



ELSEVIER

Contents lists available at SciVerse ScienceDirect

## Developmental Review

journal homepage: [www.elsevier.com/locate/dr](http://www.elsevier.com/locate/dr)



# Dual-process theories of reasoning: The test of development

Pierre Barrouillet

Université de Genève, Faculté de Psychologie et des Sciences de l'Éducation, 40 Bd du Pont D'arve, 1211 Genève 4, Switzerland

### ARTICLE INFO

*Article history:*

Available online 24 August 2011

*Keywords:*

Dual-process theories  
Cognitive development  
Conditional reasoning

### ABSTRACT

Dual-process theories have become increasingly influential in the psychology of reasoning. Though the distinction they introduced between intuitive and reflective thinking should have strong developmental implications, the developmental approach has rarely been used to refine or test these theories. In this article, I review several contemporary dual-process accounts of conditional reasoning that theorize the distinction between the two systems of reasoning as a contrast between heuristic and analytic processes, probabilistic and mental model reasoning, or emphasize the role of metacognitive processes in reflective reasoning. These theories are evaluated in the light of the main developmental findings. It is argued that a proper account of developmental phenomena requires the integration of the main strengths of these three approaches. I propose such an integrative theory of conditional understanding and argue that the modern dual-process framework could benefit from earlier contributions that made the same distinction between intuition and reflective thinking, such as Piaget's theory.

© 2011 Elsevier Inc. All rights reserved.

### Introduction

In the past decades, dual-process theories of thinking and reasoning have become increasingly influential (Evans, 2010; Evans & Frankish, 2009). This upsurge is most probably related to the need to explain the apparent paradox created by the discovery of a series of cognitive biases violating elementary rules of logic in educated university students when solving reasoning and decision making tasks (Evans, 1989; Reyna, 2004; Tversky & Kahneman, 1974, 1983; Wason, 1966), while the scientific and technological advances of our societies would suggest that human beings are intrinsically rational. A possible solution to this problem was to imagine the coexistence of two kinds of thought, intuitive and deliberative (Evans, 2007). Though some of the dual-process theories assume that these two kinds

*E-mail address:* [Pierre.Barrouillet@unige.ch](mailto:Pierre.Barrouillet@unige.ch)

of thought rely on different cognitive processes (Evans, 1984, 1989; Klaczynski, 2000; Sloman, 1996), other theories go further and suggest that this duality is rooted in the existence in human brain of two distinct cognitive systems with different evolutionary histories and different functioning (Evans, 2010; Evans & Over, 1996; Stanovich, 1999). Stanovich (1999) coined the terms System 1 and System 2 which are now in common use.<sup>1</sup> The former is usually described as unconscious and automatic, associative, massively parallel, and thus rapid. Because it would not require central resources of working memory, its functioning would not be affected by individual differences in general intelligence. By contrast, System 2 would be inherently conscious and controlled. Because it involves working memory, it is usually assumed as slow, sequential, and strongly related to individual differences in working memory capacity and fluid intelligence. While System 1 would be evolutionary old and share many of its features with other animals, System 2 would be recent and probably unique to humans (Evans, 2010).

Such a contrast between the two systems should have strong implications at the developmental level. Indeed, it can be expected that the processes of the evolutionary old, unconscious, and automatic System 1 should not strongly evolve with age, or at least that they should reach their maturity level in the early ages, whereas the controlled and working memory-dependent System 2 should become functional later in development and strongly evolve with age over an extended developmental period. Thus, it could have been expected that the developmental approach would have been used to test and refine these theories but, surprisingly, apart from rare exceptions (Brainerd & Reyna, 2001; Klaczynski, 2000), the dual-process theories have disregarded developmental questions, exclusively focusing on adult reasoning. However, as Piaget cogently said in his film with Claude Goretta *The epistemology of Jean Piaget*: “to comprehend a psychological phenomenon, one must understand its development”. The purpose of this article is to apply Piaget’s strategy to the dual-process approach, using what is known about child and adolescent development of reasoning as a testing ground for some of the main dual-process theories. I will concentrate on conditional reasoning, the development of which is well known and has been documented in a variety of tasks.

Thus, I first outline the main findings that have been observed in studying the development of reasoning on familiar and artificial conditional relations. Then, I confront with the developmental data some of the prominent dual-process theories of conditional reasoning. For this purpose, I distinguish three different approaches within this general theoretical framework. The first is the heuristic–analytic theory that has been developed by Evans over the last two decades (1989, 2006, 2007). The second concerns theories which assume that System 1 is probabilistic in nature, while System 2 could be assimilated to the manipulation of mental models. This is the case of Verschueren and Schaeken’s (2010; Verschueren, Schaeken, & d’Ydewalle, 2005) theory, but also of recent proposals by Oaksford and Chater (2010) and Geiger and Oberauer (2010). Finally, I address theories that emphasize the role of metacognitive processes in triggering System 2, such as Thompson (2009, 2010) and Stanovich (2009). In the light of these theories, I propose some suggestions for an integrative dual-process theory of conditional reasoning based on the mental model approach. In a concluding section, I discuss the interest of the modern dual-process approach compared with more ancient but akin conceptions that distinguished between intuitive and reflective thinking, as in Piaget’s theory.

## Conditional reasoning and its development

Conditional reasoning is the reasoning permitted by propositions containing the connector *If*. Though *If* can be used in several different syntactic structures like “*If ... then ...*”, “*... only if ...*”, “*If and only if ... then ...*”, “*... if ...*”, I will in this article concentrate on the form “*If ... then*” as in “*If an animal is a dog, then it has legs*”, which has been the most studied. A variety of tasks has been used to assess how individuals understand and reason from this type of sentence. Participants can be asked to list the cases that are permissible, or those that are impermissible, when a conditional is true. In the

<sup>1</sup> Recent versions of dual-process models (Evans, 2008, 2009, Stanovich, 2011) have moved away from the System 1/System 2 terminology to adopt a Type 1/Type 2 processing distinction. This is due to the fact that the terms System 1 and System 2 suggested singular systems that could be neurally distinguished, whereas it is now assumed that both systems include a variety of processes (see Stanovich, West, & Toplak, 2011, and Evans, 2011b). Nonetheless, I will here keep the commonly used terminology of Systems 1 and 2 without any underlying assumption of singularity at the cognitive or neural levels.

Download English Version:

<https://daneshyari.com/en/article/353568>

Download Persian Version:

<https://daneshyari.com/article/353568>

[Daneshyari.com](https://daneshyari.com)