

Cognitive Systems I

Christian Freksa, Thomas Barkowsky, Thora Tenbrink, Jan Frederik Sima

Summer 2009

Exercise 3: Extension of the cognitive architecture: grouping during perception and visual completion

(to be done in groups of 3-4 students, return per email by 24 May 2009 to cosy-exercises@informatik.uni-bremen.de)

In exercise 3, you are supposed to again extend your cognitive architecture with additional functionality without compromising the existing functionality (i.e., the one you implemented in the scope of exercise 1 and 2). The stimuli used are similar to the ones used in the previous exercises.

1. In the lecture you got to know the classical principles of grouping in visual perception. For the first part of this exercise you are supposed to realize in your architectures the three principles *grouping due to spatial proximity*, *grouping due to similarity of color*, and *grouping due to similarity of form* (a certain variant of "similarity of color" and "orientation" (see Fig. 1). For this perceptual processes the visual stimulus can be assumed to be presented permanently, that is, without time limit. The system should be able to inform about grouping with respect to each of the three grouping principles separately as well as to grouping in general.

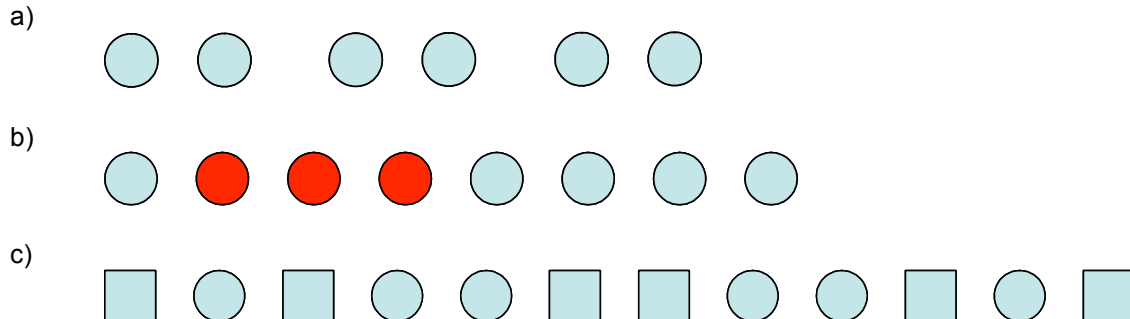


Fig. 1. a) grouping due to proximity (3 groups); b) grouping due to similarity of color (1 group? 2 groups? 3 groups?); c) grouping due to similarity of form.

Example:

(visual stimulus, Fig. 2a)

Question: "How many groups of type *proximity* are contained in the picture?"

Answer: "5"

(visual stimulus, Fig. 2b)

Question: " How many groups of type *similarity of color* are contained in the picture?"

Answer: "4"

Question: " How many groups of type *similarity of form* are contained in the picture?"

Answer: "3"

Question: " How many groups (without type specification) are contained in the picture?"

Answer: - ??? – (In this case your system is supposed to examine the picture with respect to each of the three criteria and then give an answer; where applicable conflicts between criteria have to be taken into account)

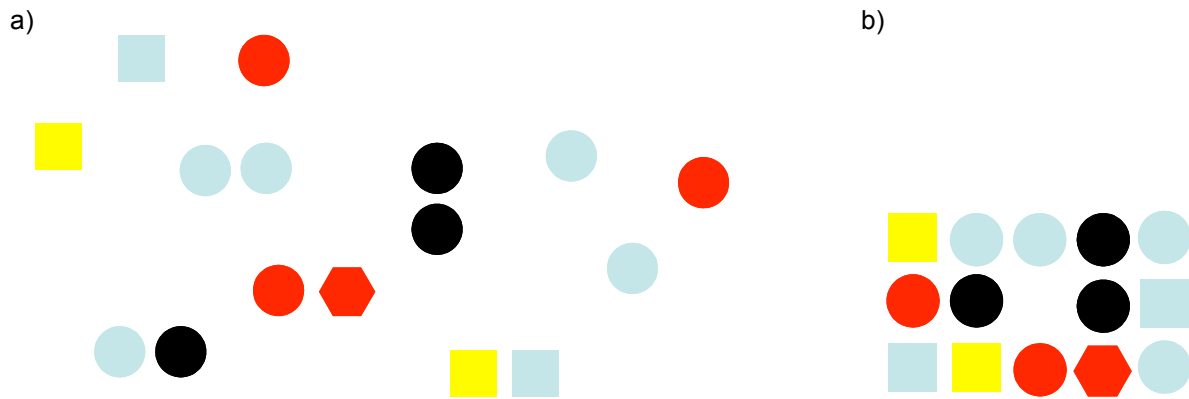


Abb. 2. Examples of visual stimuli used for the grouping task.

2. During visual object recognition partly obscured objects are completed and parts of contours are connected to each other. Extend your architecture so that partially obscured, plane objects and line objects are recognized as such. To do this you should employ the visual object type “obscuring object” (represented in Fig. 3 as white stars). Regarding the recognition of composite objects you can draw on the visual routines you developed for the last exercise.

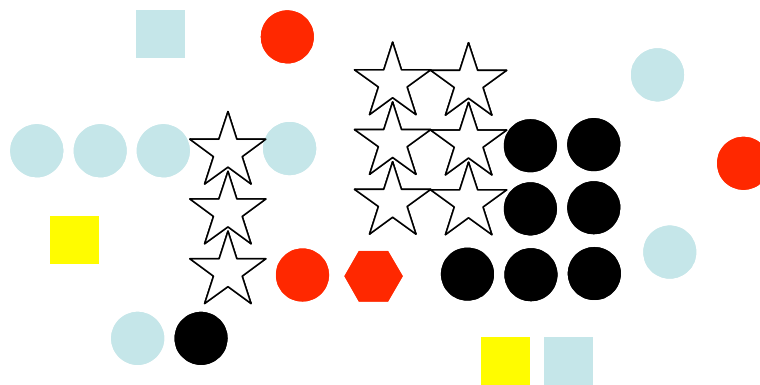


Abb. 3. Visual stimulus with two obscuring objects (signified by stars), that obscure a line and a square, respectively.

Example:

(visueller Stimulus, Abb. 3)

Question: "How many obscured objects are contained in the figure?"

Answer: "one line-like and one square-like object"

The task in more detail:

a) Describe your concept of the extensions: which additional components are necessary for solving the task(s)? How is the interplay between these components realized?

b) Implementation of the cognitive architecture: implement the components such that the above described tasks can be accomplished by the system and that the interplay of the components can be observed.

c) Exemplify how your system reacts to different requests. In doing so, you need to develop appropriate stimulus material.