Human reasoning process is related to the complexity of the problem being faced

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Date: 2024-01-21T00:00:00+00:00

Abstract

The non-exclusive dual-process working model proposed in De Neys' article effectively makes up for the shortcomings of the existing theories and models, but the explanation of the switching problem and the exclusivity problem in this article cannot constitute a complete rejection of the existing switching mechanism and the traditional fast-slow dual-process model. We believe that a more powerful and logical way of explaining the theory is as follows: human reasoning process is related to the complexity of the problem being faced, and it is also closely related to the reading process of the problem; in the process of reading the problem, the brain will automatically choose different ways of reasoning for the problem of different levels of complexity; and in the process of selection, the principle of minimum energy should still be valid.

Full Text

Preamble

Human Reasoning Process Is Related to the Complexity of the Problem Being Faced

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Abstract: The non-exclusive dual-process working model proposed in De Neys' article effectively addresses the shortcomings of existing theories and models. However, the explanations of the switching problem and the exclusivity problem in that article do not constitute a complete rejection of either the existing switching mechanism or the traditional fast-slow dual-process model. We propose a more robust and logical theoretical explanation as follows: the human reasoning process is related to the complexity of the problem being faced and

is also closely linked to the process of reading and comprehending the problem. During this reading process, the brain automatically selects different reasoning approaches based on the problem's level of complexity, and the principle of minimum energy expenditure should remain valid during this selection process.

Keywords: Dual process; Single process; Intuition; Thinking; Reasoning; Decision-Making; Complexity

In a recent paper (De Neys,2022), De Neys argues that the basic assumptions of the academic community regarding the mechanism of switching between fast and slow thinking lack empirical support. In that paper, a more feasible dual-process architecture is proposed—a non-exclusive dual-process working model—whose internal logical structure and processes are described in detail. While this work addresses shortcomings in existing theories and models of human reasoning, not all of its critiques of prior work are valid (Woo & Spelke2021), and the relevant discussion does not constitute a complete negation of the existing switch mechanism or the traditional fast-slow dual-process model (moreover, in Figure 1 [Figure 1: see original paper] of De Neys' paper, the jump from step 2 to step 3 itself represents a switch mechanism) (Fizke et al. 2017). The reasons are as follows.

It is not difficult to find straightforward evidence supporting these views. For example, in the red-and-white marble experiment, if one is encountering this type of test for the first time, the reasoning process is indeed best explained by the non-exclusive dual-process model. However, if one has previously completed the exact same test, or if the test is extremely simple (such as "The proportion of red balls in the small tray is 1/10, and the proportion of red balls in the large tray is 1/100," or the question is "1+1=?"), then a single process (System 1, I1) is sufficient to produce a clear answer without hesitation (the threshold of minimal uncertainty can be reached quickly). There is no need to initiate the deep intuitive process (System 2, I2), nor is there a need for comparing I1 and I2 or engaging in subsequent deliberation. Consequently, this process does not require an exclusivity characteristic (Kahneman, 2011; Bargh, J. A., & Ferguson 2000).

For the vast majority of people, when faced with extremely simple problems—especially those that are highly familiar—the brain should not need to activate System 2 intuition (deep intuition) but only System 1 intuition (shallow intuition). System 1 can operate without dual-process consideration and can quickly provide a definitive answer, bypassing any dual-process comparison (Fazio 2007; Hermans, De Houwer and Eelen2001; Evans & Stanovich,2013).

Therefore, based on existing meta-analyses and numerous experimental results, we propose the following more robust and logical theoretical explanation.

The brain's reasoning process is related to the complexity of the problem it faces. More specifically, the reasoning process is closely linked to the question-reading process. During this reading process, the brain automatically activates different processing mechanisms depending on the problem type: (a) For extremely

simple or highly familiar problems, the brain can quickly produce a definitive answer by retrieving memory and engaging shallow intuition (I1). Uncertainty is very low and reaches the lower threshold rapidly, allowing immediate output without hesitation. In this case, there is no need to activate the switch mechanism (Dujmović et al. 2021). (b) For complex or unfamiliar problems, the brain may engage the non-exclusive dual-process mode, comparing shallow intuition (I1) and deep intuition (I2) until uncertainty reaches the minimum threshold, at which point it produces a final answer and terminates thinking about the problem. In this case, questions arise regarding how switching occurs and whether multiple switch mechanisms exist. For problems of varying complexity, the minimum energy principle (minimizing cognitive effort) should remain valid during the brain's automatic selection of different reasoning approaches (Stanovich & West, 2000). (Note: Above is Figure 1 of De Neys' paper)

In short, while De Neys' article (De Neys,2022) represents valuable breakthrough research on human reasoning, its consideration of how problem complexity and personal experience influence the reasoning process remains insufficient, and there is still room and necessity to improve the working model. Therefore, it is necessary to examine the human reasoning process within a broader framework—one that includes the reading process as an integral component of human reasoning.

Competing interests. The author has no competing interests.

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Note: Figure translations are in progress. See original paper for figures.