

Assignment 2

Course: TNM048 - Information Visualization, Authors: Afra Farkhooy & Alice Molin

Task 1

1. Describe what preattentive processing means and discuss in your own words how it can be helpful for making good visualization environments.

When investigating how humans visual system analyses images it was concluded that there is a limited set of visual properties such as colors, shapes and placements, that are detected very fast and precise by the low-level system. These objects are called preattentive because when detecting these the brain proceeded to focus attention to them.

Preattentive objects can be used for target detection by using one color or shape for all objects in the environment (distractors) and using another well distinguished color or shape for the part that we want to draw focus to (target). This will make the targeted part pop-out as different which are detected rapidly.

It can also be used for boundary detection, then specific common visual properties are assigned to elements, initializing a group. Region tracking where the observer can track the elements, when they for example move positions, due to their unique features. Lastly it also makes it easier for the observer to estimate the amount of elements with a unique visual feature.

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 method for visualizing multiple data objects in one image is to assign different visual features to different attributes. For this not leading to visual interference a requirement is to use a data-feature mapping that is well modelled for the case. In the case of boundary detection the visual system favor color over shape.

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

One conclusion made from research is that the human vision does not work like the passive process of modern photography. The human vision does not want to replicate or mimic an image of the seen world in our heads, it is more like a dynamic project where we see short lived models of the external world that differ and suit the specific visual guidance of the viewer. What the brain chooses to see is dependent on the humans goals and expectations as much as the physics behind the light that enters the eye.

This science differ from the initial idea of preattentive processing, that certain features are recognized in an image without the need of focused attention and that other features can not be detected even if the viewer knowingly search for them. Recent research work about preattentive vision has shown that it is not as clear of a cut between visible and not visible. It is more of a spectrum between the two. A discussion of postattentive vision declares the fact that details of an image can not be remembered across separate scenes besides the focus area. This leads to a new research that studied the affect of interruption in the image being observed. This interruption, which could be flickering, eye movements etc. blinds the viewer for significant changes that may have occurred during the interruption. This is called change blindness. This phenomena is explained with a combination of factors such as focus points, the brain is not comparing the images, different feature combinations, human expectations and experiences, distractions and more.

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 preattentive processing?

Motion is commonly used in animation of particles or to visualize a fluid flow. It can also be used to highlight changes in a diagram of data. Like animating the scaling of an axis, or animate the change of values due to time. The most important properties of motion is flicker, direction of motion and velocity of motion.

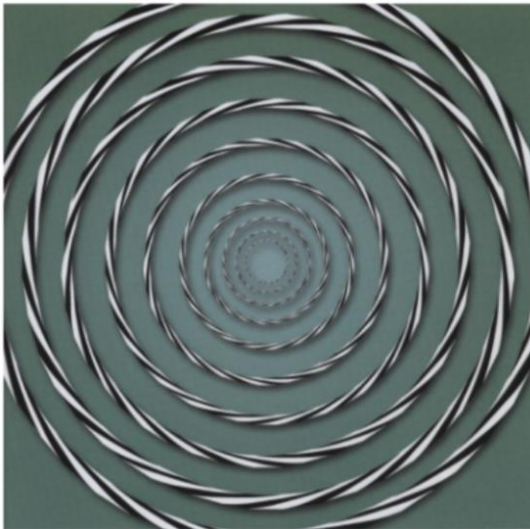
The most useful property for preattentive processing would be direction of motion. This because it is the easiest to distinguish. For example if we have an image with distraction objects that are translating downwards, lets say in the angle 180 degrees. And the target object is translating in the angle 200

degrees it would be clearly noticeable even if the change of angle is relatively small.

Such a small change in the parameter value would not be as noticeable for flickering and velocity.

