Getting to the heart of the dual-systems distinction

Keith Frankish

The Open University / The University of Crete

Web www.keithfrankish.com Email k.frankish@gmail.com

First conference of the Herbert A. Simon Society, Bounded Rationality, April 2013.

1. Dual-process and dual-system theories

Dual-process theories:

- posit two distinct mental processes that can generate a response to a problem,
- posit one process that is fast, automatic, nonconscious, effortless, highly contextualized,
- posit a second process that is slow, controlled, conscious, effortful and abstract,
- claim that the fast process relies on heuristics or associations, and generates responses that are often biased,
- claim that the slow process is rule-governed and analytic and generates normative responses,
- were developed during the 1980s and 1990s in various areas of psychology (e.g. Wason & Evans 1975; Evans 1989; Kahneman & Tversky 1982; Kahneman & Frederick 2002; Chaiken 1980; Petty & Cacioppo 1986).

Dual-system theories (DSTs):

- are more ambitious,
- synthesize different dual-process distinctions,
- attribute the fast and slow processes to two different multi-purpose mental systems (System 1 and System 2),
- ascribe further features to the two systems, such as difference of evolutionary age, heritability, malleability,
- are supported by evidence from (a) experimental manipulations, (b) neuroimaging, (c) studies of individual differences,
- emerged in the late 1990s (e.g. Evans & Over 1996, Sloman 1996; Stanovich 1999, 2004).

2. Problems for DSTs

Critics (e.g. Keren & Shul 2009; Kruglanski & Gigerenzer 2011) object that DSTs are vague and have implausible consequences, including:

- that the two systems are unified and there are no further divisions within each system,
- that processing differences are dichotomous rather than continuous,
- that the dichotomies align and there are no hybrid processes,
- that the two systems are independent,
- that the systems have discrete neural bases.

3. Evans and Stanovich reply

Evans and Stanovich (in press) argue that the objections arise from misconceptions about DST (see also Stanovich & Toplak 2012). Specifically, they:

- drop the term “system”,
- do not claim that there are two unified systems,
- distinguish two *types* of processing, Type 1 (T1) and Type 2 (T2), and allow that there may be multiple systems supporting each type,
- accept that some differences are continuous and argue that these are differences in the mode of T2 thinking,
- accept that the dichotomies do not align perfectly and that there can be hybrid processes,
- accept that the two types of processes interact via a default-interventionist architecture (Evans also stresses the role of T1 processes in supplying content to T2 thinking; e.g., Evans 2009),
- are committed to *some degree* of neural discreteness.

4. Getting to the heart of the matter

What are the core properties of T1 and T2 processes?

- T1 processes (Evans and Stanovich): autonomy, no use of WM. (Mandatory operation in presence of triggering stimuli, no need for controlled attention).
- T2 processes:
  - (Evans): Use of WM.
  - (Stanovich): Cognitive decoupling (the creation and manipulation of secondary representations, which permit hypothetical reasoning).

An alternative: Agency (Frankish 2004, 2009, in press; Dennett 1991).

- T2 processes are personal intentional actions.
  - personal: ascribed to the person as a whole, rather than to subsystems (cf. singing vs. pumping blood).
  - intentional: responsive to beliefs and desires.
- T1 process are not personal intentional actions (they are *subpersonal* processes).

5. Imagery and self-stimulation

- T2 processes involve the formation and manipulation of mental imagery, esp. images of utterances (inner speech).
- In part, at least, this exploits our capacity for the *mental rehearsal* of action (Carruthers 2006, 2009).
- Mental imagery becomes effective via *self-stimulation* (e.g. Dennett 1991).

- When attended to, sensory information is *globally broadcast* to all to cognitive subsystems (Baars 1988),
- Mental imagery can also be globally broadcast, enabling us to evaluate candidate actions (Carruthers 2006, 2009).
- The global broadcast of mental imagery can be exploited for problem solving and self-control.
- The language comprehension system attaches a semantic content to images of utterances.
- This content is then globally broadcast to T1 subsystems, with the result that:
  - rehearsed statements may generate beliefs,
  - rehearsed questions may prompt answers,
  - rehearsed instructions may prompt decisions and actions.
- Self-stimulation can thus help us evaluate hypotheses, retrieve information, and focus on goals.
- One image may stimulate another one, and so on, in cycles.
- Acts of image formation can form sequences, guided by our beliefs about what thought-sequences are normatively warranted
- Imagistic self-stimulation provides a mechanism for hypothetical thinking, information retrieval, self-control, argument construction, and general-purpose problem solving.

6. Attractions and consequences

Some attractions:

- Explains how T2 thinking could be evolutionarily late and distinctively human (Dennett 1991).
- Explains how T2 processes can be shaped by culture and explicit instruction.
- Explains the incidental features; T2 processes will typically be:
  - slow because they involve cycles of T1 activity,
  - serial because only one action can be rehearsed at a time,
  - conscious because they involve global broadcasting of sensory imagery; etc.
- Subsumes other accounts; imagistic self-stimulation:
  - loads on WM because it involves attending to and manipulating sensory imagery,
  - supports cognitive decoupling because we can image non-actual scenarios and hypothetical claims.

Some consequences:

- T2 processes are heavily dependent on, and partially realized in, cycles of T1 processing.
- Potentially any and all T1 processes could be involved in an episode of T2 thinking.
- Motor areas, especially speech, are heavily implicated in T2 thinking.
- At most, T2 processes constitute a virtual system, not a neural one.

7. References

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