Responses feature. (See Appendix)
Could not filter by usage of Google Forms. (See Appendix)
Could not group explanations by how well the Responses feature fits their needs. (See Appendix)
Could not get further details on people who entered longer feedback without finding them in individual responses
Could not find who did not answer specific questions
No way of knowing if people put in irregular responses
Not way of moving around data or choosing what charts to see at once

4.1.2 Data Observations

Thirty-one people filled out the initial survey. All respondents had used Google Forms, 100% have used Google Forms to take surveys and 71% to give feedback or evaluations. 67.7% had created their own Google Form for survey creation and 35.5% for feedback and or evaluations. Over 75% of respondents used Google Forms bi-weekly or more often.

Of respondents 64.5% had used the Responses feature with 24.6% of respondents feeling that the feature was “insufficient” for their needs. (See Figure 4). Some insightful feedback on the feature is in quotes in Table 4 ranked in order of satisfaction of user (least to greatest).

Usage of the “Open in Spreadsheets” option, the main alternative to Summary view of responses was mixed. (See Figure 5). The majority of users either commonly used the feature or never used the feature. Some feedback on reasons for usage amount is listed in Table 5 in order of user usage (least to greatest).

Figure 4: Response Feature Adequacy

How well does the Responses feature fit your needs? (26 responses)

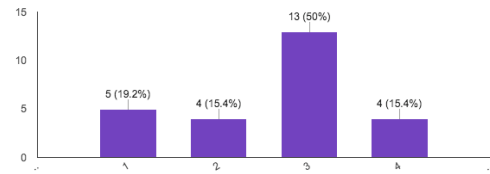


Table 4: Adequacy of Google Form’s Responses Feature

“It’s hard to understand”
“I don’t use it”
<i>The spreadsheet is better. The responses puts things into a specific format that is confusing to change. Different data means different things to different people”</i>
“It can be hard to read”
“Doesn’t link if they’re the same purpose”
“You only get certain features for certain types of questions which is annoying”
“I’m just confused at how to see everyone’s responses clearly but at once- and know which response goes with which person”
“Would like better sorting mechanisms, more features for sorting data entries”
“I wish it would automatically lengthen boxes so entire questions and answers can be seen”
“It’s dope”
“Doesn’t always provide helpful data”
“It gives me what I need but it would be great if it didn’t give me more than I needed. It makes it less organized for me. For example, I don’t want to know what time someone filled it out”
“Pretty good; haven’t explored enough to really think about it”
“I don’t really need it”
“Good for interpreting data and finding patterns. Not good to see people’s custom responses”
“No complaints with this feature”

Figure 5: Frequency of “Opening in Google Sheets”

How often do you use the "Open in Spreadsheet" option? (31 responses)

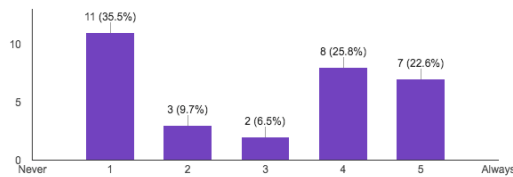


Table 5: Reasoning for “Open in Google Sheets” Usage

<i>“I didn't know I could”</i>
<i>“Didn't know this option existed, should be more explicit”</i>
<i>“Laziness tbh” (to be honest)</i>
<i>“It's kind of annoying to look at, a better way to display the responses would be nice”</i>
<i>“Depends, if its multiple choice questions I don't, if its longer, written answers I do”</i>
<i>“Sometimes, I need to open it to look for something, sometimes I can just preview it.”</i>
<i>“Another way to visualize”</i>
<i>“I like to see the answers in Spreadsheet format because it seems easier to me.”</i>
<i>“I often need to see responses tied to individuals”</i>
<i>“Every time I need to change something”</i>
<i>“It's easier to understand what individuals put”</i>
<i>“If I send it to my student group, I just want to see the responses”</i>
<i>“Easier to track answers”</i>
<i>“Generally don't need graphical representation of anything I'll do so the spreadsheet is always what I need!”</i>
<i>“If i just want a list of the answers, I use this. Also, it's easier to see people's custom answers.”</i>

4.2 Prototype Interviews

This section is divided into parts of the prototype interviews: Free Form Evaluation, Chart Filter, Highlighting Table, Drag to Combine.

4.2.1 Free Form Evaluation

All five testers were able to make basic observations with the data by using Google Form Responses’s predetermined charts from the initial survey. Although encouraged, participants largely did not make connections between graphs until shown new visualization mechanisms.

