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Data Integration: A Real- Time, Participant-Driven, and Visually Supported Method

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Data Integration: a Real-time, Participant-driven, and Visually Supported Method

Abstract

We introduce a method in which instant data visualization facilitates real-time data integration and involves participants in data interpretation. The results of quantitative research (e.g., electronic card sorting) are represented visually (e.g., in a dendrogram) and fed back to research participants in follow-up focus group conversations. The visualized quantitative results are reviewed and discussed by participants. The visual display of the quantitative results is annotated with qualitative feedback generated by participants that explains, enriches, or challenges the quantitative results. We apply our method in a card sorting study of Fédération Internationale de Football Association's (FIFA) stakeholders. An approach that facilitates real-time data integration that is participant-driven and visually supported is the unique contribution of this article to mixed methods research.

Keywords: real-time integration; collaborative interpretation; visual representation

Background and Methodological Purpose

In mixed methods research, researchers combine elements of qualitative and quantitative approaches (e.g. qualitative and quantitative viewpoints, data collection, analysis, and inference techniques) to gain breadth and depth in understanding and corroboration (Johnson, Onwuegbuzie, & Turner, 2007, p. 123). According to a recent definition, mixed methods include “any research that involves multiple sources and types of data and/or multiple approaches to analysis of those data, in which *integration* of data and analyses occurs prior to drawing final conclusions about the topic of the investigation” (Bazeley, 2018, p. 7). Notably, “meaningful integration of qualitative and quantitative data remains elusive and needs further development” (Guetterman, Fetters, & Creswell, 2015, p. 554). Researchers employing mixed methods often experience difficulty in integrating the analysis and interpretation of the quantitative and the qualitative data and writing a narrative that link[s] the analyses and interpretations (Bryman, 2007, p. 10).

Hence, there is a need to find ways to facilitate meaningful integration of quantitative and qualitative data. Our attention turned specifically to “development of descriptive and narrative accounts from quantitative (statistical) data” (Bazeley, 2018, p. 223). Such accounts result whenever researchers describe, interpret, or discuss their findings in prose. As integration of this kind is not often used as a deliberate analysis strategy in mixed methods projects, it may offer “untapped potential” (Bazeley, 2018, p. 223). In this article we unleash this potential by offering

a visual approach to elicitation of qualitative participant interpretations of visualized quantitative data in a real-time data integration. The methodological purpose of our article is to provide a method which facilitates real-time integration that is participant-driven and visually supported.

Our work is structured as follows. We begin with a review of the literature on the use of visual representations in mixed methods research and on participant involvement in data interpretation. We then provide a summary of our method, including a description of its constitutive phases and their outcomes, as well as a description of an illustrative study in which the method was employed. Finally, we evaluate the method and discuss it with reference to its contribution and limitations. The following section aims to clarify what types of visual representations exist and to contextualize their role in mixed methods research.

Literature Review

Use of Visual Representations in Mixed Methods Research

Building on recent efforts to systematize the use of visual representations in mixed methods research (Archibald, 2018; Balomenou & Garrod, 2015; D'Angelo, Ryan, & Tubaro, 2016; Guetterman, Fetters, and Creswell, 2015; Onwuegbuzie & Dickinson, 2008; Shannon-Baker & Edwards, 2018), it is possible to identify three main (often overlapping) purposes of use. Visual representations are used in mixed methods research for *data elicitation*, *data integration and interpretation*, and *data communication*.

First, mixed methods researchers use visual representations to *elicit* that which is difficult to verbalize or observe. Visual representations (e.g., diagrams, drawings) are produced by researchers or by the research participants. Visual representations that are produced by researchers are used as stimuli in the study to elicit responses from research participants. For example, Tubaro et al. (2016, p. 7) asked participants to fill in the blanks on a diagrammatic

representation of concentric circles and Alexander et al. (2015, p. 38) asked participants to fill in the blanks on a metaphoric representation of a funnel. Visual representations that are produced by the research participants express feelings or illustrate situations introspectively and reflectively. For example, the participants in the studies of Brechet et al. (2009), O'Connell (2013), and Shannon-Baker (2015) produced self-portraits, drawings and photos to express feelings and illustrate situations.

Second, mixed methods researchers use visual representations to *integrate* and *interpret* quantitative and qualitative data in order to derive new insights beyond the information gained from the separate quantitative and qualitative results (Fetters, Curry, & Creswell, 2013, p. 2143) and hence to enhance their understanding of the phenomena under analysis (Onwuegbuzie & Dickinson, 2008). For example, mixed methods researchers use *joint displays* (Guetterman et al., 2015) to integrate quantitative and qualitative data by bringing them together with the purpose of direct comparison.

Third, mixed methods researchers use visual representations to *communicate* research results to the readers. For example, crossover *graphical displays* (Onwuegbuzie & Dickinson, 2008) summarize integrated quantitative and qualitative results in (interactive) line charts, georeferencing plots, bubble plots, scatterplots, pictograms, maps, and (decision) trees. The title “crossover” (Onwuegbuzie & Combs, 2010) comes from using techniques from one tradition (e.g., quantitative) to analyze data associated with the other tradition (qualitative).

Visually supported mixed methods studies can be conceptualised as involving different levels of visual representations. In his seminal work, Tufte identified five levels of visual representations (Tufte, 2001, p. 178): *text* (level 1); *tables* (level 2), which show exact numerical values; *text-tables* (level 3), which summarize and arrange numeric data by type (i.e.,

demographics, source, time, group membership, scale, level) to facilitate comparison; *supertables* (level 4), which provide organized, sequential detail, and reference-like quality and may contain pictures; and *graphics* (level 5), which combine words, numbers, and pictures.

The visual representation used in Nicca et al. (2012, p. 229) can be categorized as a text-table – corresponding to Tufte’s third level of representations (Table 1). For the purposes of data integration/interpretation and data communication in a multi-phase mixed methods study, this table summarizes and arranges numeric data by “symptoms” according to a questionnaire, “appraisal of symptoms” according to contrasting groups of participants in narratives elicited after the questionnaire, and the results of testing hypotheses regarding differences in the participants’ narratives.

