Systems and levels: Dual-system theories and the personal-subpersonal distinction

Book Section

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1. Introduction

There is now abundant evidence for the existence of two types of processing in human reasoning, decision making, and social cognition — one type fast, automatic, effortless, and non-conscious, the other slow, controlled, effortful, and conscious — which may deliver different and sometimes conflicting results (for a review, see Evans 2008). More recently, some cognitive psychologists have proposed ambitious theories of cognitive architecture, according to which humans possess two distinct reasoning systems — two minds, in fact — now widely referred to as *System 1* and *System 2* (Evans 2003; Evans and Over 1996; Kahneman and Frederick 2002; Sloman 1996, 2002; Stanovich 1999, 2004, this volume). A composite characterization of the two systems runs as follows. System 1 is a collection of autonomous subsystems, many of which are old in evolutionary terms and whose operations are fast, automatic, effortless, non-conscious, parallel, shaped by biology and personal experience, and independent of working memory and general intelligence. System 2 is more recent, and its processes are slow, controlled, effortful, conscious, serial, shaped by culture and formal tuition, demanding of working memory, and related to general intelligence. In addition, it is often claimed that the two systems employ different procedures and serve different goals, with System 1 being highly contextualized, associative, heuristic, and directed to goals that serve the reproductive interests of our genes, and System 2 being decontextualized, rule-governed, analytic, and serving our goals as individuals.

This is a very strong hypothesis, and theorists are already recognizing that it requires substantial qualification and complication (Evans 2006a, 2008, this volume; Stanovich this volume; Samuels, this volume). There are numerous issues. Do the various features mentioned really divide up into just two groups in the neat way suggested? Are the features ascribed to each system exclusive to that system, and are they essential to it? Are the systems completely separate or do they share processing resources? Do they operate in parallel and compete for control of behaviour, or do they cooperate, with System 1 generating default responses that are then assessed and sometimes overridden by System 2? There are also related questions about the memory systems associated with

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each system. Does each system have its own knowledge base and goal structure, and if so, do the two sets of states differ in their formal characteristics?

This chapter aims to shed light on these issues from a perhaps surprising source, namely philosophy of mind. Philosophy does not, of course, supply new data, but it can offer new ways of conceptualizing data, and philosophers of mind have been active in interpreting psychological data and theorizing about cognitive architecture. In what follows I shall outline a new way of conceptualizing the distinction between the two systems and consider its implications for the issues mentioned. The key suggestion will be that the distinction between the two putative systems is primarily one of *levels*, rather than systems, and the result will be a sympathetic reinterpretation of the dual-systems hypothesis.

2. Personal reasoning and subpersonal reasoning

I want to begin with a distinction that will be familiar to philosophers, though perhaps less so to psychologists. It is the distinction between *personal* and *subpersonal* levels, introduced in its contemporary form by Daniel Dennett in his 1969 book *Content and Consciousness*. Dennett introduces the distinction to do specific philosophical work, but I shall adapt it for my own purposes.

Personal-level states and events are ones that are properly attributed to a person or creature as a whole, rather than to some organ or subsystem. Examples include being English, seeing a sunset, singing, feeling a pain in one's toe. These are states and activities of people, not their subsystems. If a personal-level event is motivated and caused in the right way by the subject's beliefs and desires, then it counts as an *intentional action*. ('Intentional' here means 'performed for a reason', and the contrast is with involuntary movements, such as reflexes.) So feeling a pain is a personal-level event but not an intentional action, whereas singing is a personal-level event that is also an intentional action. Subpersonal states and events are ones that are properly attributed to some organ or subsystem rather than to the person as a whole. Examples are having a high concentration of sodium ions, secreting adrenalin, regulating blood-sugar level. These are not states of us or activities that we perform; rather they are states of parts of us and things that our subsystems do.

Now, we can make a personal–subpersonal distinction in the mental realm. Everyday 'folk-psychological' mental concepts are typically personal-level ones: it is people who have thoughts, feelings, and desires, and who recall events, work things out, and make decisions. People also perform mental actions. Think of trying to remember a phone number, imagining a purple cow, reciting

a poem silently to oneself. Like other actions, these are things we do and can be motivated to do. Not all mental states and events are personal ones, however. Modern cognitive psychology posits a vast array of subpersonal mental states and processes, which are invoked to explain personal-level phenomena. Examples include having a Mentalese sentence stored in the belief box, building a mental model of a set of premises, constructing a representation of the logical form of a heard sentence, creating a 2.5D sketch of the visual scene. These are states and activities of neural systems, not of persons. (I shall assume that what distinguishes subpersonal *mental* states and processes from non-mental ones is the possession of informational content; subpersonal mental states are ones that carry information about things, and subpersonal mental processes are ones involving such states (Dennett 1981)). In the case of mental *processes* at least, the distinction between personal and subpersonal corresponds roughly with that between conscious and non-conscious. We are typically conscious of our personal mental processes, but not of our subpersonal ones.

There are some complex philosophical debates surrounding the interpretation and application of the personal–subpersonal distinction (see the papers in Bermúdez and Elton 2000). There is no space to address these here, so I shall confine myself to clarifying how I understand the distinction. First, the notion of a *person* employed here is a minimal one, without any of the connotations of personal identity, selfhood, moral responsibility, and so on, that the concept often carries. A person in the present sense is simply a human being, or other creature, considered as a unified entity, and a personal–subpersonal distinction could be made for animals or even robots. Likewise, I do not mean to suggest that only personal-level states are important to personal identity — that they constitute the real *self*, as it were. As understood here, the subpersonal–personal distinction is not a distinction between what is part of the self and what is not, but simply between levels of organization within a human being.

