

Visualization provides decision-makers with the big picture

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The human brain is not very well-equipped for analysing multidimensional data. In his doctoral dissertation, Mikko Berg, M.Sc. (Tech.) examined how graphical visualizations can help people to understand complex data. One of the starting points of his work were the visualizations used in the online candidate selectors of MTV3 that placed candidates with similar opinions close to each other on a graphical map.

"Good visualizations can help people to make good decisions, such as selecting a suitable candidate in elections," researcher Mikko Berg explains.

Berg's dissertation belongs to the field of media technology and combines [cognitive science](#), psychology and vision research. The dissertation explores how the [brain processes visualization](#) when the person handles complex data.

Berg examined how the use of visualization facilitates understanding by observing how people used the online candidate selectors created for the EU and communal elections held in Finland in 2004.

Pictures have been used as a means to communicate since [cave paintings](#). A classic example of well-visualized number data is this diagram presenting the causes of mortality in the Crimean War in 1855 drawn by nurse Florence Nightingale.

The diagram that underlined the importance of good hygiene shows the

viewer that it was seven times more likely for soldiers to die of diseases spreading in the hospitals than of [gunshot wounds](#).

"Visualization provides viewers with an overview and helps people to understand complex data," Berg says.

He asks me to look around in the lobby of his workplace, Biomedicum. As I look at the lobby, I feel that I can see everything. In reality, all that I can remember is a rough overall image because the area of acute vision is very narrow. Our [gaze](#) quickly focuses on new details.

"The eye moves rapidly and focuses on new details three times per second. Our vision works a bit like the Internet – we get the feeling that all the data we need is immediately available, but actually it is not retrieved from the server until we need it," Mikko Berg explains.

Numerical data in table format is difficult to process for a [human brain](#). Each numerical value has to be looked at individually and it is not easy to get a general idea of the data. "Our working memory can only store a couple of numbers or words at a time."

A graph produced using the same data helps people to obtain a general idea of the situation. Graphs also give our peripheral vision valuable hints about the areas worth looking at.

Information technology has provided us with entirely new opportunities for visualizing data. For instance the 25 questions in the MTV3 online vote matcher form a 25-dimensional answer space. It is difficult to get an overall idea of the answers provided by hundreds of candidates.

With the help of the self-organizing maps (SOM) developed at Aalto University, the candidates can be placed on a two-dimensional surface so that candidates with similar opinions are located close to each other on

the map.

Good visualization reduces the load on our working memory

Based on Berg's research results, those planning visualization for the Internet should take advantage of the opportunity to use interactive features. In interactive visualization, the user can select different variables and test what happens if he or she answers a vote matcher question differently. "We understand many things better when we perform actions," Berg says.

According to the study, good visualization reduces the load on our working memory. "Our [working memory](#) can be externalised to a visualization tool. If the brain registers the area from which a piece of information can quickly be found, it becomes unnecessary to memorize non-essential data. People do not want to remember how an individual candidate answered a certain question in a election engine," Berg explains.

Creating good visualizations is difficult because the information being presented is complex.

"It is difficult to decide who to vote for. It is a project that requires a lot of work, but good visualization can provide the tools for it," Berg says.

More information: The doctoral dissertation of Mikko Berg, M.Sc. (Tech.), Human abilities to perceive, understand, and manage multidimensional information with visualizations, was publicly examined at the Aalto University School of Science on 27 April. The dissertation belongs to the field of media technology. The opponent was Professor Erica de Vries from Université Pierre-Mendès-France. The dissertation [online](#)

Provided by Aalto University

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