

View Points

Visualization in management: From communication to collaboration. A response to Zhang[☆]



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ARTICLE INFO

Article history:

Received 8 November 2012

Accepted 30 November 2012

Available online 6 February 2013

Keywords:

Visual communication

Visualization

Management

Collaboration

ABSTRACT

The benefits of visualization are starting to be exploited in the field of management. Beyond cognitive and communicative advantages, this view point article highlights how visualization can enhance collaborative activities in organizations. Recent trends in management indicate that the activity of visualizing can be as important as the pictures that are generated. Qualitative visualizations such as conceptual diagrams, metaphors or sketches are used as collaboration catalysts to facilitate a variety of tasks, from idea generation to decision making and planning. The article derives future research avenues in this promising and interdisciplinary field of inquiry, including the impact of immersive worlds, electronic sketches or multi-user interfaces for collaborative managerial tasks.

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1. Introduction: visualizing management – beyond communicating charts

It is an idea whose time has come: the use of visualization in management. As management is an area where complex information must be used for a variety of tasks that are often performed under extreme time pressure, visualization appears like an obvious strategy to cope with the risks of information overload. In addition, managers often cannot rely on their own expertise alone. They need input from a wide spectrum of specialists and thus at times struggle to integrate knowledge from different sources and use it for idea generation, decision making or planning. To do so, they rely on what many researchers today call *socio-material* or *visual practices* [1,2], emphasizing the activity of visualizing over the pictures that are generated. These visual practices consist of jointly and iteratively visualizing facts, analyses, insights and experiences, and consequently improve the quality of collaboration.

We thus only partly agree with Zhang's [3] assessment that the use of visualization in management activities has been limited to statistical charts. While it is probably the case that the most widely used format of visualization today is the numeric or quantitative chart, we have witnessed an increasing use of qualitative visualizations (i.e., conceptual diagrams, metaphors, or sketches) in the management world, as illustrated by recent management bestsellers on the topic [4–6]. More importantly, while Zhang sees the biggest benefit of visual languages in the communication of complex information, we believe that the act of visualizing is at least as important as the visualization outcome itself. The power of visualization to enable effective and seamless collaboration (especially across disciplinary boundaries) even exceeds its potential to improve communication. In fact, limiting the use of visualization to the mere presentation aspect would not do it justice for the realm of management. In this contribution, we would thus like to build on Zhang's examples of managerial visualization and show that it can provide even more value when used as a collaboration catalyst, rather than just an accessible presentation format. To do so, we first provide an overview on the realm of management visualization, extending the scope beyond charts and diagrams, and then derive future research avenues for this promising field of

[☆] This paper has been recommended for acceptance by S. Levioldi.

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inquiry. In the final section we draw some preliminary conclusions and invite our fellow researchers to explore the research challenges in this field in an interdisciplinary manner.

2. The realm of management visualization

As illustrated in Zhang’s paper, visualization can be useful for many domains of management, ranging from finance, human resources, to general management and strategy. Zhang focuses on the use of statistical charts like scatter plots, and (interactive) diagrams, such as social network depictions, InfoShapes or simple box and arrow diagrams. Zhang’s examples, although instructive, may represent a too narrow view of the emerging field of management visualization, as they are limited to simple forms of diagramming and charting. In our research, however, we discovered that the visual languages employed by managers today are much richer. They also include ad-hoc conceptual *hand drawings* and sketches, rich *visual metaphors*, as well as more elaborate forms of visualizing such as *immersive 3D environments* populated by Avatars that represent managers in decision, training or creativity settings. The figures below show typical examples of each of these visualization genres.

These visualization formats can be used in different management functions and for diverse knowledge tasks, ranging from idea generation, decision making, planning to knowledge sharing and learning. This classification is based on McGrath’s *circumplex* model of group tasks [10] and adapted to the management context where learning and knowledge sharing is a particularly crucial task. In Table 1, we provide an overview of the research conducted on these visual formats (for a classification see: [11]), as concerns their use for core management tasks. The table shows that there is indeed a discussion on managerial visualization beyond data representation formats.

3. Collaborating with the help of visuals

If one sees images not just as data containers, but as collaboration tools for managers, the question arises how to best use them for this purpose and how to better understand their effects on collaboration? The visualization formats depicted in Figs. 1 and 2 through 3 and positioned in the table indeed differ with regard to their collaborative characteristics, meaning that they provide diverse affordances for collaboration and communication based on their visual and interactive traits. To help managers answer these two questions and to distinguish and choose adequate visual support for their

tasks, we have developed, based on Green’s Cognitive Dimensions of Notations [35,36], the notion of *collaborative dimensions of visualization* [37]. These dimensions can be used to describe the key features of a visual language and determine whether it is suitable for a certain management task or not. Table 2 gives an overview of these collaborative dimensions of visual representations.

To illustrate the dimensions approach let us give the example of one of them, namely *perceived finishedness*. This dimension addresses the fact that some images are perceived as finished, while others give the impression of being work in progress. Typically, sketches have a low perceived finishedness, as they are understood to be in flux and ‘under construction’ (they look highly provisional). Diagrams and charts, by contrast – especially when presented in reports or slide presentations – tend to have a high perceived finishedness. This is a distinction that makes a difference with regard to collaboration: Whereas sketches invite revisions and iterative cooperative moves, polished diagrams are more likely to create a by-stander effect, as managers may feel reluctant to modify a seemingly perfect looking chart or diagram. Sketches may thus be a better visual language for managers in the idea generation phase than software-supported conceptual diagrams. How each visual representation differs from another with regard to these dimensions is the subject of our ongoing research. This and other future research avenues in the management visualization field are discussed in the final section of our article.

4. A research agenda for management visualization

As a fairly recent research domain at the intersection of management studies, computer science, psychology, and design, the field of management visualization offers many promising research avenues. As Zhang correctly points out,

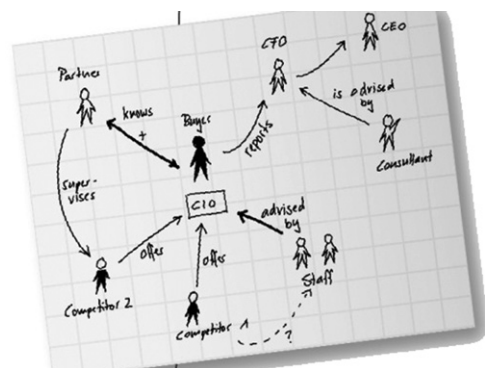


Fig. 1. Examples of managerial visualizations beyond classic diagrams and charts: sketch (source: [7]).

Table 1
Research evidence on visualization formats for specific management tasks.

Visualization format/Management Tasks:	Sketching	Visual metaphors	Diagrams	Charts	3D worlds
Idea generation	[4,7]	[12]	[13,14]		[15]
Decision making	[16,17]	[18]	[19–22]	[23,24]	[9]
Planning	[5]	[25]	[26]	[27,28]	
Learning, knowledge transfer/sharing	[4]	[29,8]	[30–32]	[23,33]	[34]

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