Insert Table 1 about here

The elaborate table used at the data interpretation stage for Alexander et al. (2015) can be categorized as a supertable – corresponding to Tufte’s fourth level of representations (Table 2). This supertable contains numeric, textual, and visual data (i.e., the experimental conditions are visually represented). The supertable allows comparisons between the shared and withdrawn thoughts regarding project experiences. The horizontal rules divide the data into group-related paragraphs; the rows are ordered so as to tell an ordered story about the experimental groups and the individual members of the experimental groups (based on integrated thoughts). Further examples of elaborate tables may be found in Peroff et al. (2019, p. 8) and Flowers et al. (2015, p. 851).

Insert Table 2 about here

The diagram used in Bustamante (2019, p. 171, Table 3) can be categorized as corresponding to Tufte's fifth level of representations. This diagram was used to represent the integration of quantitative and qualitative data: black represents quantitative data, white qualitative data, and gray represents the mixing of black and white – in this case, the outcome, or “fit”, resulting from integrating the quantitative and qualitative data. The diagram used in Tubaro et al. (2016, p. 7) also corresponds to Tufte's fifth level of representations, but has been used for the purpose of data elicitation. The personal social network of each research participant (Table 3) contains concentric circles that represent relational proximity to ego, while the quadrants represent the context of relationships in the social network. Research participants were asked to fill in the blanks between the circles. Similarly, Alexander et al. (2015, p. 38) used a diagrammatic representation (a funnel metaphor) for the purpose of data elicitation. The research participants were asked to fill in the blanks on the funnel in order to share their project-related experiences. The types of level-5 visual representations used in mixed methods include arts-based graphics. For example, Brechet et al. (2009), O'Connell (2013), and Shannon-Baker (2015) collected self-portraits, drawings and photos produced by participants and analysed them in mixed methods studies.

Insert Table 3 about here

Visual representations have the potential to add to the inference-drawing capacity of researchers, but not necessarily to the integration of data. Bazeley (2018) points out that visual displays generated by “software are helpful to varying degrees in revealing and displaying patterns in data – sometimes more *for the researcher* [emphasis added] during the analysis process than for the reader of a report” (p. 297). But what about for *participants*, who are increasingly being drawn into the process of data analysis and interpretation?

Involving Participants in Data Interpretation

The idea of involving research participants in data interpretation stems from early concerns about the provisional nature of knowledge and the limits of objectivity (Popper, 1959). Participant involvement has been motivated by early concerns regarding interpretation biases (MacCoun, 1998) as well as by more recent concerns that inferences drawn “should make sense to those who contributed the data” (Bazeley, 2018, p. 55). So-called reflexive (or participatory) research methods describe a partnership between researchers and research participants in order to use the knowledge and abilities of each (Van de Ven, 2007). Participatory methods have been used in attempts to involve participants in data interpretation (as e.g. “co-researchers”). Such methods are frequently used in fields like postmodern ethnography (e.g. Presnell, 1994), anthropology (e.g. Feighery, 2006), applied communication research (e.g. Deetz, 2008), action research (e.g. Heron & Reason, 2006; Reason & Bradbury, 2008), and less frequently used in management and organization studies (Bartunek, 2007; Van Aken, 2004; Van de Ven, 2007). In mixed methods, participatory research is “one expression of a pragmatist position” (Garner, 2015, p. 179). For example, community-based participatory research (Israel et al., 2013) combined with mixed methods research (Dejonckheere et al., 2018) engage research participants in the design and implementation of research that may benefit society (Molina-Azorin & Feters, 2019). Ivankova (2014) first discussed intersecting mixed methods with action and participatory research approaches.

It has been suggested that researchers and participants collectively negotiate the meaning of results to help complement otherwise “incomplete” research (Alvesson et al., 2008, p. 483). Another proposal for involving participants is to open up research texts to “multiple readings” by participants and audiences (Alvesson et al., 2008; King & Learmonth, 2015; Lukka & Modell,

2010). These multiple readings may take place (a) during “data collection and initial analysis” (through events such as meetings and workshops), (b) during “interpretation” (through joint interpretive forums), (c) during “dissemination” (through co-authorship of research reports), or (d) during “implementation” (through guidance and advice on implementation) (Knight & Pettigrew, 2007, pp. 7–9). Joint interpretive forums have been suggested by Mohrman et al. (2001) and Rynes et al. (2001) as events (like workshops or conversations) where researchers and practitioners work together to interpret results. However, both Mohrman et al. (2001) and Rynes et al. (2001) are conceptual epistemological papers, which suggest (but do not apply) “joint interpretive forums” as a concept.

Kieser and Leiner (2009, p. 527) noted that the overwhelming majority of articles resulting from collaborative research [with participants] are of an epistemological kind. Kieser and Leiner also indicated that they did not know of any publications that contain jointly produced *research* output describing research *results* rather than processes and the difficulties of collaboration between researchers and research participants. Hence there is a recognized need to find ways to facilitate joint researcher-participant interpretation of research results.

According to Howe and Eisenhart (1990), Bazeley (2018, p. 56), and Kuckartz (2018), “all scientific analysis involves acts of interpretation *by researchers*” [italic added]. The role of the researcher remains paramount in deciding issues relating to ... the meaning of codes, the interpretation of the data tables and displays produced using the computer (Bazeley, 2010, p. 418–419). Interpretation conducted by *researchers* is influenced by their research purposes, their subjective awareness and sensitivity, the context in which the data were obtained, the underlying conceptual framework, and the choice of methodology. Interpretation of data still remains largely the prerogative of scholars, even though participants commit substantial time and resources to

the studies and numerous approaches have set out to involve them in the process. With this work, therefore, we aim to contribute by offering a visual approach to involve participants – by using visual representations to elicit qualitative participant interpretations of visualized quantitative data in a real-time data integration.

In this section, we have (1) reviewed the visual representations used in mixed methods research, and (2) shown that there is a recognized need to find ways to facilitate joint researcher-participant interpretation of research results. On the basis of these methodological needs, we now introduce an innovative method enabling research participants to review quantitative results through visual displays shortly after the research participants have provided the quantitative data.