Second, the personal–subpersonal distinction has sometimes been employed by philosophers with an anti-reductionist agenda. Some theorists argue for the irreducibility of personal-level psychological explanation as a way of insulating commonsense psychology from scientific refutation (e.g. Baker 1987, Hornsby 2000). I do not share this agenda. I shall assume that personal-level states are realized in subpersonal ones and that it will always be possible, in principle, to reductively explain personal-level phenomena by identifying the realizing states.

Third, I want to say something about the concepts of belief and desire, which are central to the definition of intentional action. In everyday usage these concepts are personal-level ones (it is people that have beliefs and

desires, not their brains). However, many theorists assimilate them to the theoretical concepts of subpersonal cognitive psychology, holding that they refer to functionally defined states of the cognitive system (e.g. Botterill and Carruthers 1999; Fodor 1987; Lewis 1972). For present purposes I shall follow this view, though my considered position on the relation between folk psychology and cognitive psychology is actually more complex and qualified (see Frankish 2004).[1] I shall also assume that intentional actions can be caused by beliefs and desires that have not been consciously brought to mind. So construed, the concepts of belief and desire correspond to the psychologist's concepts of knowledge (or memory) and goal structure. Later, I shall introduce concepts of distinctively personal-level forms of belief and desire, which contrast with these subpersonal ones.

Finally, since I linked the personal–subpersonal distinction with consciousness, let me clarify what I mean by this term. For present purposes, I shall assume a global workspace theory, according to which information is conscious in virtue of occupying working memory and being the focus of selective attention (Baars 1988, 1997). It is arguable that this theory does not adequately address the so-called 'hard problem' of consciousness — the nature of qualia — but this issue will not be the focus here.

With the personal–subpersonal distinction in place, we can now make a distinction between personal and subpersonal *reasoning*. (I use the term 'reasoning' in a generic sense to include both practical reasoning, which terminates in decisions to act, and theoretical reasoning, which terminates in new beliefs.) Personal reasoning is reasoning that is done by people; subpersonal reasoning is reasoning that is done by neural subsystems. As a simple example, take long division. Imagine someone with a natural talent for arithmetic. We ask them what is 21582 divided by 11 and they immediately respond with the answer '1962'. We ask them how they worked it out, and they say they don't know — the answer just came to them. Here whatever reasoning was involved in arriving at the answer was subpersonal. Of course *answering* the question was an intentional action, motivated by the subject's desire to comply with the request; but *working out* the answer was not. The subject did not *do* anything to work it out; the operations involved were entirely subpersonal, though they culminated in a personal-level event. This, is of course, an artificial example; few people can do long division in this way. But it is almost certain that there are subpersonal reasoning systems of very complex kinds. Indeed, cognitive science is largely devoted to offering

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[1] In the terms of my 2004, beliefs and desires in the present sense are states of the *sub-mind* — the level of subpersonal psychology that supports the multi-track behavioural dispositions that constitute the *basic mind*.

subpersonal computational accounts of basic human abilities — pattern recognition, concept acquisition, learning, problem solving, goal seeking, and so on.

Now contrast this with another case. Here we ask someone the same question, but instead of simply answering, they start doing other things. They get a pencil and paper, write down the numbers, then perform a sequence of simpler divisions and subtractions — dividing 21 by 11, writing the integer part of the answer above the '21' and the remainder below, and so on, in the usual style. Finally, they read off the number along the top as their answer. This is a personal-level reasoning process. It involves a series of personal actions which collectively implement an algorithm for solving the problem and which are individually motivated by the desire to find the solution and the belief that the strategy being followed will produce it. Of course, each step in this process itself involves reasoning — solving simple problems of division, subtraction, and so on — and these processes may themselves be either personal or subpersonal. Take the step where the subject has to divide 105 by 11. The answer may come to them in a flash or they may write down some intervening steps. Ultimately, however, the process breaks down into actions that are the product of subpersonal rather than personal reasoning. For example, when confronted with the task of multiplying 11 by 9 most of us will write down the answer straight off without engaging in any personal reasoning.

A few points of clarification are in order. First, the actions involved in doing long division are overt and involve the use of external props. This is often necessary in mathematical reasoning, owing to the limitations of working memory, but these features are not essential to personal reasoning per se. The defining feature of personal reasoning is that it constitutively involves the performance of one or more intentional actions that are designed to generate a solution to a problem and motivated by a desire to find it. And, as already noted, intentional actions can be covert; we can talk to ourselves silently, for example, or deliberately visualize a diagram. (In calling these actions *covert*, I do not, of course, mean that they belong to a private subjective realm, merely that they have no easily observable manifestations.) And personal reasoning can also be covert, involving the formation and manipulation of mental images rather than external symbols. These actions will be motivated in the same way as their overt counterparts, by a desire to find a solution to some problem and a belief that they may generate one.

Second, I assume that personal reasoning involves attention and the use of working memory, and that it is therefore conscious. (In theory, some repetitive personal reasoning tasks might be performed with little or no attention; think, for example, of doing a series of long divisions using pencil and paper. But such cases will be rare and I shall ignore them.) I shall also assume that

personal reasoning will require the exercise of various metacognitive abilities, including the ability to focus one's attention, monitor one's reasoning activities, and evaluate the strategies one is using.

Third, although personal reasoning itself is conscious, the beliefs and desires that motivate it typically will not be. Actions can be consciously performed even if we do not consciously reflect on the reasons for performing them. For example, I am currently conscious of pressing various keys on my computer keyboard. I press these keys because I desire to type certain words and believe that pressing them will achieve that. But I do not consciously entertain those beliefs and desires as I type; I just think about the content of what I am typing. The same goes, I assume, for most personal reasoning activities.