Participant 1: “If I had written [the questions] I would have been able to find more interesting information, I think”

Participant 2: Had an easy time making up things about the data, but trouble relating them to the graphics. “I have a hypothesis, but I am not even sure it relates to the data”

Participant 3: Uses Google Forms at work. Has to fill them out or get information from people in the office. Also uses it to get information from people in student group. Believes summary is much easier to understand than spreadsheet.

Participant 4: Does not like the way the numbers are shown: not sorted, colors are confusing. Does not like the way the width of bars shrinks if there are more choices for response. Likes the ability to hover and see more information

Participant 5: Only recently started using Google Forms Weekly for his social group. Wishes there labels on smaller pie chart slices. Did not understand why some would be unsatisfied with responses feature. “You should ask better questions or word better so that you get what you want from what is offered in the view responses feature”

4.2.2 Chart Filter

Participants were excited by the prospect of Chart Filter.

Participant 1: “I like that more than the original, because it tells me more about the response calculation which I think is interesting.”

Participant 2: “I really like that feature...A good way to discern bad data.” They work with high schoolers and often get bad data. It seems easier to filter out bad data if you can filter down to find inconsistencies. They “can get more specific information about the type of people who respond to a specific question...I like the intuitiveness of just being able to click [directly on the chart].”

Participant 3: Liked the concept of filtering. “Sometimes based on an answer of a question I just want to see those responses...I think it is less intuitive than a drop down, but I think people could learn it.”

Participant 4: “Oh, I love this...For research it would be useful to see if one demographic answers a question in a certain way... I like the ability to click on it a lot. It feels very Google.”

Participant 5: “I think it’s pretty cool. I would definitely use a feature like that... At least for my groups I can see what people don’t find appealing and then can talk to them... I like sorting [by clicking the] graph. I feel like drop down menu would be too cluttered....A graph already compresses data in a certain way.

4.2.3 Highlighting Data Table

Participants were also excited when shown the video for the highlight data table. Each had different ideas on the level of usefulness.

Participant 1: “If I were working in spreadsheets I feel like I would know the data well enough that I would not need to do this....Nice for demonstrating to someone else, or trying to see something quickly.”

Participant 2: “Seems like a spreadsheet version of the [chart filter]...I could see this being a more robust version of [filtering].”

Participant 3: “Helpful because I can see what all of one persons answers are...Do not need to sort sheet to see relevant categories”

Participant 4: “I do research... and trying to find if things overlap or not is such a pain, but this is so nice...I really like that. I wish these existed.”

Participant 5: “I haven’t used the sheets function on Google Forms, but I could definitely see that tool as being very useful because on a sheet everything is very cluttered.”

4.2.4 Drag to Combine

Participants had mixed feelings on the drag and combine feature.

Participant 1: “It is something I would not know that I could do or that I wanted to do.”

Participant 2: “The feature itself is very good.” They also had trouble immediately recognizing connection between previous two charts and the combined one.

Participant 3: “I find it difficult to understand.... “I think it makes it harder to understand if you squish them together... Could be useful in certain situations.”

Participant 4: “I’m a little bit confused... It is a little scary. Like, uh, it disappears...Would be easy to accidentally drag...It is interesting to see the break down, I like that...I wonder if there is a better way?”

Participant 5: “I’m not a fan of that because you are making data more cluttered. You are merging data whereas most people want to filter data into smaller pieces.” Also found it hard to compare with the bars staggered.

4.3 Prototype Survey

Out of the 21 participants who responded, only one had not used Google Forms’ Responses Feature, but they had filled out prior Google Forms surveys. Collecting responses on individuals, analyzing survey data, and gathering feedback were all popular use cases with 15, 14, and 13 respondents respectively. 12 respondents spent 1 hour or less per week analyzing data. 4 respondents spent 2-3 hours per week analyzing data. The remaining 4 who answered the question ranged between 8 and 20 hours per week.

The 4.3 subsections contain survey responses from seeing the interactions for the first time. Respondents ranked interactions on a scale from 1-4, 4 being extremely helpful and 1 being not helpful and explained rankings (ordered low to high).

