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Visualizing Qualitative Information

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Abstract

The abundance of qualitative data in today's society and the need to easily scrutinize, digest, and share this information calls for effective visualization and analysis tools. Yet, no existing qualitative tools have the analytic power, visual effectiveness, and universality of familiar quantitative instruments like bar charts, scatter-plots, and pie charts. Amid a discussion of the need for more powerful qualitative analysis and visualization tools, this article presents a device that takes us toward better representations of qualitative results.

Keywords

Qualitative Data Analysis, Pattern Recognition, and Visualization

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Visualizing Qualitative Information

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The abundance of qualitative data in today's society and the need to easily scrutinize, digest, and share this information calls for effective visualization and analysis tools. Yet, no existing qualitative tools have the analytic power, visual effectiveness, and universality of familiar quantitative instruments like bar charts, scatter-plots, and pie charts. Amid a discussion of the need for more powerful qualitative analysis and visualization tools, this article presents a device that takes us toward better representations of qualitative results. Keywords: Qualitative Data Analysis, Pattern Recognition, and Visualization

Introduction

Humans instinctively rely on qualitative information. When there were no clocks, they coordinated activities by phases of the sun and moon; later, by sundials and hourglasses. It was not until the invention of clocks, watches, and calendars that people synchronized their lives around specific numbers.

Today, numbers are used in abundance to help describe opinions, tendencies, feelings, needs and other concepts because they are seen as more manageable and efficient than text-based qualitative information. For the sake of efficiency, a coffee drinker may forego the exact amount of desired sweetness by using a packaged gram of sugar rather than measuring until the taste is "just right."An information scientist may measure the performance of a search system by calculating its ratio of recall (finding "wanted" items) to precision (success in excluding unwanted items) rather than talking to end-users who cannot always articulate what they need but know it when they see it.

Yet, if one needed to capture the exact moment when two people want to meet, precisely the amount of sugar that makes a cup of coffee "sweet enough" or the "right" information for a computer user, one must rely on qualitative approaches. Normally, qualitative research is presented using narrative and the occasional table. Both of these methods are appropriate for "telling" the story about the results. Imagine, however, being able to "show" the story by way of displays that assist with analysis and sharing of qualitative data results. Amid a discussion of the need for more powerful qualitative analysis and visualization tools, this article presents a device that takes us toward better representations of qualitative results.

Why We Need Graphical Displays

Qualitative researchers have the formidable task of capturing, sorting, analyzing, interpreting, and sharing qualitative data. With the help of qualitative software, they have succeeded in capturing, recording, and sorting information. What would the qualitative world look like if they were able to visually capture qualitative phenomena? Two

potential outcomes of this ability are the increase in both analytical power and credibility of qualitative results.

Analytical Power

Thorne (2000) describes qualitative analysis as "confusing" because of the mystery often surrounding the way study results evolve from the data. This demonstrates the need for tools that help users visually analyze findings, share results and connect data directly to findings. Support for the graphical display of information using primarily quantitative data is well documented (Cleveland & McGill, 1984; Lockwood, 1969; Schmid & Schmid, 1979; Tufte, 1983; Wallgren, Wallgren, Persson, Jorner, & Haaland, 1996). However, little is known about the graphical display of qualitative data.

Software currently available for qualitative researchers ranges from simple databases for searching, sorting, and retrieving to visually editable displays that take full advantage of data imported from any number of sources (Lewins & Silver, 2009; Weitzman & Miles, 1995). Though the software saves time, it does not fundamentally change the way qualitative data are analyzed and represented (Coffey, Holbrook, & Atkinson, 1996; Dohan & Sanchez-Jankowski, 1998).

No qualitative analysis tool has the analytic power, visual effectiveness, and universality of quantitative tools like pie charts, bar charts, and scatter-plots. A picture has the means to communicate ideas, relationships, situational dynamics and other concepts in a qualitative dataset. It is up to qualitative researchers to provide the pictures.

Credibility

A graphical display of qualitative information may address transferability and confirmability, two of the four criteria set out by Lincoln and Guba (1985) as elements of trustworthiness in qualitative research. Transferability deals with the reproducibility of a qualitative study to other contexts or settings. Because qualitative research chronicles real life as it takes place, it cannot be replicated exactly. However, data sets, collection methods, and coding can be described in a way that provides a road map for duplicating the data collection and analysis process. Displays that include cases, factors, codes, relationships, and patterns that make results and procedures available at a glance can be major steps in this direction.

