Assignment 2

Perception in Visualization

Group 2A

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Information Visualization (TNM048)

Task 1

1.1 - Describe what pre-attentive processing means and discuss in your own words how it can be helpful for making good visualization environments

In short, pre-attentive processing is our minds subconscious ability to absorb and process our visual surroundings quickly and accurately. The information our visual system absorbs can be analysed on a surface level to achieve certain tasks. These tasks are accomplished by the low-level visual system. The name pre-attentive is originally derived from the perception that detection of these outliers preceded the minds focused attention.

An example can be given how we are exceptional at finding outliers in a group using certain descriptors. Examples of such descriptors is color, shape and hue. These outliers are most effective in environments without disturbances but function to a high degree even if disturbances are present.

These seemingly innate attention grabbers can be utilized to show clear outliers in data and mapping. An example of utilizing this phenomena could be to highlight certain bars in a bar graph. Shown below in figure 1 is an example of how the higher percentages are highlighted green (left) and the lower percentages are highlighted red (right). This achieves the effect of pre-attentiveness by drawing your attention and highlighting the data using a color difference.

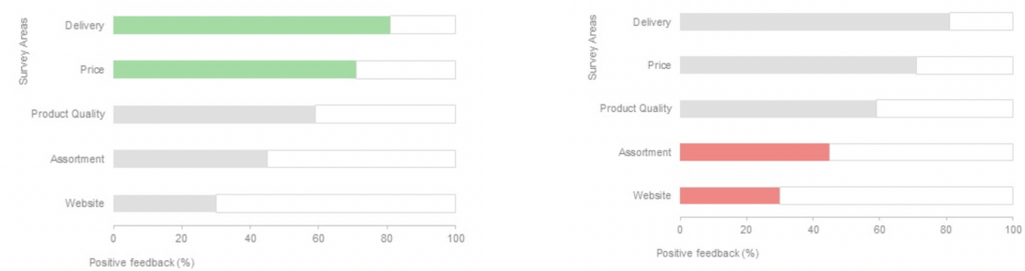

Figure 1: A fictional e-commerce company's analysis of customer's feedback data from the last quarter where the higher percentages are highlighted green (left) and the lower percentages are highlighted red (right)

1.2 - What strategy can be used to show multiple data objects with different attribute values simultaneously in a single image? What visual feature is favored in case of boundary detection?

A strategy that may be used to show multiple data objects with different attribute values simultaneously is to assign different visual features to different data points with the key factor of not allowing for any factor of interference. This allows the goal of showing multiple data objects with different attribute values simultaneously in a single image to be achieved. Noteworthy is that this also germinates a sort of boundary which detection is also pre-attentive.

In regards to the question of which attribute is favored in boundary detection, according to Christopher G. Healey [1] boundary detection research have shown that the visual system favours colour over shape. This is part of a the feature hierarchy which is based on our

understanding of our low-level vision.

1.3 - What is change blindness? If possible, explain one case where it might affect the outcome of perception of certain visualizations

Change blindness is not a proof of our inability to take note of changes in an image but instead it is a sign that we are unable to notice changes when lacking an appropriate attentional guidance to notice changes. That is to say; in order to see a change, it is a necessity to attend to it. A possible example of how change blindness may effect the perception of a certain visualization (In regards to information and data visualisations) could be its usage to divert ones attention from a certain data point of interest.

1.4 - Explain at least two cases where motion is usually used in visualization environments. Which are the most important motion properties? Which motion property would you consider as most useful for pre-attentive processing?

A very common uses of motion in visualization environments may be how it is used in visualising movement of vector fields in meteorology, as one may have seen on the news in weather forecasts. That is to say that it is commonly used to illustrate flow visualization; i.e direction, speed and change of flow patterns. Another use of motion in visualization environments can be how it is used to separate different types of data into separate visual groups.

In regards to the question of which are the most important motion properties it is of worth to note which types of motion are regarded pre-attentive currently; flicker, direction of motion, and velocity of motion. That is to say flicker, direction of motion, and velocity of motion are the most important motion properties. Also, since all of them are considered pre-attentive, the one most useful for pre-attentive processing is dependant on the situation. However, in regards to the usefulness of the individual motion properties it could be argued that the response time is the most important wherein velocity would have the shortest response time [2].

Task 2 Optical illusions

2.1 - Are the circles consistently arranged around a common center point? Explain your answer!

The circles in the image are equally spaced and have a common center point shared (in the center). The illusion of the uneven spacing and the perceived spiralling pattern is an effect of the ”polka” pattern on the circles as well as the illusion of distance created by the fading of the inner circles. The polka pattern aligns in a way that makes our mind perceive it as a continual pattern that is connected by the circles. A way to disillusion yourself would be to cover half of the image and closing one eye.

2.2 - Which one of the middle circles looks bigger? Explain your answer!

The one on the left in the image is perceived to be larger due to the contexts of the surrounding circles, but they are however of the same size.

2.3 - The circles seem to rotate. Why?

The movement of the circles are seemingly caused by the overload of information that is happening in our peripheral visual system. The circles does not seem to rotate if you are looking and focusing solely on one circle and not moving your focus.

References

[1] Christopher G. Healey. "Attention and Visual Memory in Visualization and Computer Graphics", IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS, VOL. 18, NO. 7, JULY 2012

[2] van Doorn, A. J. and Koenderink, J. J. "Temporal properties of the visual detectability of moving spatial white noise", Experimental Brain Research, VOL. 45, 179–188, 1982