The Method and an Illustrative Example

The method for data integration we introduce in this paper consists of seven phases: data collection, formation of focus groups, data analysis (quantitative), data visualization (quantitative), data collection (qualitative), data analysis (qualitative), and critical interpretation. Table 4 introduces the phases of our method, along with detailed information on associated procedures and products. We have compiled this table in accordance with guidance for visual modeling of mixed-methods design procedures provided in Ivankova et al. (2006, p. 16). The mixed methods design used is explanatory sequential (as defined by Creswell et al. 2011) because it is intended to explain initial quantitative results using a qualitative follow-up component.

Insert Table 4 about here

In order to showcase application of our method, we conducted a study in which we explored sensemaking of stakeholder groups by managers. The purpose of our study was to understand the reasoning managers apply when grouping stakeholders and when designing

strategies for dealing with each group of stakeholders. Our research question was the following:

How do managers make sense of stakeholder groups?

Sensemaking has been defined as “the ongoing retrospective development of plausible images that rationalize what people are doing” (Weick et al., 2005, p. 409). This is an important yet under-researched aspect of stakeholder management (Davis, 2014, p. 192; Turner, 2014; Turner & Zolin, 2012; Turner & Müller, 2006). The participants’ task in our study consisted of identifying groups among Fédération Internationale de Football Association’s (FIFA) stakeholders. FIFA is a suitable case for exploring managers’ sensemaking of stakeholder groups; it is beholden to a number of stakeholders who require different information about its performance (Schenk, 2011) and demand different strategic approaches. As revealed by recent scandals documented in the press (Poddar, 2014), FIFA seems to eschew formal mechanisms of accountability to its stakeholders (Pielke, 2013). Making the organization more accountable would require, among other things, making sense of FIFA’s stakeholder groups and designing a strategy for dealing with each of them.

Our study participants were 50 managers enrolled in a part-time executive MBA program in Switzerland. Our sample was appropriate for uncovering how managers make sense of stakeholder groups. The participants were collectively experienced managers (with an average work experience of 8 years), cross-functional (coming from different functional areas), and international (coming from 17 different countries). No prior knowledge of FIFA was necessary. All participants were informed that their participation was voluntary, anonymous, and would not be graded.

Phase 1: Data Collection

In this study, we collected quantitative data through electronic card sorting. To convey the card sorting instructions, we created a website

(<https://sites.google.com/site/cardsortingstakeholders>) in which we uploaded information about FIFA and explained the task that participants were invited to complete. Each participant was given 10 minutes to read the background information

(<https://drive.google.com/file/d/1L1crREVbzFZfmIotZA8-84K-SLZRfR5c/view>) and the task instructions (https://drive.google.com/file/d/1zaVF2PxxEkfwXnATGb8VcInn_VpWEaIh/view).

The background information covered essentials about FIFA's stakeholders and the problems associated with managing them. The individual task that each participant had to complete was formulated as follows:

TASK: *"You are a strategy consultant working for FIFA's president. The president is facing the challenges of stakeholder diversity and stakeholder pressure. Your task is to give him an overview of his stakeholder groups in order to help him better understand them. You will have to sort the stakeholder cards online* ([https://www.simplecardsort.com/sort.php?s=JLX122XD&p=454¹](https://www.simplecardsort.com/sort.php?s=JLX122XD&p=454<sup>1</sup))). *Each card will have the name of a FIFA stakeholder written on it. **We would like you to sort the cards into groups.** You are welcome to use any criteria you like and any group labels and subgroup labels you like, including 'don't know,' 'not sure,' and 'not applicable.'* You can create subgroups (and nest them into each other). Please read the background information about FIFA and its stakeholders before you start sorting. You can refer to this information at any time during the sorting task (you do not have to memorize any specific information)."

Each participant was then given 20 minutes to complete the individual electronic card sort for this first phase of our study (as outlined in Table 4). We designed the electronic card sorting task with the help of the simplecardsort.com online platform. The task was devised as an “open card sort,” following the procedure documented in Rugg and McGeorge (2005). We provided no pre-supplied stakeholder groups, and thus aimed “to elicit criteria and categories” from the participants (Ibid., p. 97). We used the 20 most significant stakeholders of FIFA, as listed at fifa.com. Figure 1 contains a list of the 20 cards, each bearing the name of one of FIFA’s 20 stakeholders. Each of these cards had to be dragged to the right and grouped with other cards.

Insert Figure 1 about here

All participants were assembled in a big plenary room and accessed simplecardsort.com through their laptops or mobile phones. The participants finished their card sorting task within 20 minutes. 50 individual card sorts were stored online at the end of the task. Figure 2 shows an example of an individual card sort. Each individual card sort shows how each manager distinguishes and labels FIFA’s stakeholder groups.

Insert Figure 2 about here

Phase 2: Formation of Focus Groups

We assigned all participants to 6 focus groups (3 groups of 9 people and 3 of 8). Eight to ten people is the optimal group size recommended by focus group researchers (Krueger & Casey, 2014). Each participant was randomly given a focus group number (from 1 to 6) written on a piece of paper together with the number for the room to which they should return after a break. We explained that participation in the focus groups was designed to help us understand the card sorting data. All participants then left the big plenary room for a break. Random allocation of

focus group participants was designed to ensure a non-biased interpretation of the aggregate quantitative results.

Phase 3: Data Analysis (quantitative)

Simplecardsort.com produced and stored numeric data that contained all individual card sorts. We then ran a cluster analysis using all these card sorts through the simplecardsort.com platform. The cluster analysis files, available for download here (<https://drive.google.com/file/d/1jOAyaRLefYLU2TZYHk1ZP3Dwi-cSWxm1/view?usp=sharing>), include a card summary, a group summary, a groups-by-card summary, a maximum group agreement solution, a participant summary, participant-card raw data, and a similarity matrix.

Phase 4: Data Visualization (quantitative)

Simplecardsort.com was used to produce a dendrogram representing the aggregate cluster analysis results. A dendrogram is a tree diagram used to illustrate arrangement of the clusters produced by hierarchical clustering. The percentages of agreement for each cluster popped up when the mouse rolled over a cluster in this electronic dendrogram (Figure 3).

Insert Figure 3 about here

Phase 5: Data Collection (qualitative)

The participants entered the 6 separate focus group rooms after a 20-minute break. The same interactive dendrogram (see Figure 3) was shown on a large screen in each focus group room. We facilitated the focus groups by asking questions aimed at interpreting the cluster analysis results displayed in the dendrogram. The same questions were used in all groups. Table 5 shows the questions and examples of visual outputs (i.e., how the dendrogram was annotated based on the answers to the questions).