When we think about the mind in a pretheoretical way, we tend to focus on personal reasoning, which is the kind of which we are conscious, rather than the subpersonal variety. But most of our behaviour is generated without the involvement of personal reasoning. Think about the actions involved in such everyday activities as driving a car, holding a conversation, or playing sports. These are intelligent actions, which are responsive to our beliefs and desires (think of how beliefs about the rules of the game shape the actions of a football player), and a great deal of complex mental processing must be involved in generating them. Yet, typically, they are performed spontaneously with no prior conscious thought or mental effort. Indeed, giving conscious thought to such activities is a good way to disrupt their fluidity. Even everyday 'folk' psychology recognizes this; we find it perfectly natural to give belief-desire explanations for routine behaviour, such as that involved in driving a car, which we know is not the product of conscious thought. (For example, we would say that the driver pressed the indicator stalk because they wanted to signal a turn, and believed that pressing it would do that.) Personal reasoning, by contrast, is an effortful form of cognitive activity, which we engage in only when properly motivated — perhaps because subpersonal reasoning has failed to deliver a satisfactory response, or because we have reason to take special care.

What forms can personal reasoning take? The most obvious, perhaps, is the construction of arguments in inner speech, following learned rules of inference, either deductive or inductive. In doing this, one might draw on explicit knowledge of logical principles, consciously recalling a rule and then constructing an argument in accordance with it. But explicit knowledge is not required; one could also draw on practical skills in the construction of good arguments — procedural, as opposed to declarative, knowledge, embedded in linguistic skills. For example, through practice in public argumentation one might learn to recognize and produce utterance patterns that instantiate modus

ponens and to regard them as normatively correct argumentative moves, even though one has never been taught the rule explicitly. Such skills could then be deployed in one's private personal reasoning, enabling one to generate sequences of inner utterances that conform to the rule; just saying the premises over to oneself might prompt one to supply the conclusion. Skills of this kind can be used to generate extended sequences of personal reasoning, as when we reason something out in interior monologue. Argument construction can also be supported by skills in the manipulation of sensory imagery. For example, one might visualize a Venn diagram to aid reasoning with quantifiers.

We can also deliberately apply rules of thumb, such as the recognition heuristic ('If you have to say which of two items best satisfies some criterion, then choose the one you recognize'). There is, of course a large psychological literature on the role of innate heuristics in non-conscious subpersonal reasoning, but heuristics can also be learned and applied in conscious personal reasoning (Evans this volume). Again, the knowledge involved might be either declarative or procedural. (Even when procedural, this knowledge of heuristics is different from that involved in subpersonal reasoning, since it is embedded in skills in the construction of arguments at a personal level, in overt or covert speech.)

Argument construction may be the paradigm form of personal reasoning, but it is not the only one. Personal reasoning includes any intentional actions designed to further problem solving and decision making, and the range of these is wide. (For convenience, I shall focus on actions that can be performed covertly 'in the head'; if we were to include ones involving the use of external props, then the range would be even wider.) For example, one might deliberately direct one's attention to certain aspects of a situation, guided by normative beliefs about the relevant factors (see Buchtel and Norenzayan this volume). Or one might engage in thought experiments involving the deliberate manipulation of sensory imagery, such as that used by Galileo to refute the Aristotelian view of gravitational attraction (e.g. Gendler 1998). Or one could use sensory imagination as a handy substitute for empirical investigation. For example, if you want to know how many chairs there are in your house, then a quick way to find out is to visualize each room and count them.

Sensory imagery is also central to a broad class of personal reasoning techniques which Daniel Dennett has dubbed *autostimulation* (Dennett 1991, ch.7). By this Dennett means the trick of generating self-directed stimuli — words and images — as a way of eliciting reactions from oneself that may be useful in solving problems. Originally, Dennett suggests, the actions involved would have been overt ones — talking aloud to oneself, drawing diagrams, and so on — but our ancestors learned the trick of covert autostimulation using inner speech and other forms of sensory imagery. In particular, Dennett

stresses the benefits of *self-interrogation*. A self-generated question, he argues, will be processed by subpersonal comprehension systems in a similar way to an externally generated one, and may evoke an instinctive verbal reply containing information that we would otherwise have been unable to access. This reply will then be processed in turn, giving global neural publicity to the information it carries. Dennett focuses on the role of self-interrogation in broadcasting information stored in isolated neural subsystems, but it is plausible to think that it can also be a creative process, stimulating subpersonal reasoning to generate new inferences and novel responses.

Self-interrogation is, I suspect, a very common feature of human mental life. We often deliberately *try* to work something out, even though we do nothing more explicit than 'thinking'. This seems to be an intentional action (we can do it at will, and it requires motivation and effort), and what we are doing at such moments, I suggest, is engaging in self-interrogation: articulating a problem and challenging ourselves to come up with a solution to it, just as another person might challenge us, and thereby deliberately focusing our subpersonal reasoning abilities onto the task. If successful, this will culminate in a further personal event, such as an episode of inner speech or the occurrence of a visual image, carrying relevant information. Since self-interrogation is an intentional action, this counts as a personal reasoning process, even though all the real work is done subpersonally. From a personal-level perspective, the process is an associative one, and it may be one of the mechanisms underlying what Stanovich (this volume) calls *serial associative cognition*.

Of course, self-interrogation is not a very reliable problem-solving strategy, but it would be a useful way of generating hypotheses for subsequent evaluation, as part of an extended personal reasoning process. In particular, it would facilitate kinds of reasoning for which there are no formal procedures, such as abductive reasoning (inference to the best explanation). We could focus on our data, ask ourselves what could explain it, and then test out any hypotheses that come to mind — comparing them with rival ones, exploring their consequences, and so on. Similarly, we could use self-interrogation to evaluate a model by actively searching for counterexamples.