Confirmability refers to the degree to which others can corroborate results. Visual displays can provide quick and visible answers to questions such as who did what, why a phenomenon occurred, and what influenced the phenomena, so that different analysts can see the same information and either confirm findings or draw alternative interpretations. A well-constructed visual display can provide researchers with a collective knowledge of relationships, concepts, phenomena, and players in a qualitative dataset.

The Current State of Graphical Displays

Most visual displays of research are adequate for use with quantitative (what, where, and when) results, but are not so good with qualitative (why and how) ones. A graphic depicting the number of people who go to therapists, for instance, would look

very different from one showing why they go. This makes apparent the shortcomings of currently available graphical displays in reporting qualitative research results.

Pie charts, circular displays of categorical data showing percentages of a whole, are familiar and easy to create and understand. Yet, their effectiveness lies in the display of quantitative, not qualitative, data. Likewise, a horizontal or vertical bar chart allows a researcher to display results of a study based on the length or height of the bar. A reader may readily recognize patterns based on variables like frequency or amount but they cannot see phenomena in context or understand how or why an event occurred.

Scatter-plots, which usually consist of a large amount of data, provide a visual summary of the affect of one variable on another. An imaginary line drawn through data points in the display determines best "fit" in that the more the points cluster around the line, the stronger the relationship between the two variables. Scatter-plots of this type, however, depend on numerical data and cannot show phenomena in context or answer how or why. Miles and Huberman (1994) show textual data using diagrams similar in appearance to scatter plots, and SPSS produces scatter-plots of categorical data. The diagrams, however, are not independent of the datasets.

Semantic network diagrams can be developed using qualitative software known as conceptual network builders (Weitzman, 1999). The diagrams present a treelike structure with branches that demonstrate relationships. Users can identify particular cases or number of participants and can see relationships and develop theories. Patterns, however, are difficult to discern at a glance and results are difficult to share. Also, like the textual scatter-plots, the diagrams are not independent of the datasets.

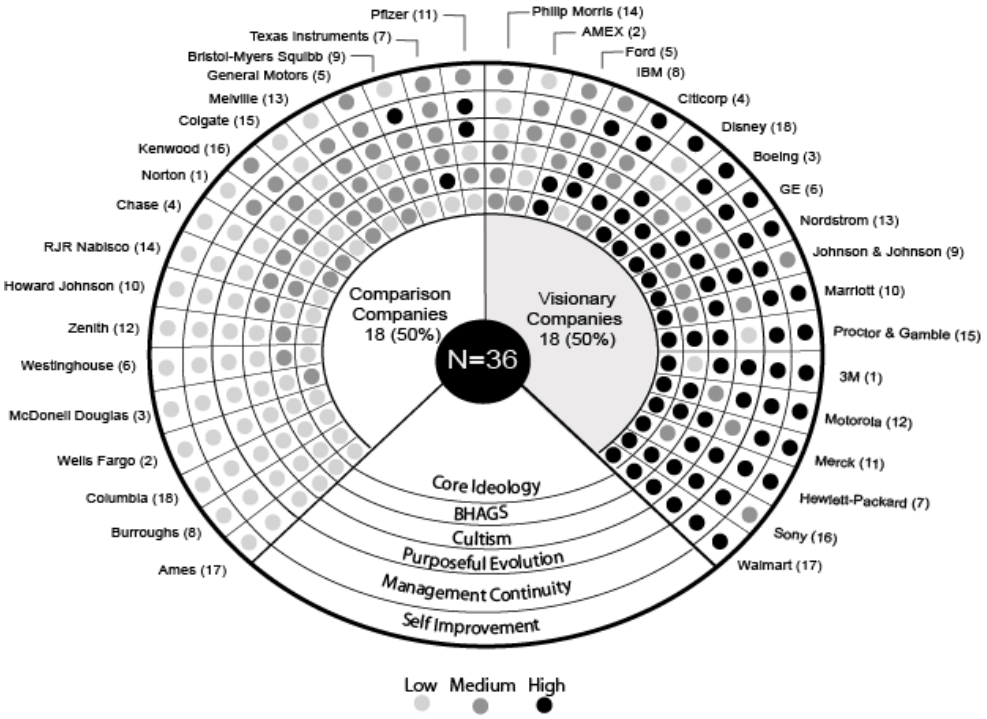
Though the diagrams herein have advantages, none is superior to tables. Using tables, an analyst can quickly ascertain relationships amongst categories. Tables are easily editable. One might, for instance, show percentages of cases within each category or how some categories compare to others. Tables reveal more information than the pie chart, bar chart, and scatter plot, and are less cumbersome than the semantic diagram. Though they are currently the best display tools for qualitative data results, tables cannot graphically show patterns within the data nor the structure of relationships between factors, cases, and categories.

