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Dual-process theories of reasoning: Contemporary issues and developmental applications

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ABSTRACT

In this paper, I discuss the current state of theorising about dual processes in adult performance on reasoning and decision making tasks, in which Type 1 intuitive processing is distinguished from Type 2 reflective thinking. I show that there are many types of theory some of which distinguish modes rather than types of thinking and that assumptions about underlying cognitive architecture vary. I show that some dual-system theories have been replaced recently by the idea that we have two or more distinct 'minds' with different evolutionary histories. I also present the most recent formulation of my own account of dual processing within hypothetical thinking theory, at a level more easily applied to performance on specific tasks. I then consider implications for cognitive development, pointing out that while Type 2 thinking is clearly linked to the development of cognitive ability, it combines and competes with multiple Type 1 processing systems which persist in adult cognition, each of which could have their own developmental time course. Hence, while dual-process theories can and should inspire much research and theory in cognitive development, the derivation of predictions for cognitive development is far from straightforward.

Introduction

It is a commonplace observation that there seem to be two kinds of thinking, one fast and intuitive and the other slow and deliberative. Indeed, philosophers and psychologists have been discussing such a duality for centuries, sometimes tied to more detailed theoretical proposals and often in ignorance of the similar writings of others (see Frankish & Evans, 2009). In modern psychology,

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dual-process theories have been proposed in many fields, including learning (Reber, 1993; Sun, Slusarz, & Terry, 2005), social cognition (Smith & Collins, 2009; Smith & DeCoster, 2000), judgement and decision making (Kahneman & Frederick, 2002) and from the 1970s onwards, in the psychology of reasoning (see Evans, 2003, 2007a; Stanovich, 2010). In all of these literatures, the main focus has been on adult cognition. In this special issue, contributors redress the balance by focussing specifically on dual processing in cognitive development.

Following the coining of the terms by Stanovich (1999), it has become common practice to refer to the types of processing in terms of System 1 and 2 (e.g. Evans, 2008; Kahneman & Frederick, 2002). However, this terminology may suggest the operation of exactly two systems across a wide range of tasks which is almost certainly incorrect, as I discuss below. Hence, I shall generally avoid these terms and instead talk about Type 1 and 2 processing, as first introduced in the earliest dual process theory of reasoning (Wason & Evans, 1975). To give a bit more clarity and scientific weight, I will define these terms as currently applied in the cognitive psychology of reasoning:

Type 1: fast, high capacity, independent of working memory and cognitive ability
Type 2: slow, low capacity, heavily dependent on working memory and related to individual differences in cognitive ability

Most readers of this issue will be developmentalists. From this perspective it seems natural to ask the question: what can dual-process theories tell us about the nature of cognitive development? This question is indeed addressed throughout the current issue and elsewhere by developmental psychologists such as Paul Klaczynski (e.g. Klaczynski, 2001; Klaczynski & Cottrell, 2004). However, this special issue also well represents authors who have worked to develop the cognitive psychological theory of dual processing in adults. From this perspective, it is also important to ask the reverse question: what can cognitive development tell us about dual-process theories? I shall argue that it is essential for the relatively neglected developmental story of dual processing to be worked out in any complete cognitive theory. But as Stanovich, West, and Toplak (this issue) rightly warn us, testing the theory by developmental studies is not a simple matter.

The evidence for dual processes in adult reasoning and decision making has accumulated strongly (for recent reviews and discussion see Evans, 2007a, 2008, 2010b; Stanovich, 2009a, 2010). This evidence draws from experimental manipulations, individual differences in different types of processing, and neuroscience (see also Goel, 2008; Lieberman, 2007). In spite of all this, critiques appear from time to time suggesting that dual-process theories are unnecessary and single process accounts will do the job (for recent examples see Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011). I personally find these critiques unsatisfying, as they have failed to address the stronger forms of evidence for dual processing involving cognitive psychological and neuroscientific methods. However, the strong scepticism being expressed by some influential authors suggests that we can never have too many sources of evidence. Hence, the importance of finding support in the study of cognitive development. Of course, if claims made by dual-process theorists are right, then the understanding of children's thinking and its development will benefit strongly in the process.

It is important, however, to understand that dual-process accounts are a family of theories and that there is no definitive version. This is true even if we focus on the psychology of reasoning and leave aside dual processing accounts in other fields, such as social cognition and learning. As I pointed out recently (Evans, in press) both supporters and critics alike have tended to refer to a generic or what I call *received* view of dual-process theory or reasoning which is really an approximate merger of several different accounts proposed in the 1990s (especially those of Evans & Over, 1996; Sloman, 1996; Stanovich, 1999). This received view not only ignores important differences between these earlier accounts, but also overlooks major developments in both empirical and theoretical research on dual processing that have occurred since. My purpose in this paper is to explain the contemporary state of theorising about dual processes and systems, in which I will focus mostly on my own work and that of Keith Stanovich, who also contributes to this special issue. The proposals about cognitive architecture underlying dual processes made by Stanovich and myself are largely compatible but with some important differences as I shall show. Finally, I shall discuss how thinking about dual processes can best be applied in the developmental context.