Insert Table 5 about here

The participants answered our questions, but they were also free to add further and unprompted interpretations. We annotated the dendrogram according to participant input while the group conversation unfolded. The group decided what was to be annotated and how. The annotated dendrogram in Table 6 represents a final version of the dendrogram with the annotations produced in one of the focus groups.

Insert Table 6 about here

The annotated dendrogram shows that the focus group agreed on the following labels for the clusters of the dendrogram – “confederations,” “opinion leaders,” “active participants,” “FIFA’s responses to public pressure”, etc. We compared these with the labels provided in the individual card sorts and found that the focus-group labels were more detailed and exhaustive. In 25 percent of the cases, the individual participants had labeled their groups of cards either “internal stakeholder”, “external stakeholder”, or a variation containing the word “internal” or “external” (see “group summary” folder in the cluster analysis files; see also “max group agreement solution” in the cluster analysis files, where the “internal stakeholders” group label received the highest agreement).

Once the clusters were labeled, the focus group participants were asked to suggest strategic measures that FIFA should undertake to manage each labeled cluster (i.e., group of stakeholders). These suggested strategic measures were also added to the dendrogram. We obtained two products from our focus groups: 1) six annotated versions of the (same) dendrogram (archived as jpg. files) and 2) six audio recordings of the focus group conversations.

Phase 6: Data Analysis (qualitative)

We transcribed and thematically coded the audio recordings from the focus groups (following the procedure described in Gläser and Laudel, 2010 and Krueger and Casey, 2014). We performed three coding cycles – we used peer debriefings to discuss codes and assess if the conclusions that were reached were plausible. We re-formulated our codes during the process. The following themes emerged as main topics: “seeking agreement (collaboration) with media partners”, “peer collaboration among stakeholders”, “non-traditional media”, and “involvement” (see Table 6 and Meta-inference 2 below). The transcripts of the audio recordings also showed that the participants often changed their minds about what is worth labeling and how the stakeholders should be grouped and labeled accordingly. For example, a fifty-sixty percent agreement threshold was agreed upon in the beginning of most focus group conversations, but modified later on (see Meta-inference 1 below).

Phase 7: Critical Interpretation

We compared the dendrogram displaying the results of the cluster analysis (quantitative) with the transcripts of the focus group conversations as well as the textual annotations on the dendrogram (qualitative). We depicted this comparison on a joint visual display, an excerpt of which is presented in Table 6. At the top of Table 6 is an example of a dendrogram with the annotations added during a focus group conversation. The right-hand column in Table 6 contains verbatim quotations from the transcript of this focus group conversation. These quotations reveal the reasoning behind the strategic measures suggested for each stakeholder group. For example, according to the thinking behind the measures suggested for “public independent organizations,” traditional means of communication do not work because FIFA is not formally accountable to this stakeholder group. Non-traditional channels should therefore be used in conveying new

values, pro-actively providing information about progress made by FIFA in reform, and establishing partnerships. Accordingly, the following strategic measures were suggested:

“establishing partnerships (dedicated staff), providing pro-active information about reform, and communicating new values.”

Comparing the coded transcripts with the annotations on the dendrogram, as well as with the dendrogram itself (which was an aggregate visual representation of the quantitative results), allowed us to derive the following meta-inferences, which provided answers to our research question, i.e., “how do managers make sense of stakeholder groups?”.

Meta-inference 1: *In making sense of stakeholder groups, managers dynamically redefine the boundaries of those groups.*

As can be seen from the annotated dendrogram (Table 6), the orange lines (added during the focus group conversation) set labeling thresholds that do not follow the dendrogram’s clusters blindly. One example is UEFA, which is included under the general “confederations” label, although UEFA is displayed in a separate cluster on the dendrogram (a cluster with 57 percent agreement). This was explained by our focus group participants by the necessity to treat all confederations equally, although some, like UEFA, exhibited unique courses of action, including engagement in public campaigns against FIFA’s president. This challenged the quantitative results.

It is also apparent from the dendrogram that the orange lines do not always follow the fifty-sixty percent agreement threshold that were tentatively agreed upon in the beginning of the focus group conversation (see Table 6). For example, politicians were included under a separate “opinion leaders” label, although the level of agreement corresponding to this dendrogram cluster was only twenty to thirty percent. This was explained as follows – politicians are a special

group that has to be approached separately, as a group of potential opinion “champions” (see annotated dendrogram in Table 6). “Fans” were also labeled as a separate group. This also challenged the quantitative results – i.e., approximately 50 percent of all individual card sorts (as depicted by the respective cluster in the dendrogram) agreed that fans should be placed in the same group as the unions, associations, clubs, and leagues. Our focus group participants disagreed, arguing that *“the fans are, in fact, a unique group, which deserves unique treatment,”* and should be strategically approached through an online forum created especially for them.

Meta-inference 2: *Managers make sense of stakeholder groups by primarily trying to figure out which level of involvement is appropriate for each stakeholder group.*

Involvement was recommended as an essential strategic measure (*“Involvement: that is the core. Involve them, make them partners ...”* and *“Involvement, that is the most important”*). Involvement was intended in a broad sense – from consultation to taking part in FIFA’s decision-making. Although involvement was recommended for most stakeholder groups (e.g., so that *“...they cannot say that a decision was wrong, because they were part of it”*), our participants were notably careful about which stakeholder groups should actually be involved. For example, they did *not* recommend active involvement of fans. Had the quantitative results (i.e., the dendrogram) been merely replicated, the fans would probably have received the same label and consequently the same recommendation for active involvement as the “active participants.” As indicated by a high-voltage sign in the annotated dendrogram in Table 6, participants perceived conflict between the “opinion leaders” and the “media and sponsors”. Hence active pursuit of consensus between the latter two stakeholder groups would need to be encouraged by organizing peer events. The media representatives could be involved only on the condition that they had settled their conflict with the politicians beforehand. This revelation would not have been

possible based solely on the quantitative results, i.e., the qualitative input extended the quantitative results.