Another View: The Spectrum

Example One

"Valid analysis requires, and is driven by, displays that are focused enough to permit a viewing of a full data set in the same location, and are arranged systematically to answer the research questions at hand" (Miles & Huberman, 1994, p. 92). A device called the Spectrum facilitates analysis of qualitative results at a glance. Figure 1 shows a display of data from *BusinessWeek* bestseller, *Built to Last: Successful Habits of Visionary Companies*, by James Collins and Jerry Porras (2002).

Figure 1. A Spectrum display of data from *Built to Last: Successful Habits of Visionary Companies*



Using surveys and historical data, the authors developed a list of 18 "visionary" companies based on characteristics that made them successful over time. They compared each company to another in the same industry that had not performed as well. The results were originally presented in narrative and seven tables, which were reduced to factors, categories, codes, and symbols for display on the Spectrum. Factors are groups of related categories. The center of the diagram in Figure 1 contains a nucleus, a black circle or semi-circle that displays the total number of cases. Immediately above the nucleus is a larger semi-circle that represents the first factor. A number of rows and columns resembling a table are above the semi-circle. The topmost part of the diagram displays each case, or sample, in the dataset. Labels in the lower part of the diagram help describe categories in factor two.

The first factor is level of success (visionary or comparison). Within these categories, the companies are organized by their similarity to others within the second factor, characteristics which includes core ideology, the principles that drive a company beyond profits; BHAGs (Big hairy audacious goals), daredevil-like goals that are in line with a company's core ideology and within the realm of possibilities; cultism, a cult-like commitment to the company and its core ideology; purposeful evolution, the process of evolving and trying new things as the company expands; management continuity, filling top management positions from inside the company; and self-improvement, the quest to do better on subsequent days than the day before.

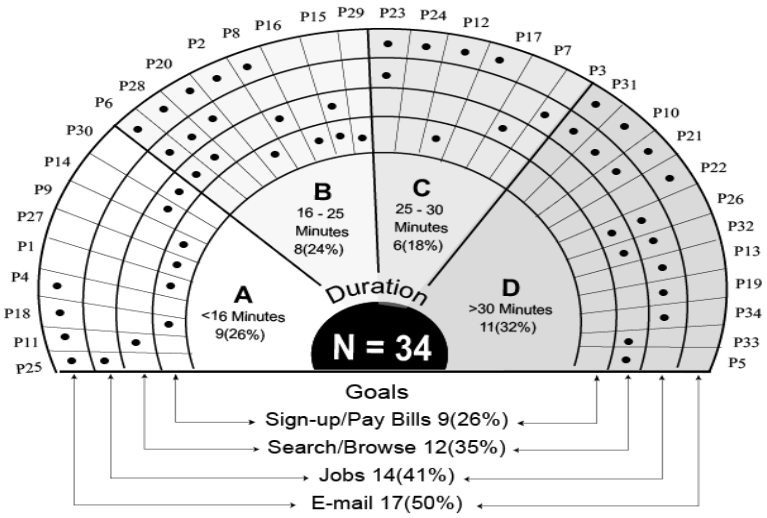
The numbers in parentheses (1-18) represent the match between the visionary company and its comparison company. In the display, the best-rated companies in each category of the second factor are represented with black bullets. Dark gray bullets mark the mid-range companies in each category and light gray represent the lowest-rated companies. The volume of black on the right side of the diagram confirms the findings by Collins and Porras that visionary companies perform better in key qualitative characteristics of performance than do comparison companies.

More significantly, the display presents new questions. Why does the retail discount industry contain the highest rated company over time (Wal-Mart) and one of the lowest rated (Ames)? Does the location of Ford and General Motors near the top of the display suggest there is less qualitative difference between high-performing and low-performing companies in the auto industry than in other industries? Do high ratings on Core Ideology and BHAGs distinguish high performing companies in the auto industry from low performing companies? Does the fact that Merck is one of the most successful Visionary companies and that its match, Pfizer, is the best of the Comparison companies mean that companies in the pharmaceutical industry perform better overall than those in other industries? Questions of this sort open the door to further inquiry, the essential task of qualitative research.

Published works highlight the benefits of Spectrum displays. In a study of Internet users, the Spectrum showed the relationship between mental models, motivation, and experience on searching habits (Slone, 2002). Displays in Slone (2003) showed the association between Internet users' age group and their search goals and experience. Other diagrams illustrate the categorical differences in the ways end-users searched on the Internet and on a library online catalog, and demonstrated the relationship between time and the manner in which end-users searched the Internet (Slone 2005; 2007).

Example Two

Figure 2. Spectrum representation of user goals in relation to search duration[1].



