# Pattern recognition psychology

Pattern recognition is a skill of how people identify the objects in their environment which is what we do all the time in our daily life. For example, you can recognize your teachers, friends, and also which items can eat or cannot eat. Everything in the world has its own pattern. Our superiority over computers as pattern recognizers has the practical advantage that pattern recognition can serve as a test of whether a person or a computer program is trying to gain access to the Internet.

## Describing Patterns

There are many kinds of the description of patterns stored in our long term memory (LTM), thus, when we observe or listen to a pattern, our mind will automatically form a description of it and compare it against the descriptions which stored in LTM. If the description closely matches with one of the descriptions in our LTM, then we are able to recognize the pattern. There are three description theories used to describe patterns which are template theories, feature theories, and structural theories.

Template theories propose that patterns are really not “ described” at all. Rather, templates are holistic, or unanalyzed, entities that we compare with other patterns by measuring how much two patterns overlap. Shortly it’s an analyzed pattern that is matched against alternative patterns by using the degrees of overlap as a measure of similarity.

There has some limitation with using the degree of overlap as a measure of pattern recognition. First, the comparison requires that the template be in the same position and the same orientation and be the same size as the pattern you are trying to identify. Second, is the great variability of patterns

which would be difficult to construct a template for each letter that would produce a good match with all the different varieties of the letter. Third, a template theory doesn't reveal how two patterns differ. Lastly, the template theory does not allow for alternative descriptions of a pattern.

Feature theory used to describe a pattern by listing out its attributes. For example, we might describe a friend as having long blond hair, a short nose and bushy eyebrows or else can say. Gibson (1969) proposed some criteria as a basis for selecting a set of features for uppercase letters. First, the features should be critical ones, present in some members of the set but not in others, so as to provide a contrast. Second, the identity of the features should remain unchanged under changes in brightness, size and perspective. Third, the features should yield a unique pattern for each letter and the last is the number of proposed features should be reasonably small. A set of features is usually evaluated by determining how well it can predict perceptual confusions as confusable items should have many features in common.

Distinctive feature is a feature present in one pattern but absent in another aiding one's discrimination of the two patterns. For example, in child learning, when first confronted with the letters E and F, the child might not be aware of how the two differ. Learning to make this discrimination depends on discovering that a low horizontal line is present in the letter E but not in the letter F. The low horizontal line is a distinctive feature for distinguishing between an E and an F; that is, it enables us to distinguish one pattern from other. Feature theories can also be used to represent faces. If you describe a

woman’s face you would likely refer to features such as her nose, eyes and mouth.

Structural theory describes how features join together to create a structure which represents a guiding principle of Gestalt psychology. It emphasizes the relations among the features. Geon refers as different three dimensional shapes that combine to form three dimensional patterns. It’s a limited number (24) of simple geometric shapes or geon’s for us to analyze patterns. For example, mug versus bucket.

Biederman’s Component Model (1987) describe three-dimensional objects would be fairly complicated if we had to describe each of the lines and curves in the object. Like the features of letters, these components can be combined in many different ways to produce a variety of objects. For example, the mug and the pail contain the same two components in a different arrangement. Both the components and the relations among the components determine the perceived similarity of patterns (Arguin & Saumier, 2004). For example, the briefcase and drawer are similar because they share the same components. However, the briefcase is more similar to the pail than to the cup because of the relation between components-the handle is on top for both the briefcase and pail.

## Information-Processing Stages

Sperling (1960) is responsible for the initial construction of an information-processing model of performance on a visual recognition task. Sperling was interested in measuring the number of letters that could be recognized during a brief exposure. In other words, subjects might have recognized

most of the letters in the display but then forgot some before they could report what they had seen. Sperling therefore changed his procedure from a whole-report procedure to report all the letters to a partial-report procedure, which report only some of the letters.

## Sperling's Model

Sperling's (1960) study of sensory memory. After the subjects had fixated on the cross, the letters were flashed on the screen just long enough to create a visual afterimage. High, medium and low tones signaled which row of letters to report. In 1963, Sperling proposed an information-processing model of performance on his visual report task. The model consisted of a visual information store, scanning, rehearsal and an auditory information store. Visual information store (VIS), a sensory store that maintains visual information for approximately one-quarter of a second. Rehearsal is repeating verbal information to keep it active in short-term memory or to transfer it into long-term memory. In Sperling's model auditory information store maintains verbal information in short-term memory through rehearsal.

## Rumelhart's Model

Rumelhart (1970) proposed a detailed mathematical model of performance on a wide range of information-processing tasks, including the whole-report and partial-report procedures studied by Sperling. His model built on importance of the visual information store and the use of a parallel scan to recognize patters. More time the observer has, the more features the observer can recognize. The rate of feature recognition in Rumelhart's model is influenced by both the clarity of the information and the number of items in the display. As the number of items increases, the amount of attention

that can be focused on each item declines, and this slows the rate of recognizing that particular item. Detection paradigm was designed by Estes and Taylor (1966).

Word superiority effect is a finding that accuracy in recognizing a letter is higher when the letter is in a word than when it appears alone or is in a non-word.

## Word Recognition

One of the great challenges for psychologists interested in word recognition has been to explain the reasons for the word superiority effect (Pollatsek & Rayner, 1989). Interaction activation model was proposed by McClelland and Rumelhart (1981). It’s a theory that process that both feature knowledge and word knowledge combine to provide information about the identity of letters in a word. Exeltatory connection is a positive association between concepts that belong together, as when a vertical line provides support for the possibility that a letter is a K and inhibitory connection is a negative association between concepts that do not belong together, as when the presence of a vertical line provides negative evidence that a letter is a C.

## Neural Network Models

The interactive activation model was the first step for McClelland and Rumelhart in their development of neural network models of cognition. It’s a theory in which concepts (nodes) are linked to other concepts through excitatory and inhibitory connections to approximate the behavior of neural networks in the brain. Nodes are the format for representing concepts in a semantic network. Activation rule is determines how inhibitory and

excitatory connections combine to determine the total activation of a concept.

# Literature Review

## Perceptual Colour Representation of the Face: Extracting the Colour of Skin, Hair, and Eyes by

## Levente Sajo, Korn El Bertok, And Attila Fazekas (2011)

In human communication the face conveys a lot of information. People are identified by their face and it also has a strong effect on first impressions. From face detection, through face and facial feature tracking, to face classification problems (face recognition, gender, age, race, facial expression detection), there have been various face representations used, all of them having their advantages in their specific domain. The colours of the facial features are determined in two steps. First, the skin, eyes and hair are segmented in the image using only structural information (Section 2). Then, within the segmented regions the huge number of colours in real colour images is substituted by a smaller colour set, which is used to determine the colour of a given feature. The way the colour model was defined to resemble human perception and the colour extraction method based on the model are presented in Section 3. The solution was tested with automatic categorization of facial images and a colour-based image retrieval application. The results are presented in Section 4 (Levente, Kornel & Attila, 2011).

The objective is to determine the color of various facial features like skin, hair, eyes and also to identify the exact location, dominant color, size and the shape. They used method to detect the colour of skin, eyes and hair.

First, using structural information about the face, certain features are segmented from the others. Then, within the segmented region the dominant colour is determined. Used the colour extraction methods described above, for demonstrational purposes, an image retrieval system was constructed, which searches a face database using the colour of the skin, eye and hair as queries.