In a third case, in which involvement was *not* recommended for the stakeholder group labeled “FIFA’s responses to public pressure,” the qualitative input explained the quantitative results. Had we relied solely on the quantitative results, it would have remained unclear why FIFA’s internal committees had been clustered in one group together with the medical assessment center. The “internal committees” label, which had been produced quantitatively, would not have helped in clarifying the grouping for these two stakeholders. The label produced during the focus group conversation, namely “FIFA’s responses to public pressure,” was more effective in explaining the recommendation for controlling these two stakeholders groups. The following explanation was provided by our participants: stakeholders like FIFA’s internal committees, which had been created solely in response to public pressure, should be controlled because of their damaged reputation and their historically-evidenced inability to act credibly.

Discussion

Our method produced meta-inferences challenging and extending the quantitative results. The dendrogram annotations challenged the quantitative clustering. As the focus group conversations unfolded, participants shifted the threshold lines for some stakeholder groups and contradicted the dendrogram by dynamically redefining the boundaries of those groups. Neither was labeling in complete agreement with the dendrogram. Compared with the quantitative labels, the cluster labels that were added to the dendrogram during the focus group conversations were more detailed and exhaustive.

Exploring disagreement with the quantitative results, therefore, led to expanded understanding. According to Fetters et al. (2013, p. 2143), “expansion occurs when the findings

from the two sources of data diverge and expand insights of the phenomenon of interest... For example, quantitative data may speak to the strength of associations while qualitative data may speak to the nature of those associations.” In our study, the cluster analysis results spoke to the strength of association with the clusters of the dendrogram. Conversely, the qualitative focus-group interpretations spoke to the nature of those associations. The final product of the focus groups – the interpretative annotations added to the Table 6 dendrogram (as labels or “strategic measure” proposals) – were an integrative reflection of quantitative explicitness merged with nuances of qualitative thoughtfulness.

Contribution to the Field of Mixed Methods

A widely discussed challenge to mixed methods is the need to make the process of data integration legitimate in the sense of being meaningful and seamless (Bustamante, 2019; Guetterman et al., 2015; Ivankova, 2013; Leech et al., 2010; Wall et al., 2013). The unique contribution of this article to the field of mixed methods research is an approach that facilitates *participant-driven, visually supported, and real-time* data integration.

First, the method employs the potential of data visualization to facilitate *participant-driven data integration*. Using interactive and annotatable visual representations, researchers and participants work together to integrate quantitative and qualitative data. Spontaneous interpretations of results by the participants – in the form of qualitative responses – are inserted as annotations in the quantitative data visualizations. Hence integration of quantitative and qualitative data becomes seamless and authentic. The focus is placed “on involving the voices of the targeted population in the research” (Fetters et al., 2013, p. 2139).

Second, the method facilitates *visually supported* data integration. The interactive data visualizations are diagrams (see Table 3), i.e., computer-generated drawings that display

information about the geometric and topological relations among the components of the research problem and express it explicitly. For example, the geometric and topological relations among the clusters in our study explicitly represented the aggregate results from the card sorting task. By so doing, these diagrams serve as a guide (Gibson, 1978; Silver, 2008; Suthers & Hundhausen, 2003) during the follow-up group conversations (in our study, the percentages of agreement that popped up when the mouse rolled over a cluster within the dendrogram guided sensemaking).

Third, the method facilitates *real-time* data integration. “Rapid research feedback” (Wenger-Trayner et al., 2017, p. 13) is obtained from research participants by conducting focus groups shortly after the initial quantitative phase. Our research participants join the focus group conversations with fresh memories of the quantitative phase. By so doing, they are able to provide credible and meaningful interpretations of the visualized quantitative results. “Time-to-audience” (Dyllick & Tomczak, 2009, p. 7) of the quantitative research results is reduced from months (or years) to twenty minutes.

Scope of Application

The method has a broad scope of application. It is useful whenever initial quantitative results need to be explained or enriched by using a qualitative follow-up component (e.g., in an explanatory sequential mixed methods design). The latter can be applied provided that the initial quantitative results can be aggregated in a visual representation (like a bar chart, a dendrogram, or another computer-supported visual representation). Examples include results of surveys, experiments, and card sorting, with the latter having been illustrated in our study.

The application of this method is especially suitable for situations in which participant-driven, visually supported, and real-time data integration is needed. For example, *participant-*

driven integration is needed in the field of management, where the voices of the targeted population have to be heard to understand the context. The voices of the targeted population may help researchers understand constituencies affected by wicked problems (see Mertens, 2015). When practitioners become involved in interpretation of research results, they are better able to base their subsequent practice on those results – so that mixed methods research can help in “building a better world” (Molina-Azorin & Fetters, 2019).

Visually supported integration is particularly helpful within heterogeneous or multi-disciplinary groups or teams. In this case the fact that “different constituencies and stakeholders do not all value the same kind of information” (Molina-Azorin & Fetters, 2019, p. 280) becomes especially relevant. Here, the universal nature of the visual language can mitigate linguistic, disciplinary, or knowledge barriers and provide integrated mixed methods findings that are compelling for all stakeholders. *Real-time data integration* would be useful in any managerial or research situation in which time is a factor.

Limitations

To ensure a broad scope of application for our method, a few basic considerations should be taken into account in designing the quantitative visual representation (Bresciani & Eppler, 2015). Generally, a visual representation depicts information less precisely than a number or a table (Few, 2006; Kosslyn, 2006). Researchers need to apply a visual representation which is adequate for the information to be represented. Some visual representations based on predefined forms or (technology-driven) templates do not meet this standard (Few, 2006; Tufte, 2001). For example, if a visual representation is designed to place a focus on some items (Lurie & Mason, 2007), this might channel thinking in a set direction (Mengis, 2007). The large screens needed to display the visual representation (e.g., the dendrogram) in the center of each focus group room

for our study are another limitation on our method. If large screens prove unfeasible, white walls for data projection or smaller (e.g., laptop or tablet) shared screens can be used instead. In any case, screens shared via the Internet will be necessary in remote settings. A further limitation of our method is connected with the risks of ineffective focus group facilitation. To allow participants to express their genuine thoughts and feelings associated with the quantitative results displayed in a visual representation, facilitators must refrain from “explaining” the representation.