4.3.1 Chart Filter

Figure 6 Helpfulness of Chart Filter

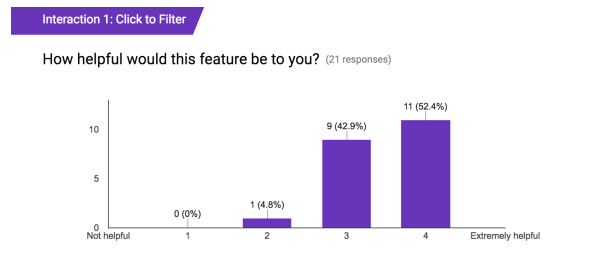


Table 6: Helpfulness of Chart Filter

<i>“Little confused as to what it does:”</i>
<i>“Good if you want to quickly scroll through”</i>
<i>“Probably not necessary for what I use Google Forms for, but it's a cool feature.”</i>
<i>“For any serious analysis, I'd download the data and use a stats program, but that would be useful for quick things”</i>
<i>“Hard to parse connected answers”</i>
<i>“Being able to see the demographics of a particular answer/response would allow me to think about what influences people to answer/respond in this way”</i>
<i>“I don't like google sheets at all, but if I want to compare answers and correlate them with each responder, this would be much easier.”</i>
<i>“Hard to parse out data with the current system. This looks like it helps cut down the variables to see how different groups fit together and parses the data”</i>
<i>“I don't use the Google Forms feature, but I believe that if I did, this feature would be extremely helpful in getting better feedback and a better understanding of those participating.”</i>
<i>“I feel as though the potential for google survey isn't quite actualized, and could be much more useful. This would allow me to sort and focus and be more detailed about my reports.”</i>
<i>“This would allow me to see things in new ways”</i>
<i>“Easier to narrow what I'm looking for”</i>

Out of the three interactions Chart Filter was ranked the most successful for the greatest number of participants. The average score was 3.48 with a standard deviation of 0.60.

4.3.2 Highlighting Table

Figure 7: Helpfulness of Highlighting Table

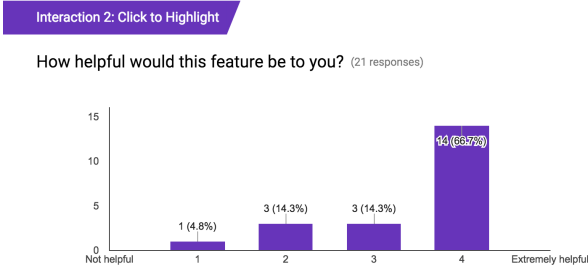


Table 7: Helpfulness of Highlighting Table

<i>"Whats wrong with just filtering"</i>
<i>"BE cool, but not crazy"</i>
<i>"Yes, Google Sheets often hard to read/track visually"</i>
<i>"It would be helpful for seeing who is answering questions a certain way"</i>
<i>"Easier to see"</i>
<i>"Being able to select specific date points would also be helpful if you are looking for specific patterns, trends, etc from the data points"</i>
<i>"ANYTHING TO MAKE THIS EASIER IS WELCOME"</i>
<i>"Clearer to connect names with certain responses or demographics"</i>
<i>"Once again, I don't use the Google Forms feature, but I believe that if I did, this feature would help me gain a better understanding of those participating."</i>
<i>"This would allow me to visually separate the differences between groups and even compare it to other groups and get a view of what might be overlapping qualities. This would be a great step between google survey as it is now, and others, like survey monkey, that i would have to pay for."</i>
<i>"OMG this would be so wonderful"</i>

The Highlighting Table was ranked the most "Extremely Helpful" by the greatest number of participants, but had a

lower mean (3.43) and greater standard deviation (0.93) than Chart Filter.

4.3.3 Drag to Combine

Figure 8: Drag to Combine

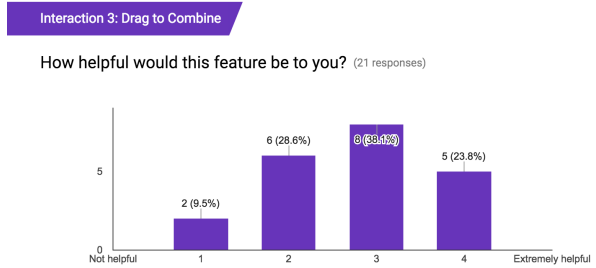


Table 8: Helpfulness of Drag to Combine

<i>"Doesn't look useful"</i>
<i>"Not sure how I would use this(/video cuts off quickly)"</i>
<i>"Seems slightly confusing. Would need good documentation to be helpful. Not a big fan of less-than-transparent combinations of analyses."</i>
<i>"It looks more complicated than i actually need with these forms"</i>
<i>"Once again, I don't use the Google Forms feature, but I believe that if I did, although this feature seems like it could be helpful, is seems to be more confusing and it would definitely take more time to understand than the separate graphs or other methods."</i>
<i>"Probably not necessary for what i use google forms for, but it's a cool feature."</i>
<i>"Nice to use, but doesn't necessarily give me a lot of functional use with data analysis."</i>
<i>"I like the option of learning more about how different questions intersect"</i>
<i>"Being able to compare and contrast different responses and charts would be helpful when trying to determine the overlap of responses and data"</i>
<i>"To be honest, I have tried to force my responses to do this even though I knew it wouldn't work."</i>
<i>"Wow, I could group together multiple categories once I realize that they're related"</i>

Drag to combine had the most evenly divided results with a mean of 2.76 and standard deviation 0.94. Eight respondents

found it to be unhelpful while thirteen thought it may be useful.

