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"THE VALUE OF VISUALIZATION"

In the paper, Van Wijk has attempted to determine the value of visualization by presenting an economic model, and benefits and costs are established. The author has referred to visualization as an ambiguous term that refers to the research discipline, technology, or visual result.

MODEL-

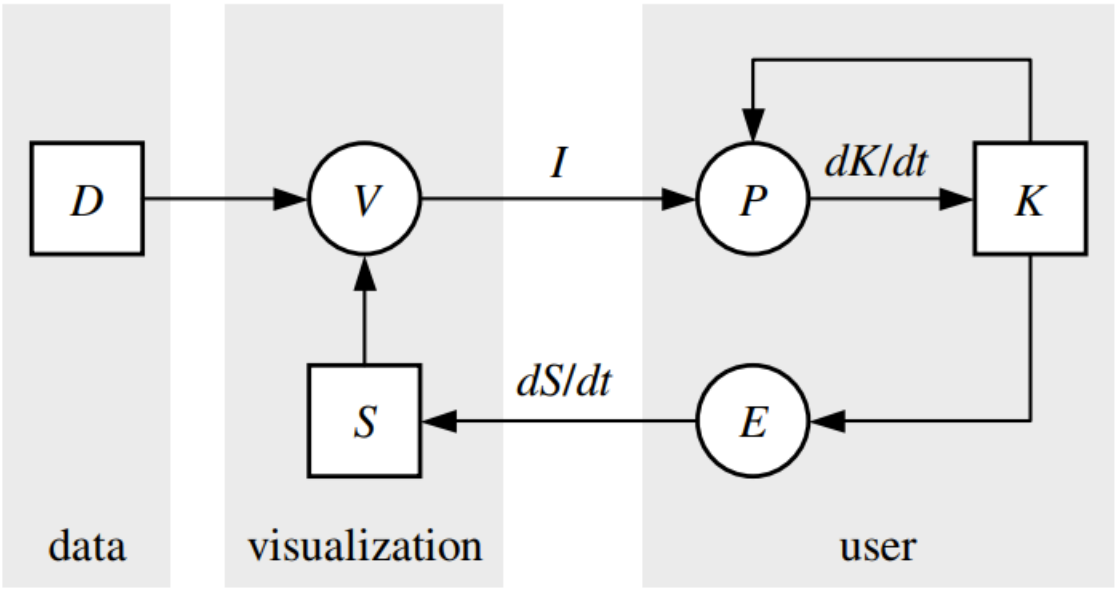

Figure 1: A simple model of visualization

Figure 1 is depicting a simple model in which boxes represent containers, circles donate processes transforming inputs into outputs. The aim is to describe the context in which visualization operates. A mathematical notation is used to give a sense of quantification. Processes here are called functions. The process V in figure 1 is visualization V: **I(t) = V(D,S,t)**

D -> data

S -> specification

I(t) -> time varying image and D is transforming according to S into I(t).

The amount of knowledge gained depends on the image, the current knowledge of the user, and the particular properties of the perception and cognition P of the user. **dK/dt = P(I,K)**

A doctor will be able to glean more information from a medical image than a layperson in terms of K's effect. A straightforward but significant illustration of the impact of P is that a person who is colorblind will find it more difficult to learn from a picture, a more vivid image than an individual with full eyesight. Interactive exploration, here symbolized by E, is a crucial component (K). Based on his existing understanding, the user may choose to modify the visualization's specification in order to better study the data **dS/dt = E(K)**

ECONOMIC MODEL- The author has used a real-time example to assess if a visualization method is worthwhile by assuming a homogeneous user community.

No. of users in the community- n, using visualization v running m times on a dataset in time T and using k explorative steps.

The costs are divided into 4 simple steps- Initial development costs where it is necessary to create and apply the visualization technique and sometimes purchase new technology.