Conclusion

In this paper we discussed the theoretical underpinnings and proposed application of a method in which instant data visualization facilitates real-time data integration and involves participants in data interpretation. We have proposed an application of this method within the context of mixed method research, whenever initial quantitative results need to be interpreted, explained or enriched by using a qualitative follow-up component – quantitative data can be comprehended, questioned, modified and augmented by research participants. We illustrated our arguments with an examination of an example study (in an explanatory sequential mixed methods design), hence providing a discussion of the advantages of our method.

According to Ketokivi and Mantere (2010) reasoning is “incomplete” (p. 315) if it fails to amplify our knowledge; in other words, the conclusion should be more than a restatement of the premises. The method introduced in this paper potentially amplifies quantitative knowledge; the collaborative interpretations of visualized quantitative data offer a “ $1 + 1 = 3$ ” integration formula (Fetters & Freshwater, 2015, p. 116). They permit challenging and extending of the quantitative results in a manner that would not have been possible otherwise. This is a value-

adding research outcome of data integration, whereby “analytic density” (Fielding, 2012, p. 127) is achieved by involving the research participants as co-interpreters.

The implications of the method include its possible application whenever (a) the voices of the targeted population have to be heard (participant-driven integration), (b) linguistic or knowledge barriers have to be mitigated (visually supported integration), (c) time is a factor (real-time integration). The method has the potential to help practitioners better understand research results, become involved in a real-time interpretation of the collected data, and base their practices on those results – so that research can have impact in the real world.

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Tables and Figures

Table 1

An Example Visual Representation Used in Mixed Methods Research Corresponding to Tufte's

Third Level

Visual representation	
Description	Level
text-tables – summarize numeric data by type (i.e., demographics, source, time, group membership, scale, level) by “arrang[ing] the type to facilitate comparison” (Tufte, 2001, p. 178)	level 3 (Tufte, 2001)

Purpose: data integration/interpretation, data communication

Example: This table summarizes and arranges numeric data by *a)* “symptoms” according to a questionnaire, *b)* “appraisal of symptoms” according to contrasting groups of participants in narratives elicited after the questionnaire, and *c)* the results of testing hypotheses regarding differences in the participants’ narratives.

Concordance/Discordance of Reports of PLWH and Their CSPs on the Presence of Symptoms					
Symptom (in Order of Appearance in Questionnaire)	Appraisal of Symptom by PLWH and CSPs (N = 122)		McNemar (Paired Test)		
	Yes by PLWH (n)	Yes by CSPs (n)	χ^2	p Value (Two-Tailed)	H ₀ = 1 (q Value)
Fever	6	10		.454 ^a	.603
Chills	11	15	0.35	.556 ^b	.712
Flushing	19	18	0.00	1.000 ^b	1.000
Night sweats	20	11	2.07	.151	.262
Day sweats	12	3		.035 ^a	.116
Sensitivity to insect bites	7	5		.774 ^a	.869
Increased sensitivity to hematoma	3	5		.727 ^a	.842
Weight gain	12	9		.664 ^a	.822
Weight loss	8	14		.286 ^a	.426
Weight gain in stomach area	19	21	0.025	.874 ^b	.967
Hump on back of neck/shoulders	2	4		.687 ^a	.836
Skinny arms and legs	13	5		.096 ^a	.200
Swollen feet/legs	8	3		.227 ^a	.365
Prominent leg veins	17	7		.064 ^a	.146
Fear/worries	30	12	6.88	.009^b	.041
Anxious	31	12	7.54	.006^b	.037

Note: PLWH = persons living with HIV; CSP = close support person.

a. Exact significance, two-tailed; binomial distribution. b. Asymptotic significance, two-tailed; continuity corrected. Bold: significantly discordant symptom reports.

Source: Nicca et al. (2012, p. 229), re-printed with permission from the authors and the publisher

Table 2

An Example Visual Representation Used in Mixed Methods Research Corresponding to Tufte's

Fourth Level

Visual representation

Description

Level

supertables – “elaborate tables” which provide “organized, sequential detail, and reference-like quality” (Tufte, 2001, p. 178) and may contain pictures

level 4
(Tufte, 2001)

Purpose: data integration/interpretation

Example: This elaborate table, a supertable, contains numeric, textual, and visual data (the experimental conditions are visually represented). The supertable allows comparisons between the shared and withdrawn thoughts regarding project experiences. The horizontal rules divide the data into group-related paragraphs; the rows are ordered so as to tell an ordered story about the experimental groups and the individual members of the experimental groups (based on integrated thoughts).

Participant	Group	Condition	Individual Experiences	Integrated thoughts (No.) (available in pre-survey AND on template)	Withdrawn thoughts (No.) (available in pre-survey but NOT on template)	Total thoughts (no.) = integrated thoughts + withdrawn thoughts	Integrated thoughts (Percentage) = Integrated thoughts/ Total thoughts	Group Average: Integrated thoughts	Thought 1	Thought 2
26	9	2 (Grid)	7	5	2	7	0,71	0,54	Explain and communicate the need in front of the enterprise. Why? For what purpose? (negative)	INSIDE: monthly project info (positive)
27			7	4	3	7	0,57		PLAN: Communicating an idea with a well-defined goal, information sharing, learning from others and experience sharing (positive)	PLAN: Difficulty in synthesising the variety of ideas (negative)
28			6	2	4	6	0,33		During the implementation of a new IT strategy (CRM solution implementation) I supported the IT project team as a bridge between the IT and the business.	The business was not willing to accept the changes.
23	8	3 (Funnel)	9	4	5	9	0,44	0,20	Merge of different departments of my company (engineering) – new label of the group after 30 years of history	No plan was prepared by the board of directors.
24			7	1	6	7	0,14		optimization of resources of 2 sectors: laboratory / production	formation of laboratories for 1) 2) 7 products 3) 1 single sector, single outlet plus
25			8	0	8	8	0,00		SIMPLEX: harmonization of suppliers and raw materials / purchasing	ACTIONS: matching of PM between suppliers / delivery / with existing product recipients

Source: the authors – table used at the data interpretation stage for Alexander et al. (2015)

Table 3

Example Visual Representations Used in Mixed Methods Research Corresponding to Tufte’s Fifth Level

Visual representation	
Description	Level
graphics (e.g., diagrams) – “combine words, numbers” (Tufte, 2001, p. 178), show arrangement and relations, and “preserve explicitly the information about the topological and geometric relations among the components of the problem” (Larkin & Simon, 1987, p. 66)	level 5 (Tufte, 2001)

Purpose: data integration, data communication

Example: This diagram was used to represent the integration of quantitative and qualitative data: black represents quantitative data, white qualitative data, and gray represents the mixing of black and white – in this case, the outcome, or “fit”, resulting from integrating the quantitative and qualitative data.

