CS 6795 Spring 2024 - Individual Exercise 1

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***Abstract*—The individual exercise explores problem-solving in Raven's Test of Intelligence, focusing on identifying image patterns. The participant uses imagistic reasoning, supplemented by analogical reasoning, to deduce the solution. The problem engages visual analogs, requiring imagistic representations and reasoning while excluding conceptual representations. The solution approach involves applying observed patterns from the matrix's left to the right side.**

Keywords—reasoning, representation, mind, cognition science.

I. Question 1: Raven's Test of Intelligence Inspired Problem

I select option 1 as my answer to the given problem in Figure 1. My approach is as follows.

This question is about finding patterns in the given images and matching the answer from 1-6 to fit in this existing pattern, so I started by looking at the properties of A, B and C - all three images are assembled with square boxes of decreasing lengths in equal intervals according to the principle of being centred in the center; the gaps between these square boxes can be filled with black colour or not. I looked for further patterns, mainly by the number of square boxes and filled gaps that made up these images.

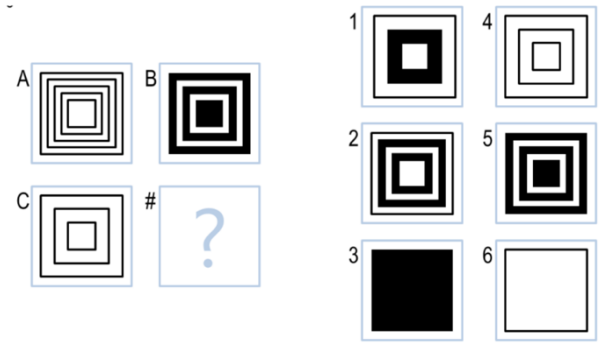

Fig. 1. The Raven's Test of Intelligence Inspired Problem

First, look at the left half of this two-by-two matrix. From A to C, the square boxes decrease from 5 to 3, and none of the gaps between the boxes are filled with any colour. Therefore, I expect this number of boxes and color-filling pattern to be consistent in the right half of this matrix image as well. Since B consists of 5 square boxes, as does A, the number of boxes should have only 3 square boxes in the solution(#), and the gaps in between should be coloured according to the same fill-not-fill pattern as in B.

Of choices 1-6, only 1 and 4 satisfy the condition that the number of square boxes is 3, and only 1, 2, and 5 satisfy the same filling pattern as B. Therefore, option 1 is the solution to this problem.

II. Question 2: Representation

Yes, this problem engages analogies. Since the given is a typical visual problem, the similarity of visual analogs is not just conceptual but also involves their visual appearance [1]. In this case, the visual analogs are the left (source) and right (target) parts of the two-by-two matrix image, and the appearances involve the colour fill pattern between the square borders and the number of boxes that make up each sub-image. See Table I for the Analogies Representation. Hence, this problem engages analogies and reasoning by mapping the left pattern to the right.

TABLE I. Analogy Representations

Target	Source
Pattern: ***1. Five Square Boxes*** ***2. Every other gap is filled with colour from outside to inside***	***A Pattern:*** ***1. Five Square Boxes*** ***2. No gaps between the boxes are filled with colour***
Pattern: ***1. Three Square Boxes*** ***2. Every other gap is filled with colour from outside to inside***	***C Pattern:*** ***1. Three Square Boxes*** ***2. No gaps between the boxes are filled with colour***

Yes, this problem requires imagistic representations and reasoning. Although this problem involves analogies and can be presented verbally/in words, it is challenging to avoid redundant explanations and inferences in this case. Imagistic representations and reasoning are likely helpful if the solution depends on the problem's visual appearance [1]. As represented in Figure 2, imagistic representations are more intuitive than analogical representations and require little inferential reasoning to select the correct answer through visual and brain imaging from left to right.

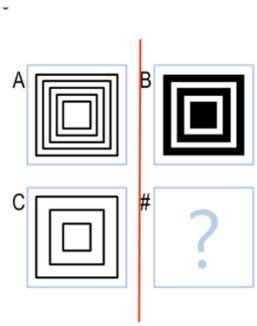

Fig. 2. Imagistic Representations

No, this problem does not require conceptual representations and reasoning for me to find the solution. According to Thagard, Concepts consist of packages of features and information that can be applied to new situations [1]. However, my behaviour of finding aims to find the solution in a similar situation – still within the Raven's Test

of Intelligence Inspired Problem Domain. Additionally, in comprehending the question, I do not represent the given problems according to the concept representation, and I do not consider the rules extracted from the problem about square borders and colour fills to be general enough to be conceptual, so I think this problem does not require conceptual representations and reasoning to come up with the solution.

III. Question 3: Solution Approach

My approach to the solution primarily relies on imagistic reasoning with supplementary elements of analogical reasoning to systematically deduce and eliminate options based on observed patterns in A, B and C.

First, the given is a typical problem of finding patterns in images, for which imagistic representation and reasoning are an instinctive response of human perception. Secondly, Thagard believes visual mental images provide powerful ways of representing how things look and how they are spatially arranged, which fits well with this problem [1]. Therefore, imagistic reasoning is better than logic, rules, concepts, analogies, and connection representations under this certain circumstance. From my experience, imagistic reasoning eliminates a lot of unnecessary verbal or written reasoning, allowing me to find patterns and determine the correct answer in a very short period of time. As for finding and applying the image patterns, I also applied analogical reasoning.

As my answer in Question 1 described, I looked for patterns from the left half of the problem and applied them to the right to determine the solution. Visual images complement but cannot fully replace verbal representations of the sort we have seen in chapters 2-5 of *Mind* by Thagard [1]. Even though I did not list specific representation statements in my thought process as Thagard did in his book, and that process was relatively brief, I still relied on the core idea of analogical reasoning to solve this problem. Additionally, I believe integrating thoughts and documenting representation statements in the text would be helpful for revisiting the problem or/and further research.

References

[1] P. Thagard, "Mind: Introduction to Cognitive Science," MIT Press, pp. 1–133, 1996.