- Initial costs per user where the user must invest time in choosing and acquiring V.
- Initial costs per session where data conversion and a preliminary specification of the visualization are required.
- Perception and exploration costs where the user must invest time in understanding the visualization.

The total costs are now given by C = Ci +nCu +nmCs +nmkCe

ALTERNATIVE METHODS- A common justification for new techniques performing less well unlike those that already exist, users have not had enough it's time to get used to them. Alternative methods are not limited to visualization methods. Figure 2 depicts a case study of how we applied conventional techniques to a newly combined, the results are shown using two conventional representations: average daily patterns of clusters are shown as graphs, and the days per cluster are shown on a calendar.

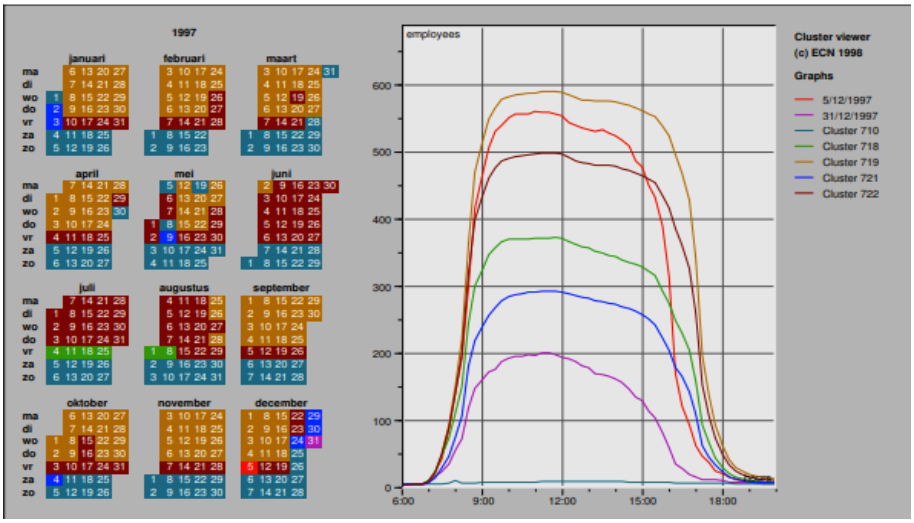

Figure 2: Visualization of daily patterns

Visualizations can be inaccurate and deceptive. Alternately, negative knowledge ($|\Delta K| < 0$) can be created using the language that was just taught. Tufte has made available the lie factor, which he defined as the proportion of an effect's magnitude in the data to its size in the image. The outcome of the data's bilinear interpolation is depicted in Figure 3. The two sets of waves that are generated—the standard waves and a set of waves orthogonal to these—are clearly seen in Figure 4. Figure 5, which employs an approximating spline, provides a far better picture.