Source: Bustamante (2019, p. 171), re-printed with permission from the author and the publisher

Purpose: data elicitation

Example: This diagram (a sociogram) depicts the personal social network of a research participant. The concentric circles represent relational proximity to ego, while the quadrants represent the context of relationships in the social network of each research participant. Research participants were asked to fill in the blanks between the circles.

The personal network of Agnieszka, a respondent from the Polish migrants study.

Source: Tubaro et al.³ (2016, p. 7), re-printed with permission from the author Louise Ryan and the publisher

Table 4

An Overview of the Method and its Application in our Study (italic)

Research Phase	Procedure	Product	Duration (time)
1. Data collection (quantitative)	Each research participant individually provides data by completing an individual task, such as an electronic survey or card sorting.	<ul style="list-style-type: none"> • numeric data stored electronically (online) 	30 min
<i>in our study</i> <i>electronic card sorting</i>	<i>Each research participant completed an individual electronic card sorting session online. Number of participants: 50</i>	<i>• numeric data stored electronically (online, at simplecardsort.com), containing all individual card sorts</i>	
2. Forming focus groups	The research participants are randomly or systematically assigned to focus groups.	Focus groups of 8-10 people	2 min
<i>in our study</i>	<i>All 50 participants were assigned to focus groups.</i>	<i>6 focus groups</i>	or longer
3. Data analysis (quantitative)	The researchers run the numeric data through an analysis tool.	<ul style="list-style-type: none"> • electronic files containing the descriptive and inferential results from the quantitative phase 	15 min
<i>in our study</i>	<i>We ran the numeric data through simplecardsort.com. Simplecardsort.com performed the cluster analysis.</i>	<i>• electronic files containing the cluster analysis results from the card sorting</i>	
4. Data visualization (quantitative)	The analysis tool is used to produce a visualization of the aggregate quantitative results (e.g., dendrograms, bar charts).	<ul style="list-style-type: none"> • electronic (interactive and annotatable) visual representation 	5 min
<i>in our study</i>	<i>Simplecardsort.com was used to produce an interactive dendrogram, which represented the aggregate cluster analysis results.</i>	<i>• an electronic (interactive and annotatable) dendrogram representing the aggregate cluster analysis result</i>	
5. Data collection (qualitative): integration through instant merging	The electronic visualization is shown to research participants in focus groups. The researchers facilitate focus group conversations aimed at interpreting the quantitative results displayed in the visual representation. The researchers ask the participants to explain the results. The researchers annotate the visual representation according to participants input.	<ul style="list-style-type: none"> • audio recordings of the focus group conversations, which contain data interpretations extending (or challenging) the quantitative results • annotated visual representation 	45 min
<i>in our study</i>	<i>The electronic visual representation was a dendrogram.</i>	<i>• audio recordings and annotated dendrogram (the same dendrogram with multiple annotations)</i>	
6. Data analysis (qualitative)	The audio recordings are transcribed and coded.	coded transcripts of audio recordings and identification of key themes	5 days
<i>in our study</i>	<i>The audio recordings were transcribed and coded.</i>	<i>coded transcripts of audio recordings and identification of key strategic suggestions</i>	
7. Critical interpretation of quantitative and qualitative results (data integration through a joint display)	The researchers interpret the qualitative and quantitative findings by merging: the annotated visual representation is compared with the coded transcripts of the audio recordings.	a joint display	10 days
<i>in our study</i>	<i>We compared the annotated dendrograms with the coded transcripts of the audio recordings. We merged the annotations and excerpts from the coded transcripts on a joint display.</i>	<i>a joint display, which contains insights further extending (or challenging) the quantitative results</i>	

Table 5*Questions Asked, Examples of Answers, and Visual Outputs*

Questions (asked by the facilitator in each focus group) & Example Answers (by focus group participants)	Visual outputs (how the dendrogram was annotated based on the answers to the questions)
<p>Question: Facilitator: In your opinion, which clusters of the dendrogram are worth labeling? Please suggest where to draw the lines of what is worth labeling.</p> <p>Answers: Participant F: I think ... around sixty percent. Participant G: OK, this makes sense, let's label all around ... fifty percent, and neglect all of the ones that are below this line...</p> <p>Facilitator: Does everyone agree with fifty-sixty percent?</p> <p>Participant G: Yes, it is a good idea, so that we know what to label.</p> <p>Participant F: Let us neglect the ones with a small percentage. Let's concentrate on the middle ones, because they are the most... Let's draw a line there, hmm..., at around fifty-sixty percent agreement.</p> <p>Participant B: Yes, this makes sense.</p> <p>Facilitator: Ok, let us do this. [Facilitator starts drawing lines on the dendrogram.]</p>	<p>Threshold lines (in orange) were added to indicate what was worth labeling:</p>
<p>Question: Facilitator: What labels would you give to the clusters of the dendrogram? Please suggest the best possible labels.</p> <p>Answers: Participant G: The thing is, they aren't running to any clubs, or any confederations – they are general.</p> <p>Participant F: Independent?</p> <p>Participant G: Yeah, ...</p> <p>Participant F: No...hmm...</p> <p>[Participant C points toward Participant F and helps him find the right word].</p> <p>Participant C: Public.</p> <p>Participant F: Yes, exactly, they are public.</p> <p>Participant A: How about the internals – ex controllers?</p> <p>Participant F: The medical assessment centre was created thanks to public pressure.</p> <p>Participant C: Yea, so the public intervened to regulate an issue.</p> <p>Facilitator: What's a good label here?</p> <p>Participant F: Public influencers?</p>

Labels were added to the clusters of the dendrogram:

Participant A: FIFA founded the Medical Assessment Center just in order to avoid the risk of being excluded from the Olympic Games.

Participant F: So, responses to public pressure?