Another form of autostimulation is the mental rehearsal of action — imagining oneself performing some action. Peter Carruthers has argued that this can play an important role in practical reasoning (Carruthers 2006, this volume). Mentally rehearsing an action, Carruthers argues, generates perceptual and proprioceptive feedback which is then globally broadcast to subpersonal inferential and motivational subsystems, producing cognitive, motivational, and emotional reactions similar to those the action itself would produce. By this means, Carruthers suggests, a creature would be able to calculate some of the

consequences of contemplated actions, thereby vastly extending its problem-solving abilities.

This is not intended as an exhaustive list of possible personal reasoning techniques, and of course empirical investigation would be needed to know which ones people actually employ. Some of the skills involved may have an innate basis (Dennett suggests that this is the case with autostimulation), but there are likely to be large differences between individuals in the particular skills used and the ways they are deployed, reflecting differences in people's normative beliefs about the nature of good reasoning — differences which may show considerable cultural variation. (Much of the data on thinking styles from cross-cultural psychology is, I suggest, best construed as relating to personal-level reasoning.) There may also be individual differences in the development of the metacognitive dispositions required to support personal reasoning, and cultural influences may play an important role here, too.

3. A two-levels view

The proposal I want to make will already be obvious. It is that the distinction between System 1 processes and System 2 processes is to be identified with that between subpersonal and personal reasoning. This view is, arguably, implicit in some existing accounts of the distinction. System 2 processes are typically characterized as *controlled* and sometimes as *volitional* (e.g. Evans 2003, this volume), and the characterization of System 2 processes as intentional actions is one way of spelling out this claim. At any rate, the features of subpersonal reasoning and personal reasoning coincide closely with the core features of the two putative systems. Subpersonal reasoning is typically fast, automatic, effortless, and non-conscious, whereas personal reasoning is typically slow, controlled, effortful, and conscious. Personal reasoning is also serial, shaped by culture and formal tuition, and, since it typically requires attention, demanding of working memory. By contrast, there is no reason to think that subpersonal reasoning will possess these features, and if it is effected by a collection of specialized, task-specific subsystems operating independently of consciousness, then it will not.

There are also theoretical advantages to the proposed identification. In particular, it explains why the features ascribed to System 2 form a natural kind (Samuels this volume). Personal reasoning is typically slow, effortful, conscious, serial, and demanding of working memory *because* it involves the performance of sequences of intentional actions. And it is shaped by culture and formal tuition because it is guided by beliefs and desires which culture and tuition impart. The proposed view also offers an attractive framework for thinking about the evolution of System 2 reasoning, as I shall explain shortly.

The proposal is not a completely bland one, however, and it dictates some revisions to the standard characterization of the two systems. The most important of these concerns the procedures used by System 2. System 2 is often characterized as decontextualized, rule-based, analytic, and normatively correct. The proposed view partially vindicates this, since personal reasoning can involve the construction of valid arguments in accordance with formal rules of inference. (Indeed, it may be that decontextualized reasoning like this occurs *only* at the personal level.) But, as I explained, a range of other techniques can be employed in personal reasoning, including quick-and-dirty heuristics, selective direction of attention, and forms of autostimulation, some of which involve deliberately contextualizing a problem or exploiting associative subpersonal processes. Moreover, even when it is rule-based, personal reasoning may fail to be normatively correct. People can learn incorrect rules or apply correct ones carelessly. Other qualifications to the characterization of System 2 are dictated, too. By identifying intentional control as the defining feature of System 2 reasoning, the proposal demotes the other features to the status of, at most, typical but non-necessary features. Thus, most personal reasoning activities are slow and effortful, but in the right circumstances some could be quick and effortless. This emphasis on the varied character of System 2 processes harmonizes well with recent work in dual-process tradition (Buchtel and Norenzayan this volume; Evans 2006b, this volume; Stanovich this volume).

The proposal also has important implications for our view of the architectural relations between the two systems. System 1 and System 2 are often regarded as separate neural systems, operating either in sequence or in parallel. On the proposed view, however, System 2 is not a neural system at all, but a *virtual* one, constituted by states and activities of the whole agent. (If we ask what it is that implements personal reasoning processes, then the *immediate* answer is that it is the person themselves.) Moreover, on this view System 2 will be heavily dependent on System 1. There are several aspects to this.

First, System 2 will be dependent on System 1 for its *inputs*. Conscious, personal-level reasoning can begin only after a great deal of preconscious processing has been completed — processing that determines which problems become the focus of attention and what information is consciously recalled for use in solving them. (It is true that we sometimes deliberately *try* to recall things, as when we *rack our brains* for a piece of information, but this is, I assume, simply a form of self-interrogation, and its outcome is dependent on subpersonal processes.) This sort of dependency is a key feature of heuristic-analytic versions of dual-process theory, according to which heuristic (System 1) processes select information that is then made available for processing by

the analytic system (System 2) (e.g. Evans 2006b, 2007), and in this respect the present proposal can be regarded as a variant of such theories.

Second — and more controversially — System 2 will be *causally* dependent on System 1. The intentional actions involved in personal reasoning will themselves be generated by subpersonal cognitive processes. These will include the processes involved in deciding to initiate personal reasoning, choosing reasoning strategies, directing attention, selecting, generating, and manipulating inner speech and other sensory imagery, together with the mechanisms of language comprehension, self-monitoring, self-regulation, and many other processes, depending on the nature of the task. (For detailed suggestions about the subpersonal underpinnings of personal reasoning, see Carruthers 2006, this volume.)

Third, System 2 can be *instrumentally* dependent on System 1. As already noted, we can deliberately engage in various forms of autostimulation, which allow us to exploit our subpersonal reasoning abilities and employ their deliverances in extended sequences of personal reasoning.