5 Discussion

Analysis of the initial survey confirmed hypothesis that Google Forms is a popular but underdeveloped feature. Nearly all survey takers had either taken or created surveys using the service more often than every two weeks. Yet, over a quarter found the responses feature inadequate for their needs.

The designed features for Google Forms in this study were welcomed with varying degrees of enthusiasm by testers. Chart Filter was the most consistently popular update to the existing program. Users liked the ability to filter by what they were seeing. This is logical because it helps users to visually contextualize their data without having to actively scroll and decide what filter to apply.

The Highlighting Table had the largest of people who found it "extremely useful," but also had an assortment of people who were unsure of use cases. Results of the preliminary survey mirror these results because most respondents either always used "Open in Google Sheets" or never did. It is possible that this feature makes Google Sheets more useful to visually minded individuals. This feature was also highlighted as being useful to see overlapping trends and full data entries for subsets.

Drag to Combine had the most mixed reviews. It was unnecessary for people looking to make simple observations. It also showed more data in one chart, which was overwhelming for some users. It is possible that a bad example was chosen to show the capabilities of the feature. The pie chart and the bar chart that were combined already had several variables each. Despite the mixed reviews, it is still useful to look into the capabilities of such a feature and how to make combining data more intuitive and less overwhelming for users. This feature could be a more advanced option or one that less people use.

Other recommendations for Google Forms Responses are the freedom to change chart type (ex: transition from a pie chart to a bar chart), introduce a plotting graph for numerical data, and consistent labeling of charts. Based on preliminary survey responses, prior data visualization research, personal experience, and competitor offers these are low risk upgrades that could have high yields for the platform.

With these new features Google Forms can keep the same simple format with a summary of responses with a chart for each question. But it additionally allows users to narrow down to the data they care about, makes Google Sheet view less contextually separated from the visualizations, connects full entries to certain aspects of graphed data, and shows the relationships between pre-existing charts.

6 Future Work

The next step is to create a working version of prototypes that integrates with Google Forms. More quantitative

assessments could be made with the functional application. One could test between an A and B group (with users outside of the Stanford Bubble) to see which group could produce the most accurate interpretations within an allotted amount of time, or time an A and B group to accomplish different tasks on the original and new version to see which is easier and faster. A new round of prototypes could then be developed from these assessments.

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Appendix:

Preliminary Survey Response Results

Figure 9: Major/Profession

Major/Profession (Click Multiple if Double/Triple/etc Majoring) (31 responses)

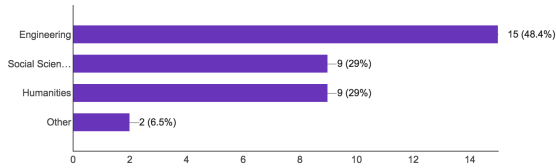


Figure 10: Google Forms Use

How do you use Google Forms? (31 responses)

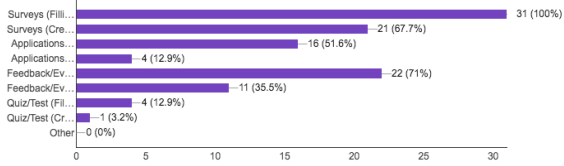


Figure 11: Google Forms Frequency of Use

How often do you use Google Forms? (31 responses)

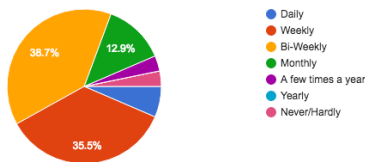


Figure 12: Responses Feature Experience

Have you used the Responses feature? (allows you to see summary of form entries)

(31 responses)

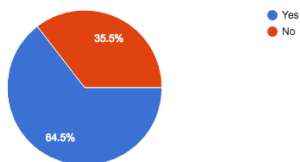


Figure 13: Numeric Data Representation

Age (31 responses)