Facilitator: OK, responses to public pressure [Facilitator writes this label on the dendrogram.] Does everyone agree that this is a good label?

Question: Facilitator: What strategic measures should FIFA undertake to manage each labeled cluster (of stakeholders)?

Answers: Participant B: Of course, they need to participate.

Participant C: With “Play the Game”?

Facilitator: And who else?

Participant B: “Transparency International” – would you make your opponent part of your decision process?

Participant C: You can question them, but...

Participant A: No, no...

Participant C: They cannot say that a decision was wrong, because they were part of it.

Participant B: You can establish partnerships with them.

Participant A: Proactively...

Suggested strategic measures were added to the dendrogram (on the right-hand side):

Table 6

A Joint Display of Dendrogram Annotations from the Focus Groups and Verbatim Quotations from the Transcripts of the Focus Group Conversations

Annotated dendrogram (example from one focus group)	
<p>Stakeholder ACTIONS</p> <ul style="list-style-type: none"> COMM. INFORMATION INVOLVEMENT COLLABORATE ENLIST AS "CHAMPIONS", ACTIONS, INVOLVE MORE FORUMS ACTIVELY PEER "CHAMPIONS", ACTIONS, INVOLVE MORE FORUMS ACTIVELY DEDICATED STAFF CONSULTATION MONITORING INFO EVENTS ESTABLISH PARTNERSHIPS (DEDICATED STAFF) PRO-ACTIVE INFORM. ABOUT REFORM PROGRESS, communicate new values CONTROL THEM 	
Suggested measures (for... stakeholder group)	Quotes from the transcripts of the focus group conversations
communicate, inform, involve, collaborate (for "Confederations" – see annotated dendrogram above)	<p>TOPIC: Seeking agreement (collaboration) with media partners</p> <p>Facilitator: What strategic measures should FIFA undertake to manage this cluster of stakeholders? ...</p> <p>Participant: Involvement, that is the most important.</p> <p>Participant: ... and collaborating.</p> <p>Participant: Collaborating meaning following their rules, or... playing their game?</p> <p>Participant: No, I think, helping them grow their regions, supporting them in reaching agreement with their regional media partners, ... collaborating in reforming FIFA governance.</p>
enlist as champions, involve more actively support peer actions, hold forums (for "Opinion Leaders" – see dendrogram)	<p>TOPIC: Peer collaboration among stakeholders</p> <p>Facilitator: ... Any other ideas regarding opinion leaders or politicians?</p> <p>Participant: Probably, to organize more peer actions involving those people. Like forums, or invite them to give speeches.</p> <p>Participant: Keep them closer, together.</p>
consult, monitor, organize info events (for "Active Participants" – see dendrogram)	<p>Participant: Involvement: that is the core. Involve them, make them partners, in some committees.</p> <p>Participant: But do you mean "involvement" as to make decisions? Bypassing the confederations, that's a bit tricky. You don't want to alienate your owners.</p> <p>Participant: It's probably more partnership in actions. ...</p> <p>Participant: Organizing events where they get to know each other. Because unions and clubs aren't communicating with each other, they may communicate with FIFA,</p>

	<p>but...</p> <p>Participant: Yeah, and they never contact FIFA, they hear the negative things only through the press. They may want to get a little bit closer.</p>
<p>establish partnerships (dedicated staff), provide pro-active information about reform progress, communicate new values (for “Public Independent Organizations” – see dendrogram)</p>	<p>Participant: I would do something else with the independent organizations as well.</p> <p>Facilitator: What should I write?</p> <p>Participant: Be more pro-active.</p> <p>Participant: I would even say that they need to develop their governance together.</p> <p>Participant: Yeah.</p> <p>Facilitator: Oh, really?</p> <p>Participant: Yeah.</p> <p>Participant: I don’t know. I know they are important, but I think it would be too much for FIFA to involve all these external organizations, and, moreover, to try to get consensus between all of them to make a decision in FIFA. So, then you would have multiple opinions on issues, on where you want to go, and – never a decision, so...</p> <p>Participant: Yeah, if you engage stakeholders, they might contradict themselves. So, let’s delete “involve”.</p> <p>Participant: But if they would come together as a group with a recommendation for FIFA, that would be different.</p> <p>Participant: Yes, but you don’t want to really support them, so that they can speak in one voice against you?</p> <p>Participant: The thing is, how would the Olympic Committee agree with Transparency International? I mean, at Transparency International we even have concerns regarding the Olympic Committee, so?</p>
<p>establish partnerships (dedicated staff), pro-active information about reform progress, communicate new values (for “Public Independent Organizations” – see dendrogram)</p>	<p>TOPIC: Non-traditional media</p> <p>Participant: If FIFA is to be held accountable, as most of its stakeholders demand, this can hardly be achieved by traditional means. The reasons for this are two-fold: first, unlike a public company, FIFA is not answerable to stakeholders. So, do we have to consider this point? They are not answerable, so is this mandatory?</p> <p>Facilitator: Legally, they are not answerable. But, based on the pressure they are getting – they are.</p> <p>Participant: They can’t do everything for everyone. They have to segment their actions.</p>
<p>online forum (for “Fans” – see dendrogram)</p>	<p>Facilitator: Moving right along to the fans... What’s the right way to deal with them? What’s FIFA’s role in managing this stakeholder group? What would you recommend?</p> <p>Participant: An online forum – for sure. It would be really appreciated by the fans if they would count on their opinion.</p> <p>Participant: Yeah, and FIFA can be more active in participating in a dialogue.</p> <p>Facilitator: A very good suggestion. Does everybody agree?</p> <p>Participant: Yeah.</p>

Figure 1

The Individual Card Sorting Workplace

Figure 2*Example of an Individual Card Sort*

Figure 3

An Interactive Electronic Dendrogram Representing the Aggregate Cluster Analysis Results for all 50 Individual Card Sorts. (The percentage represents the level of agreement for a particular cluster).

Endnotes

1. The simplecardsort.com online shut its online services down on October 1st, 2019.

Other online card sorting tools include OptimalSort, Proven by Users Online Card Sorting, UserZoom, uzCardSort, xSort, UsabiliTest Card-Sorting (for a list see <http://www.measuringuserexperience.com/CardSorting/index.htm>).