Finally, System 2 will be dependent on System 1 processes to make its *outputs* effective. I assume that conscious reasoning can affect our actions, perhaps overriding default responses generated non-consciously. This is not to deny that some conscious reasoning may be confabulatory, serving merely to rationalize intuitive responses generated by non-conscious processes. There is good evidence that much of it is (e.g. Gazzaniga 1998; Wegner 2002; Wilson 2002). But it is implausible to hold that *all* conscious reasoning is confabulatory. Yet, if such reasoning takes the form I have proposed, it is not easy to see how it could guide action. The termination of an episode of personal reasoning will typically be itself an action — an utterance in inner speech, say — which expresses the conclusion reached. And such actions will have no *direct* effect on further action. Saying that one will do something does not immediately cause one to do it. For example, thinking about the best way to get to a friend's house, I may conclude by saying to myself 'I'd better get a taxi'. This utterance is itself simply a behavioural response; if it is to have any effect on my journey, then mediating processes will be required. Some of these may also be intentional actions. For example, I may remind myself of my decision during subsequent personal reasoning. But these actions, too, will require mediation if they are to affect my subsequent behaviour, and the mediating events must ultimately be subpersonal ones. This is a conceptual point; the mediating process cannot involve an endless sequence of personal actions. (And of course any mediating intentional actions will themselves be generated by subpersonal processes.) For similar reasons, subpersonal mediation will be required if a conclusion arrived at in one episode of personal

reasoning is to be recalled and used as a premise in later episodes. Thus on the proposed view System 2 depends for its efficacy on System 1 processes.

Let me say a little more about this. What might the subpersonal mediating mechanisms be? How could saying to myself that I will take a taxi influence my subpersonal systems to initiate that action and implement the decision? One possible mechanism is autostimulation: conclusions articulated in inner speech might be processed by the speech comprehension system and interpreted as instructions or reports, which are then adopted as intentions or beliefs in subpersonal reasoning (Carruthers 2006, ch.6, this volume.) Such processes may play a role, but unless one is preternaturally suggestible, it is unlikely that they will ensure that conscious decisions are reliably implemented. (Of course, such decisions are not *always* implemented; but they often are, and it is doubtful that autostimulation alone would be sufficient to secure this.)

A more plausible suggestion appeals to the role of metacognitive attitudes in subpersonal reasoning (Frankish 2004). Suppose we have a strong desire to act upon the results of our personal reasoning, executing any decisions and relying on any conclusions. (I shall say something shortly about why we might have this desire.) Then this desire could play the mediating role through its influence in subpersonal reasoning. The idea is this. At a subpersonal level, my utterance of 'I'd better get a taxi' is interpreted as a decision to take a taxi, and this, together with a general desire to act upon my personal-level decisions, strongly influences my subsequent subpersonal reasoning, leading me to phone for a taxi. The subpersonal metacognitive attitudes make the personal decision effective. Of course, I would not normally explain my action by citing these metacognitive attitudes; I would simply cite the attitudes involved in my personal reasoning. And this commonsense explanation would be not wrong, since those attitudes did play an important role. But it would not be the whole story.

One attraction of this view is that it offers an account of how conflicts between the two systems are resolved. It is a basic tenet of dual-system theories that the two systems may deliver conflicting results. In the standard scenario, System 1 generates an intuitive response that is adaptive but non-normative, whereas System 2 generates a more considered response that is in line with one's normative theories. On existing theories, the result will be either that the two systems compete for behavioural control, or that System 2 attempts to override System 1. The present proposal offers a different perspective, however, on which the conflict will be resolved at the System 1 level. Schematically, the story goes like this. Suppose that our subpersonal processes generate a desire to perform some action X, but that before performing it, we engage in personal reasoning which terminates in a decision to perform some incompatible action Y. Since we have a general desire to act

on our personal decisions, we shall then be motivated to perform Y. So we shall have competing desires at the subpersonal level: a first-order desire to perform X and a second-order desire to act on our personal decision to perform Y. The resolution of the conflict will be determined simply by which desire is stronger. (Cases where the first-order desire outweighs the second-order one are, I suggest, cases of what we call *weakness of will*; see Frankish 2004, ch.8.)

I turn now to some further issues raised by the proposed view. First, given the complex dependency of personal reasoning on subpersonal reasoning, does it make sense to think of personal reasoning as constituting a distinct *system*? Why not speak simply of System 1 characteristics and System 2 characteristics, and say that we have a suite of subpersonal systems with System 1 characteristics, and that some of these systems occasionally cooperate to sustain personal reasoning processes with System 2 characteristics?

Such a description would not be inaccurate, and indeed on the present view the core distinction is one between processes rather than systems. However, I think we can retain talk of a distinct System 2, and that it is useful to do so as a way of highlighting the *functional autonomy* of personal reasoning. We can think of personal reasoning as a functionally defined system that takes representations (typically sentences of inner speech), manipulates them in accordance with procedures designed to implement various forms of inference, and generates further representations, which assume the causal role of conclusions or decisions. It is true that this system is dependent on lower-level reasoning systems, but from a functional perspective this is irrelevant, and the reasoning tasks performed at the two levels during an episode of personal reasoning will typically be quite different. The higher-level system will be devoted to a first-order problem of some kind, the lower-level systems to the task of how to access and implement procedures to solve this problem.

