Mind the map

Pino Trogu, San Francisco State University

Infographics are everywhere. New visualization tools and access to data have pushed information graphics to center stage in newspapers, magazines, and digital media. Yet, despite their immediate appeal and veil of authority, the effectiveness of infographics, and especially of mind maps, remains overrated.

The mind map, also known as concept map and popularized in 1984 by Novak and Gowin, has become a staple of the design process, influencing decision-making from the classroom to the corporate boardroom. While possibly helpful when used in an active, making role, there's little evidence of its advertised benefits for visual communication, learning, and remembering.

In Change by Design, Tim Brown, the CEO of the design firm IDEO, provides his readers with a mind map as a non-linear alternative to the traditional table of contents – T.O.C. – requested by his editor. This example illustrates some of the problems with mind maps: one is the lack of isomorphism – the visual elements of a geographic map roughly parallel the corresponding features on the earth – between the map and the object that it's supposed to represent. Paradoxically, the table of contents is a much better map to the journey that is the book.

The psychologists G. Miller in the 1950s, and more recently A. Baddeley pointed out the physical bottleneck of working memory during which, in just a few seconds one must quickly make sense of a whole. Working memory – short-term memory – places a strict limit on the number of items that can be held in memory at a given time, and this natural barrier is another obstacle in the perception of mind maps, concept maps, and network graphs. Given the span of just a few seconds within a recycled window of time that keeps moving on, the viewer simply cannot hold in memory so many things at once.

The road map is the easy analogy in support of mind maps, but the key in a real map is its correspondence with the real world. The viewer typically navigates the map, and the world, within a narrow, selective, highly meaningful and familiar personal path: from A to B and always in relation to the you-are-here spot. Good maps always point to the you-are-here spot. In the book, finding oneself in the table of contents will be much easier than in the concept map, which does not resemble the book at all. Cognitive minded industrial designers have termed this orientation process natural mapping, and have applied it to the design of intuitive controls and interfaces. Natural mapping is the reason that too much information is never a problem in a geographic map.

While a non-linear mind map can depict an abstract concept, and there's indeed something non-linear about our ability to store and retrieve information, especially from long-term memory, we nevertheless always learn sequentially, and store and retrieve in a non-linear way.

Other designers like Hugh Dubberly favor concept maps as knowledge tools for topics like the Internet Domain Name System and Alzheimer's disease. Arresting and aesthetically pleasing, these maps place too high a cognitive load on the viewer, unless she is already familiar with the topic. The cognitive load will be higher the more abstract the topic. Dubberly's map of How to Play Baseball is more tangible than A Model of the Creative Process, and perhaps more accessible, although the same map on how to play cricket might be just as obscure unless you happen to be from England.

These maps include numerous elements connected by lines or sentences – the hub-and-spoke model – but cognitive psychologists like D. Willingham contend that what is memorable and retained from them is mostly their visual form – the shape of the graph – rather than the more important subject matter.

In these maps, simultaneity of presentation cannot translate into holistic view or instantaneous closure. In a text, we achieve closure after a series of elements representing wider concepts have been processed into a larger whole. Similarly in a graphic, closure occurs when the viewer is able to organize individual parts into something larger. In this process, the time limitation of working memory cannot be changed, but the viewer's relevant prior knowledge will affect the speed with which one is able to achieve closure. Ideally, the viewer will be familiar with the topic and require little additional information to understand the material. But while this is not always the case, even experts cannot escape the limitations of their own working memories.

Mind maps and network graphs offer infinite scalability and a bird's eye view reminiscent of the 1972 photo of the earth taken by Apollo 17 on its last lunar mission. But the analogy is misplaced: the picture of the earth is a likeness of the tangible thing, while concept maps represent intangible things and artificially arrange the elements into hypothetical, doubly abstract models. Even when the relationships are direct – Linkedin connections for example – the sheer quantity of simultaneous elements render the map meaningless.

And yet simultaneity has a storied pedigree: the Futurists, Laszlo Moholy-Nagy, Jan Tschichold, Paul Rand, and Marshall McLuhan to name a few, all saw it as the essence of the modern age and celebrated it in their work. But simultaneity of presentation cannot break the time limitation of working memory. Despite J. Bertin's claim, we simply cannot see things in a single instant of perception.

Simultaneous, non-linear forms are not faster unless the viewer is already familiar with the topic. And in the book example, the fixed form of the TOC reserves the right to the infinite connections and cross-references of the text, which cannot be but fixed and sequential, just like its analog TOC. A mind map of a book can disappoint like an ordinary movie based on a great book. In the book, we see the writer's story without actually seeing it, but the movie can disappoint because what is depicted is not what we had imagined. If it's a good book, no pictures are needed by our imagination, but in the movie we are confined by the single formal interpretation of the director.

In addition to cognition and working memory, context and convention, both of specific cultural conventions as well as conventions of representation, play a fundamental role in any perception. Thus the designer needs to work with a varied cast of characters. Some she will only have partial control over – cognition, working memory – others, like context and cultural conventions, will be her allies and better inform her use of the traditional tools of the trade: typography, color theory, layout etc., towards the goal of mitigating the natural forgetfulness of her audience.