Chapter 2.26
Knowledge Visualization

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INTRODUCTION

Making knowledge visible so that it can be better accessed, discussed, valued, or generally managed is a longstanding objective in knowledge management (see Sparrow, 1998). Knowledge maps, knowledge cartographies, or knowledge landscapes are often heard terms that are nevertheless rarely defined, described, or demonstrated. In this article, we review the state of the art in the area of knowledge visualization, and describe its background and perspectives. We define the concept and differentiate it from other approaches, such as information visualization or visual communication. Core knowledge visualization types, such as conceptual diagrams or visual metaphors, are distinguished, and examples of their application in business are shown and discussed. Implications for research and practice are summarized, and future trends in this domain are outlined.

The Concept of Knowledge Visualization

Generally speaking, the field of knowledge visualization examines the use of visual representations to improve the creation and transfer of knowledge between at least two people. Knowledge visualization thus designates all graphic means that can be used to construct and convey complex insights. Beyond the mere transport of facts, people who employ knowledge visualization strive to transfer insights, experiences, attitudes, values, expectations, perspectives, opinions, and predictions, and this in a way that enables someone else to re-construct, remember, and apply these insights correctly. Examples of knowledge visualization formats are heuristic sketches (e.g., ad-hoc drawings of complex ideas), conceptual diagrams (such as Porter's Five Forces diagram), visual metaphors (such as Plato's cave metaphor of reality), knowledge animations (such as a rotating double helix), knowledge maps (such as a landscape of in-house

experts), or domain structures (e.g., a co-citation network of knowledge management literature). All these formats capture not just (descriptive) facts or numbers, but prescriptive and prognostic insights, principles, and relations. They are used as indirect (and at times ambiguous) communication in order to trigger sense-making activities and to motivate viewers to re-construct meaning. Thus, the 'what' (object), the 'why' (goal), and the 'how' (methods) of knowledge visualization differ from information visualization. These differences are further described in the following section.

The Differences Between Knowledge and Information Visualization

A related field and precursor to knowledge visualization is information visualization. Information visualization is an advancing field of study both in terms of academic research and practical applications (Card, Mackinlay, & Shneiderman, 1999; Chen, 1999a; Spence, 2000; Ware, 2000). Information visualization offers novel visual applications for the interactive browsing and analysis of data with the aim to derive new insights by seeing trends, outliers, or clusters. Card et al. (1999) define information visualization, as "the use of computer-supported, interactive, visual representations of abstract data to amplify cognition." This definition is well established among computer scientists active in this field. The information visualization fields neglects, however, the potential of visualizations as a medium for the transfer of complex knowledge. Another neglected aspect relates to the integration of non-computer based visualization methods (e.g., posters, physical objects, etc.) as architects, artists, and designers use them. This is the objective of knowledge visualization and at the same time the main difference to information visualization: information visualization and knowledge visualization are both exploiting our innate abilities to effectively process visual representations, but the way of using these abilities differs in both domains. Information visualization aims to explore large amounts of abstract (often numeric) data to derive new insights or simply make the stored data more accessible. Knowledge visualization, in contrast, facilitates the transfer and creation of knowledge among people by giving them richer means of expressing what they know. While information visualization typically helps to improve information retrieval and access, and generally optimizes the presentation of large data sets—particularly in the interaction of humans and computers—knowledge visualization primarily is used to augment knowledge-intensive communication among individuals. Such visual communication of knowledge is relevant for several areas within knowledge management, as described in the next section.

Application Areas within Knowledge Management

Knowledge visualization can help to solve several predominant, knowledge-related problems in organizations. First, there is the omnipresent problem of knowledge transfer (or knowledge asymmetry). Knowledge visualization offers a systematic approach to transfer knowledge at various levels: among individuals, from individuals to groups, between groups, and from individuals and groups to the entire organization. To do so, knowledge must be recreated in the mind of the receiver (El Sawy, Eriksson, Carlsson, & Raven, 1997). This depends on the recipient's cognitive capacity to process the incoming stimuli (Vance & Eynon, 1998). Thus, the person responsible for the transfer of knowledge not only needs to convey the relevant knowledge at the right time to the right person, he or she also needs to convey it in the right context and in a way so that it can ultimately be used and remembered. Graphics such as rich but easily understandable visual metaphors can serve exactly this purpose, as the brain can process images often more easily than text. In this context, visualization can also facilitate the problem of inter-functional knowledge com-