The suggestion, then, is that System 2 is a reasoning system constructed out of other reasoning systems — a sort of super-system. (Elsewhere I have dubbed it a 'supermind'.) Is this view compatible with the claim that System 2 is a recent system? After all, the various subpersonal systems involved in supporting personal reasoning will be of different evolutionary ages — some, such as the visual system, very old; others, such as the language system, much more recent. However, there may still be a sense in which System 2 is recent. Perhaps it is not the *components* of the system that are recent, but their *assembly*. It is possible that most, if not all, of the resources involved in supporting personal reasoning (working memory, language, sensory imagination, metacognitive abilities, etc.) evolved independently, and that personal reasoning emerged only when these disparate resources were co-opted to serve a new task, perhaps with some minor additional adaptations. (We might

compare it to the emergence of reading and writing.)[2] And the crucial developments may have been cultural rather than biological, involving the discovery of skills in argumentation and self-stimulation and the formation and transmission of a body of normative beliefs about good reasoning.[3] From an evolutionary perspective this account has an attractive economy, and if it is right, System 2 may be very recent (compare Dennett 1991; Jaynes 1976).

A corollary of this view is that we may well be innately disposed to form the metacognitive desires that drive personal reasoning and make it effective, including desires to set explicit goals for ourselves, to engage in personal reasoning about how to achieve them, and to act upon the conclusions of this reasoning. To borrow a metaphor from Daniel Dennett (1991), these attitudes are part of the software required to program the brain to engage in personal reasoning, and thereby create a flexible decontextualized reasoning system. Assuming there was selective pressure to develop such a system, there would also have been pressure to develop a disposition to form the required attitudes.

A further attraction of the proposed view is that it has the resources to accommodate new distinctions that have recently been introduced by theorists in the dual-systems tradition. I shall briefly consider proposals by Jonathan Evans and Keith Stanovich.

Evans (this volume) now recommends reverting to talk of processes rather than systems, and he identifies the use of working memory as the key functional distinction underlying dual-process approaches. He distinguishes *type 1* processes, which do not require working memory, and are, consequently, fast, automatic, and effortless, and *type 2* (or *analytic*) processes, which manipulate explicit representations in working memory. He also makes a distinction among type 1 processes, distinguishing *autonomous* processes, which control behaviour directly, without the involvement of working memory, and *preattentive* processes, which supply content to working memory. Thus, on this view, there are two different dual-process distinctions to be made: between autonomous and analytic processes, which work competitively and in parallel, and between preattentive and analytic processes, which work co-operatively and in sequence. Evans notes that existing dual-systems accounts fail to make this distinction, leading to confusion and cross-talk. Evans also introduces a third category of processes, *type 3* processes, which are responsible for initiating type 2 processing and resolving conflicts between autonomous and analytic processes, and which have ultimate control of behaviour.

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2 Steven Mithen has also argued that flexible intelligence — which seems linked to System 2 reasoning — developed from the co-ordination of previously isolated specialized intelligences (Mithen 1996).

3 For another approach which also connects System 2 reasoning with argumentation, see Mercier and Sperber this volume.

There is of course much more detail to Evans's picture, but his basic distinctions at least can be accommodated within the framework I have proposed. Personal reasoning, unlike the subpersonal type, requires attention and the use of working memory, so the distinction between type 1 and type 2 processes corresponds closely to that between subpersonal and personal reasoning. And the distinction between autonomous and preattentive processes corresponds to that between those subpersonal reasoning processes that guide action directly and those that provide inputs to personal reasoning. (There are, of course, other ways in which subpersonal processes are involved in supporting personal reasoning, corresponding to the other kinds of dependency mentioned earlier, and we could make further distinctions among type 1 processes to reflect this.) Finally, Evans's type 3 processes correspond to the subset of subpersonal processes involved in deciding when to initiate personal reasoning and whether or not to act on the outputs of any given episode of it. On the view proposed earlier, decisions of the latter kind will often involve competition between a general second-order desire to act on the outcomes of our personal reasoning and specific first-order desires to perform other, incompatible actions.

Whereas Evans makes a distinction among type 1 processes, Stanovich has recently argued for a division within System 2, between what he calls the *reflective mind* and the *algorithmic mind* (this volume). These correspond to two different levels of processing. The reflective mind is the top level and consists of goals and beliefs which exert high-level control of behaviour. Importantly, these include *epistemic* goals and values, which exert reflective control over our reasoning, together with 'thinking dispositions' such as openmindedness, impulsiveness, and willingness to engage in effortful thought, which are manifested in our decisions about how to interpret tasks, what strategies to adopt, what rules to apply, and so on. (Stanovich adopts the term 'mindware' for the learned rules, procedures, and strategies that guide System 2 processes.) The algorithmic mind is a subordinate level, and consists of the processing machinery that supports these reflective-level states. Support for the reflective–algorithmic distinction comes from tasks studied in the heuristics-and-biases literature. Measures of general intelligence are known to predict variation on these tasks; this is taken to reflect differences in System 2 functioning. But there is further variation in performance once general intelligence has been controlled for, and measures of thinking dispositions predict this. Stanovich argues that tests of general intelligence measure the processing efficiency of the algorithmic mind, whereas measures of thinking dispositions reflect individual differences in the reflective control of reasoning.

Again, in outline at least, this distinction maps easily on to the picture I have sketched. The reflective mind corresponds to personal reasoning. It is

plausible to regard thinking dispositions, such as openmindedness, as personal-level states, which manifest themselves in our personal reasoning activities. And it is our personal reasoning over which we can exercise reflective control, since it is precisely intentional actions that are responsive to reason. The algorithmic mind, by contrast, corresponds to the subpersonal processing resources which support personal reasoning and over which we cannot exercise reflective control. This view also accords with the data on individual differences. We should expect there to be variation in personal reasoning abilities independent of variation in cognitive capacity, reflecting individual differences in knowledge of reasoning strategies, normative beliefs about good reasoning, metacognitive dispositions, and so on — differences in mindware rather than hardware.