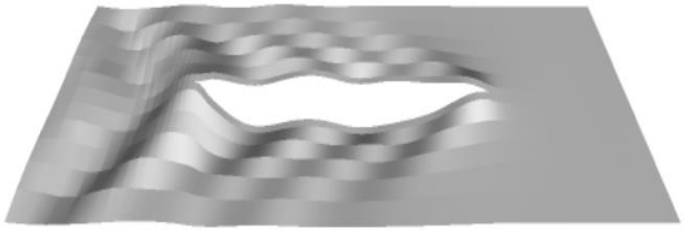

Figure 3: Bilinear interpolation

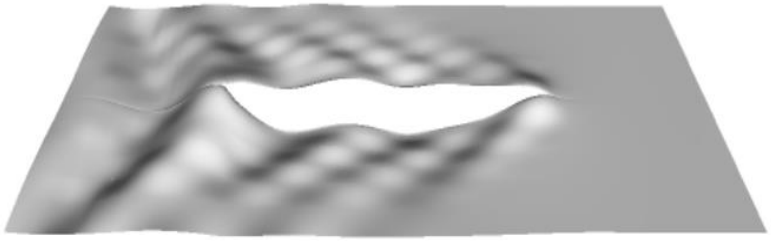

Figure 4: Cubic interpolation

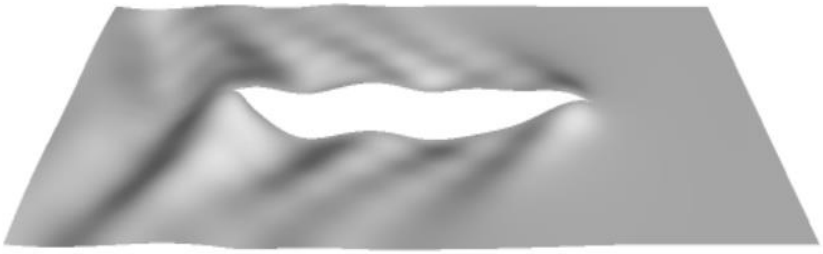

Figure 5: Cubic approximation

TEXTURE BASED FLOW VISUALIZATION - Since the early 1990s, texture has been used to represent the fluid flow. The notion is that, unlike typical arrows and streamlines, which only provide discrete and challenging-to-interpret samples, thick textures allow viewers to determine the direction of flow at all points of the plane. Today, common technology can readily produce high-quality 2D texture pictures of flow fields at 50 or more frames per second. When it came to other factors, such as estimating the flow's angle, LIC produced poorer results than it did for critical point identification. Additionally, conventional LIC does not include the flow direction's sign.

CUSHION TREEMAPS - To depict massive hierarchical data sets, Johnson and Shneiderman developed the treemap idea in the early 1990s. The fundamental algorithm is simple: A rectangle is recursively split into smaller rectangles according to the hierarchical information, with each rectangle's size being equal to that of a leaf element.

Visualization is viewed as a technology in the cost model, to be evaluated for usefulness. Firstly, innovation is a brutal process in which few novel solutions persist. Secondly, innovation is a long chain. Thirdly, it may be said that everything is only a matter of time. It takes time for new concepts to catch on and for efforts to be made to incorporate new techniques into current systems. Fourth, the model places a strong emphasis on numerous users and use cases. Finally, one argument is that, in comparison to other fields, perhaps we are not doing too badly.

SCIENCE - We may think of visualization study as a scientific field, in addition to viewing it as a technology or as art for its own purpose. First, a descriptive strategy can be developed further. Analyzing and classifying methods produces taxonomies that illustrate how they are related to and distinct from one another. Second, validation and assessment are crucial. From a technological standpoint, evaluating the efficacy and efficiency of various approaches and techniques is essential. It also serves as a foundation for more general assertions about visualization.

CONCLUSION – The author has come to the conclusion that there isn't just one solution and that it all relies on the viewpoint one takes. One perspective is to approach visualization solely technologically, focusing on efficacy and efficiency. Finally, a viewpoint on visualization as an empirical science was presented. Another perspective is to think of visualization as an art.

Figure 6 depicts these three views schematically–

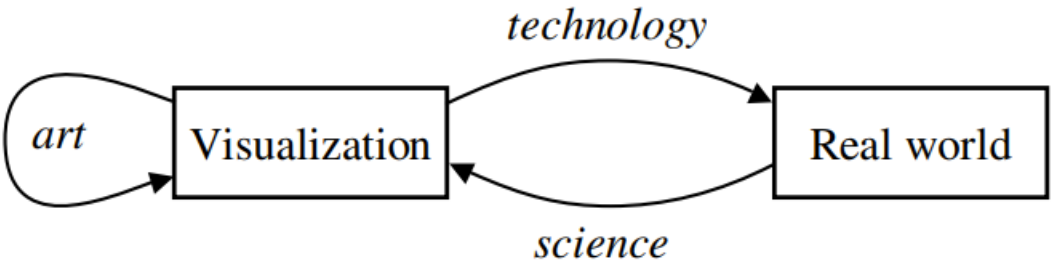

Figure 6: Views on Visualization