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The Value of Visualization Report

Visualization of information allows for data to be used in many different efficient ways. The human body is able to use its visual system to detect features and patterns in the visualization quickly. The value of visualization can differ in various ways and can be used to make decisions that may impact areas that need improvement or solutions that need to be implemented. Visualization, for the purposes of this report, will be considered as a technology, meaning that it defined as "a collection of methods, techniques, and tools developed and applied to satisfy a need" (Van Wijk). Another way of defining visualization is saying that the visualization is supposed to do what is intended to do while using little resources.

Visualization can be put into a mathematical equation that can provide a measurement instead of an exact definition. There are various variables that should be considered such as *D* meaning data "is transformed according to a specification *S* into a time varying image I(*t*)" (Van Wijk). The data type that needs the visualization ranges from time-varying 3D fields to as small as single-bit. The equation for Visualization is:

$$\mathrm{I}(t) = V(D, S, t).$$

A visualization should have some type of value to it. The method of great visualization is one that multiple people use in order to gain knowledge or information without the need to spend much time, money, or effort. Visualizations that are great follow this method and allows viewers to gain insight, a deep understanding, of the data. Looking at visualization in the economical sense, there are four levels of costs that's associated with certain visualizations. The first level is the Initial Development Costs, which includes any hardware or software costs that are needed in order to develop the visualization. The second level is the Initial Cost Per User, which includes the costs of time of learning the visualization, understanding it, and making it work in way he intends it to work. The third level is the Initial Costs Per Session, which includes the costs that comes with specifying and converting the data into the visualization. The last level is the Perception and Exploration Costs, which includes the costs of the time of watching, understanding, modifying, and exploring the data in the visualization.

One downside to this method is that it is always hard to measure how much insight a person gained and the value of the insight. Although it is difficult to acquire the measurement of

insight a visualization can provide, a person can still attempt to and can handle it as such as you would in handling a problem. You first must figure out the problem, then get information to find a solution, and finally, implement that solution into action. A visualization should be able to allow the viewer to view the most important information from the data. Once you know what insight the visualization should give, you should find out if the visualization supports that insight. As in the real world, there can always be more than one solution that could be implemented. Alternative solutions that can be used by new visualization methods developers each have their advantages and disadvantages and should be looked at carefully, as a new method does not necessarily mean the method is better. Usually, methods that are already in use are the ones most likely to be used, as they proved that the method works.

A high initial cost per user is one of the disadvantages of using new visualization methods. For example, consider a researcher that wants to use a visualization for his complex simulations. Visualization software would be a method that can be used to provide the visualization using regular techniques that accomplishes what the researcher is trying to visualize with the data. If visualization software is unavailable, then the researcher has to implement alternative methods to provide a visualization such as reading books, research papers, or even talking with experts. Even with a prototype visualization, additional software would have to be developed so that his data is in a suitable format. Much time, money, and effort are usually spent at this point, and it is no guarantee that the method would ultimately solve his visualization problem.

There could be subjective aspects of visualization if the visualization does not provide any clear patterns. A way of limiting this is showing an audience the visualization and allowing them to judge it. Visualizations can also include negative knowledge, which basically means that a visualization can be misleading. In information visualization, a lie-factor is used, which Tufte introduced, to show the accuracy of a visualization. The lie-factor is “defined as the ratio of the size of an effect shown in the graphic to the size of the effect in the data” (Van Wijk).

When viewing visualization in the technology sense, you could find multiple solutions that stems from innovation. There will be multiple ideas that can create hundreds of prototypes and only one of those will ultimately be successful. There will be multiple ways to gain access with technological visualization, such as commercial companies providing their visualization

technology for open source or for academic purposes and usually, they are funded by government entities. Another way of viewing visualization is the art sense, so that the visualization is interesting enough itself. Lastly, science is also a way that visualization can be viewed.

In conclusion, visualization allows for data to be shown as visual information that can be used to identify different features and patterns. These patterns can help impact decision-making in different aspects such as discovering an area that needs improvement. A great visualization provides a viewer insight without the need to spend much time, money, or effort doing so. New methods of visualization are being developed constantly, however, they do not always work out and in most cases, the methods already in use work.