There are also differences between the pictures, however. Stanovich treats the algorithmic-level processes that support the reflective mind as an aspect of System 2, so, assuming these processes are subpersonal, personal reasoning cannot be identified with System 2 in Stanovich's sense. To some extent, this difference is terminological: Stanovich's System 2 can be identified with the personal reasoning system *together with* the subpersonal processes that support it. There is a case, however, for restricting the term 'System 2' to the personal, reflective-level processes themselves, since it is they, rather than the subpersonal algorithmic-level mechanisms, that exhibit the distinctive properties of System 2 processes (controlled, effortful, conscious, etc). (This reflects the general point that functional systems can be realized in lower-level processes of a very different character; for example connectionist networks can be modelled on digital computers.) There is a more substantive issue here too. Can we make a sharp distinction between those subpersonal resources that are involved in supporting the reflective mind and those that are not? In retaining a distinction between systems, in addition to the distinction between levels, Stanovich implies that we can. Now there is good reason for this: there are heritable individual differences in the capacity of the cognitive mechanisms supporting System 2 reasoning — tapped by measures of general intelligence — which are not found in the autonomous subsystems grouped under the System 1 banner. However, it does not follow that such variation is found in *all* the mechanisms involved in supporting System 2 reasoning; it might be exhibited by just one or two key components, such as working memory. And some autonomous subsystems might be involved, including language and theory of mind, which do not display such variation. Indeed, different subsets of subpersonal mechanisms might be involved on different occasions, depending on the nature of the task. If this is right, then it will not be possible to draw a hard-and-fast distinction between the subpersonal mechanisms

associated with Systems 1 and 2. If we are looking for a simple binary division, then the personal–subpersonal division may be the only one available.

Finally in this section, I shall address a possible objection to the proposal I have made. It goes like this. The aim of cognitive psychology is to provide reductive explanations of personal-level phenomena in terms of the underlying subpersonal states and processes. The two-systems hypothesis is an attempt to do this: dual reasoning systems were posited in order to explain why people respond as they do on various reasoning tasks. So to reclassify one of the systems as a personal one is to take a step backwards in this explanatory project. Now I agree that the aim of cognitive psychology is to provide reductive explanations, but it does not follow that the proposal is a backward step — or at least that it is an unnecessary one. For we need to have the right explanandum for subpersonal theory. Take a sporting ability, such as being able to play a good round of golf. From a psychological point of view this is not a single skill, and we would not seek to explain it directly in subpersonal terms (Clark 1993, p.203). Rather, we would explain it as the product of a cluster of more basic skills — at driving, chipping, putting, gauging distance, and so on. And it is these more basic skills for which we would then seek reductive explanations. And the same may go for some of our reasoning abilities: they may involve the deployment of a cluster of personal skills in constructing explicit arguments, applying heuristics, autostimulation, and so on, which are the proper targets for reductive explanation. Thus the present proposal is not incompatible with the search for subpersonal explanations, and may be a needed corrective to the tendency to seek them prematurely.

4. Dual mental states

A dual-systems theory of reasoning may need to be supplemented with a dual-systems theory of memory, according to which the two reasoning systems have separate suites of beliefs and desires (knowledge bases and goal structures), differing in content and functional characteristics. Such a view is a corollary of theories which treat the two systems as operating in parallel, and may be implicit in other versions, too. The case for dual memory systems is also supported by social-psychological work on persuasion and attitude change, which has led several theorists to distinguish two independent memory systems: an implicit system, which is non-conscious, automatic, and slow-learning, and an explicit system, which is conscious, effortful, and fast-learning (e.g. Wilson *et al.* 2000; Smith and DeCoster 2000; Smith and Collins this volume; see also Sun *et al.* this volume). The distinction between subpersonal and personal reasoning is also associated with a distinction of mental states,

similar to that between implicit and explicit, and in this final section I shall sketch this briefly.[4]

Beliefs are states that serve as premises in reasoning, and we can distinguish two broad types of belief, depending on whether the reasoning in question is subpersonal or personal. The former will be subpersonal states of the cognitive system, whereas the latter will be behavioural dispositions of the whole person. (Personal reasoning is an activity, and to have a personal-level belief is be disposed to conduct this activity in a certain way, taking the content of the belief as a premise.) For convenience, we can refer to these as *subpersonal belief* and *personal belief* respectively. (I should add a caveat here. As noted earlier, there is a sense in which all beliefs are personal; it is people who believe things, not their brains. The proposed terminology is designed to underscore the claim that there are two very different ways in which a person can believe something, defined by the relative roles of subpersonal and personal factors in the processing of the belief in question. It is also worth stressing that the distinction between the two kinds of belief is not drawn in terms of content, and that 'personal' does not mean 'relating to oneself'.[5]) We can make a similar distinction for desire, with personal desire consisting in a disposition to take the desired outcome as a goal in one's personal reasoning. The beliefs and desires that motivate and guide personal reasoning are subpersonal ones, whereas those that form its content are personal ones.[6]

I assume there will be numerous subdivisions to be drawn within each category of belief. In particular, just as there are likely to be many subpersonal reasoning systems, so there are likely to be many subpersonal memory systems (Carruthers 2006, ch.2). However there are also certain fundamental differences between the two. The first relates to consciousness. Subpersonal beliefs are operative at a non-conscious level, whereas personal ones are entertained as premises in episodes of conscious reasoning. (This is not to say that we are not aware of possessing our subpersonal beliefs; we may, for example, infer their existence from our own behaviour; but we do not employ them in our conscious reasoning.) The second difference relates to mode of formation. Subpersonal beliefs are formed passively, by subpersonal processes.

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4 What follows draws on Frankish 2004, to which the reader is referred for detailed discussion.

5 My use of the term 'personal belief' should be distinguished from that in the social psychological literature, where personal beliefs are often contrasted with shared cultural stereotypes (e.g. Devine 1989). Personal beliefs in this sense will, however, often be personal in my sense, too.