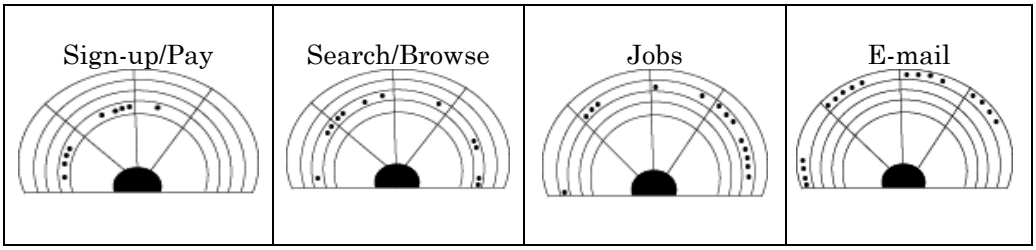
[1] P(#) is the number assigned to each participant.

Figure 2 displays results from Slone (2007). The first factor, duration, contains categories or groups A, B, C, and D, which are based on the amount of time spent online for 33 participants using the Internet in a public library. Group "A" contains participants who were online for less than 16 minutes; those who used the Internet for 16 to 25 minutes are in "B;" participants who used the Internet for 26 to 30 minutes are in group "C;" and those who used the Internet for longer than 30 minutes are in group "D."

Within these groups, participants are organized by a second factor, goals. Here, bullets represent the types of activity each participant performed. The categories include sign-up or pay bills, jobs, searching or browsing, and ee-mail.

Figure 3 displays miniature representations of the goals factor from Figure 2. The bullets that represent the sign-up/pay bills category are primarily in the first two categories of the duration factor, which represent shorter searches, while the job-seeking pattern is weighted to the right side (longer searches). The patterns suggest that the less time one has for Internet use the more likely s/he is to pay a bill than to search for a job or that users allow more time for job searching than for bill paying.

Figure 3. Mini representations of the patterns from Figure 2.



Given these scenarios, one can say that both the sign-up/pay bills and job-seeking categories are time dependent. The bullet patterns for searching/browsing and e-mail, on the other hand, are more evenly distributed across the four groups of the Spectrum, indicating that searching/browsing and use of e-mail are less related to time than paying bills or job hunting.

Development of the Spectrum

The Spectrum was not a planned creation. It was the result of an attempt to organize and understand a massive amount of categorized and coded qualitative data. The data was initially organized using QSR NUDIST, qualitative data analysis software, and MS Word tables. At the time (2000), few qualitative analysis software packages could assist with visual comparisons of the relationships between qualitative cases and categories. The Spectrum was successful in showing these relationships. This is because each bullet points back to the raw data. For instance, the first bullet in figure 2 means that participant 25 used e-mail for less than 16 minutes. Interpretations that may not have been made were done so using the Spectrum.

Limitations

There are several limitations of Spectrum use. Perhaps the most significant one is that, of the many qualitative methods available, the Spectrum uses only grounded theory whereby the data is methodically reduced to codes and symbols. Further, symbols are used in place of labels within the curved table, so it is not always easy to determine what each individual symbol represents. This is mitigated by label definitions at the bottom of the display, but does not substitute for narrative. Additionally, the Spectrum requires at least one mutually exclusive category. This limitation is important given that the Spectrum is organized hierarchically beginning with a mutually exclusive factor. In some cases this may give more importance to mutually exclusive categories than they might otherwise have had. Finally, the Spectrum is unfamiliar to qualitative researchers.

The closest analogies to the Spectrum for qualitative analysis are semantic network diagrams, which can be created using a number of software packages or even a simple draw program. The diagrams are more accessible and easily understandable. The difference in a semantic network diagram and the Spectrum is that, in the former, the look and organization of the display is based on the data, while in the latter, the elements are consistently arranged (cases, factors, categories, etc.) without regard to data.

Conclusion

Humans instinctively rely on qualitative information, have an aptitude for pattern recognition and like to share information. What if qualitative researchers had in their hands the power to address all of these characteristics in one display? Such power would derive from a tool that is familiar, flexible, easy-to-use and easily shareable. Researchers can use it for analysis and non-researchers can understand a phenomenon at a glance.

Yet, tools currently used to analyze information (primarily data organizers and databases) and for presentation (narrative and tables) fall far short of matching the analytical power, familiarity, and share-ability of quantitative tools like bar-charts, pie-charts, and scatter-plots. As a result, the valuable work of qualitative researchers is available only to a limited audience. This article supports the merging of qualitative information with the human ability to derive understanding from graphics. Though not all qualitative studies lend themselves to graphical displays, those that do have the potential to provide visual renditions of data in context that are both powerful and analytically effective.

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