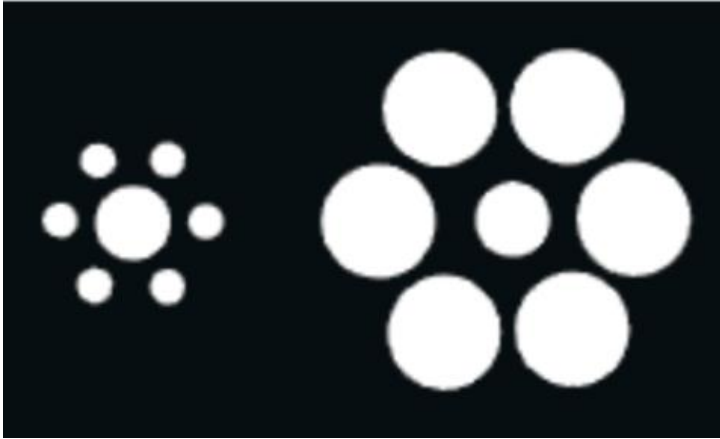
Task 2

**1. Are the circles consistently arranged around a common center point?
Explain your answer**



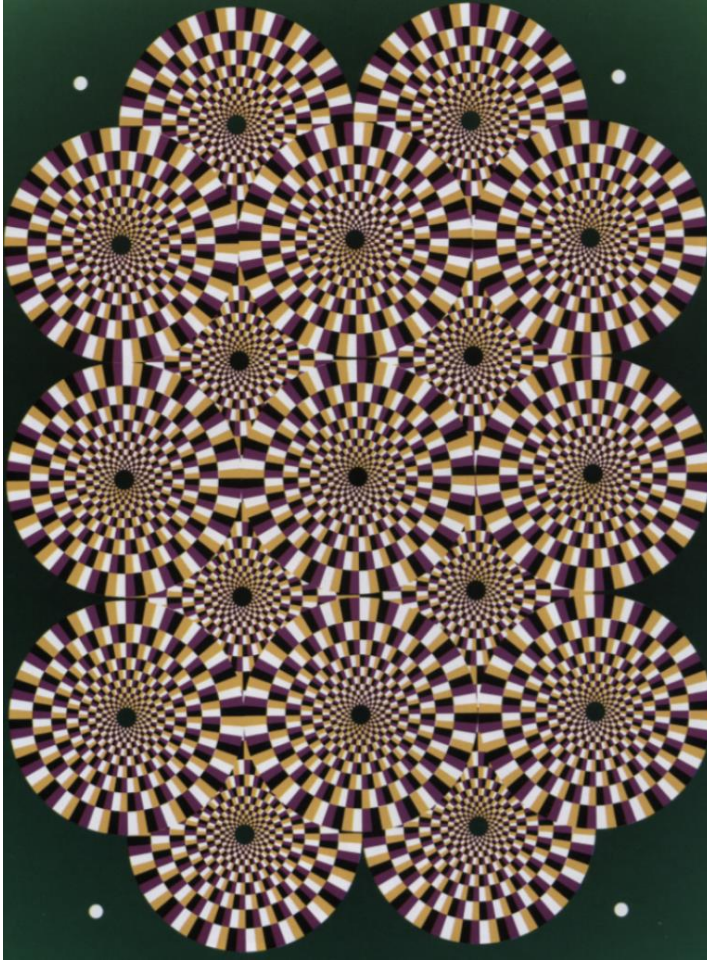
It is actually a series of concentric circles, not a spiral. This is called the Popple illusion. The circles are made of small patches that are black and white. These are called Gabor patches. The Gabor patches are set up so the brightness are distributed in a broken spiral pattern which forces our eye's to think they do.

2. Which one of the middle circles looks bigger? Explain your answer!



They are the same size, but relatively the closest dots, they look different in size, which is why our brains trick us into thinking that they are actually different in size as well. This illusion is called Ebbinghaus illusion and is an optical illusion that creates the perception of relative sizes.

3. The circles seem to rotate. Why?



This image is an example of a "peripheral drift" anomalous motion illusion. Although the image is not animated, the circles still seem to rotate. This illusion is caused by the brain's interpretation of patterns seen outside of the eye's area of focus. Larger images usually produce a stronger effect and some color combinations work better than others. If you stare at a fixed point in the image the motion disappears, in the area of focus, until you move your fixed point. But the peripheral vision seem to be in constant movement.