6 There may be another difference with Stanovich here. For Stanovich (this volume), the reflective mind seems to include both the attitudes that figure as premises and goals in System 2 reasoning and the epistemic attitudes that guide this reasoning. By contrast, I am suggesting that the two sets of attitudes are located at different levels.

Often, I assume, this will be a gradual process, involving repeated exposure to relevant environmental regularities. Personal beliefs, on the other hand, can be actively formed, by one-off decisions. Since personal reasoning is under intentional control, we shall be able to make decisions about which propositions to take as premises in it. If we think a proposition is well-warranted — say, because we have been told on good authority that it is true or because we have inferred it from something else we believe — then we can decide to adopt it as a premise for use in subsequent personal reasoning on relevant topics. (As with other personal-level decisions, such decisions will become effective in virtue of subpersonal metacognitive attitudes — specifically, a belief that one has decided to adopt the proposition in question as a premise and a general desire to act on one's personal-level decisions.) A third contrast relates to degree. It is plausible to think of subpersonal beliefs as graded states, corresponding to subjective probability assignments. Much human reasoning can be analysed as probabilistic in character, even though we rarely make explicit assessments of probability (e.g. Evans and Over 2004; Oaksford and Chater 2007). Personal beliefs, on the other hand, are ungraded, all-or-nothing attitudes. To have the personal belief that *p* is to be disposed to take *p* as a premise in one's personal reasoning, and one either has this disposition or not; there is no halfway house. (Of course, the *content* of a personal belief may be a probability claim — for example, that there is a 75% chance of rain today — but the attitude towards this content remains ungraded.)[7]

The distinction between subpersonal and personal belief corresponds closely to one drawn by some philosophers between *belief* and *acceptance* — the former being a passive, graded state, and the latter a voluntary, all-or-nothing one (e.g. Bratman 1992; Cohen 1992; Engel 2000). Accepting a proposition involves deciding to treat it as true for certain reasoning purposes, and writers on the subject stress that the attitude can be adopted for pragmatic reasons as well as epistemic ones, and that it can be restricted as to context. For example, a lawyer might accept that their client is innocent for the purposes of deciding how to conduct their defence, even though they strongly believe that they are guilty. Personal belief is very similar to acceptance, and I assume that it, too, can be pragmatically motivated and restricted in context. (We might hesitate to call pragmatically motivated attitudes *beliefs* tout court, but we could think of them as *professional*, or *pragmatic* beliefs.) This serves to emphasize the essentially

[7] Note that to say that our personal beliefs are ungraded is not to say that we treat them as *certain*. One can be disposed to take a proposition as a premise in one's personal reasoning without being disposed to rely on it in all contexts, no matter what is at stake (see Frankish 2004, ch.4). Note, too, that we can have varying degrees of *attachment* to our personal beliefs, reflecting how reluctant we would be to revise or abandon them.

hypothetical character of personal belief and personal reasoning. In forming a personal belief and using it in personal reasoning, one is adopting and exploring a working hypothesis, and one can be motivated to do this for a variety of reasons.

I shall conclude this section with some remarks about the relation between the two levels of belief, where it is plausible to see a constitutive dependency relation. A personal belief is a behavioural disposition — a disposition to conduct one's personal reasoning in a certain way, taking the believed proposition as a premise. And this disposition (assuming it is not simply a reflex) will exist in virtue of subpersonal beliefs and desires that make the behaviour in question attractive. These might be the belief that one has decided to take *p* as a premise (formed as result of having made such a decision) and the desire to act on one's personal decisions, or the belief that *p* is well-warranted and the desire to take well-warranted propositions as premises. Such metacognitive subpersonal attitudes would constitute, or *realize*, the first-order personal belief that *p*.

It may be objected that if personal beliefs are constituted by subpersonal ones, then they are not a distinct type of belief. The objection is similar to one discussed earlier in relation to the personal reasoning system itself, and a similar response is in order. The claim is not that personal beliefs *are* metacognitive subpersonal beliefs, but that they are functional states that are *realized in* metacognitive subpersonal beliefs; a person exhibits the premising dispositions in which personal beliefs consist in virtue of having the appropriate subpersonal attitudes. And, as just noted, there will be significant functional differences between the realized and realizing states — differences relating to consciousness, mode of formation, and degree. It is true that if personal beliefs constitutively involve subpersonal ones, then it must be the case that some subpersonal beliefs can be formed quickly, as personal ones can. However, the subpersonal beliefs in question will be ones about one-off events, to the effect that we have decided to adopt this or that proposition as a premise, and it is plausible to think that subpersonal beliefs of this kind can be formed quickly (e.g., Smith and DeCoster 2000).

5. Conclusion

I have argued that the distinction between System 1 and System 2 corresponds to that between subpersonal and personal reasoning. But even if the distinctions do not align in this way, a weaker claim still stands. The distinction between personal and subpersonal reasoning marks *one* broad binary division in human reasoning, and one that needs to be acknowledged in psychological theory. Indeed, it may be the *only* such division. Most dual-systems theorists

accept that System 1 is actually a suite of systems, and several contributors to the present volume suggest that System 2 may also fragment in various ways (Evans this volume; Samuels this volume; Stanovich this volume). Indeed, there could be hybrid systems at a subpersonal level, with some System 1 properties and some System 2 properties. Personal reasoning, on the other hand, constitutes a distinct level of mental activity, which can be clearly distinguished from the lower, subpersonal one.

Of course, those interested in the nuts and bolts of cognition may regard personal reasoning as a superficial phenomenon. In a sense it is, but it is a real one, and one that must be recognized in psychological theorizing, if only to avoid the error of premature reduction. And in the end, it may be the main source of the remarkably widespread intuition that there is a fundamental duality in human reasoning.

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