Effect of the learning history at a low level of object analysis

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According to most theories, object analysis operates on the basis of a fixed set of features or on the basis of perceptual bottom-up rules (among others: Palmer, 1977; Hoffman & Richards, 1984; Biederman, 1987; Treisman & Gelade, 1980). Some recents experimental data have shown that the segmentation of an object into parts can be directed by the learning history (Schyns & Murphy, 1994; Schyns & Rodet, in press). Our purpose is to study which level of analysis is concerned by this learning effect. In the present experiment, we test the effect of learning history for a task of target detection that is generally considered as a perceptual task.

Experiment design

We use unknown stimuli called "cells" defined by unknown shapes inside grey disks. Subjects had to learn three particular shapes. Three learning groups were defined according to three learning histories. In the first two groups, two parts of each cell were presented before the whole cell (two vertical parts or two horizontal parts according to the group). In the third group, subjects saw the whole cells without segmentation.

The test task is a replication of the illusory conjunction experiment of Treisman and Paterson (1984). The authors used a task of target detection in which the target was a two-features pattern (an arrow defined by an oblique line and a angle). They found that even in absence of target, subjects did recognize the arrow when the two features were present separately. Authors argued that illusory conjunctions appeared because of a wrong integration of these two features.

Our purpose was to see whether perceptive units could be defined with learning. Subjects had to detect a target in patterns of shapes. Each target was a new stimulus defined with two parts: a part previously learned (a vertical one or an horizontal one) and an "additive part". If illusions appeared in the absence of the target and when the two parts were presented separately, we could argue that subjects associated the presented parts in a wrong way causing illusions.

If differences appeared between learning groups, one could argue that the previous presentation of a stimulus influenced the further perception process: when stimuli have not been learned as segmented patterns or when learned parts did not correspond to the parts of the target, few illusion would have appeared in the absence of the target. At the opposite, for subjects who learned parts of the target, the conjunction of the learned part and the additive part provided the illusion that the target was present while it was not the case.

Results and Discussion

We compared the corrected recognition rates between control items (where parts of the target were not present) and illusory items (that contained parts of the target) for the different experimental conditions. Our hypothesis focused on a difference in this comparison according to learning histories and the type of target.

A first analysis of variance showed that corrected recognition rates were higher for control items than for illusory items, $F(1)=254$, $p<.001$. In other words, illusory items provided more illusions than control items. Moreover, this result appeared for each of the three groups of subjects. It means that illusions appeared with or without learning segmentation of the cells.

Finally, if illusory items provided more illusions than control items, the difference varied as a function of both the type of target (defined with horizontal or vertical parts of the learning cells) and the learning history. $F(2)=3.27$, $p<.05$. More precisely, more illusions appeared if the type of target was in accordance with the learning experience.

The effect of the learning process on the recognition rates in our experiment showed that even though there was a preferential segmentation of an object into parts, this segmentation could be changed by the learning experience. If we consider the illusions task as a perceptual task, we can conclude that the learning history may affect the format of the perceptual representation of an object.

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