

## **New ambitions for a new paradigm: Putting the psychology of reasoning at the service of humanity**

**Jean-François Bonnefon\***

CNRS and University of Toulouse, France

To what extent can the psychology of reasoning “serve humanity”? Three case studies suggest that the psychology of reasoning has failed to make itself as relevant to the welfare of humanity as its closest fields, judgement and decision-making (JDM) and moral cognition research. This state of affairs is arguably the legacy of the deduction paradigm that long dominated the field, and things might change for the better with the advent of a new paradigm. On the basis of its three pillars (probability, utility, and dual processes), this new paradigm has largely blurred the boundaries between reasoning, JDM, and moral cognition. As a consequence the psychology of reasoning has acquired brand new opportunities to investigate high-stakes domains and risk factors, and to pursue full integration with JDM and moral cognition. These new opportunities will likely bring a rapid increase in the relevance of reasoning research to people’s daily challenges and societies’ greater ambitions.

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The motto of the 30th International Congress of Psychology (2012) was “Psychology serving humanity”. The running theme of the congress was to consider how psychology translated its science and practice into the knowledge, skills, and tools that would help relieve the current burdens of humanity, and serve its long-term development goals. In such a context, holding a symposium on reasoning might feel vaguely intimidating and out of place. For, in truth, the psychology of reasoning does not have a reputation for making itself relevant to people’s daily challenges and societies’ greater ambitions.

In this article I consider the possibility that the relative lack of relevance of the psychology of reasoning is mostly the legacy of the deduction

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\*Correspondence should be addressed to Jean-François Bonnefon, CLLE (CNRS, UTM, EPHE) Maison de la recherche, 5 allées A. Machado, 31058 Toulouse Cedex 9, France. E-mail: [bonnefon@univ-tlse2.fr](mailto:bonnefon@univ-tlse2.fr)

paradigm which dominated the field for decades, and that things might change for the better with the paradigm change that the field is now experiencing. To measure up the current situation I start with three “case studies”. In these case studies I assess the presence of reasoning research in (i) the *Psychological Science in the Public Interest* monographs, (ii) the book *Nudge* and the governmental reports it inspired, and (iii) the ongoing UN actions undertaken under the aegis of the *Millennium Development Goals*. I reason that the presence of a psychology subfield in these three places should broadly reflect its applied relevance (perceived or real).

All through these case studies I use judgement and decision-making (JDM) research and moral cognition research as a foil to reasoning research.<sup>1</sup> That is, I contrast the presence of these two subfields to that of reasoning research. The reason for this choice is twofold: First, it will appear that, in contrast to reasoning research, JDM and moral cognition are well represented in all case studies. Second, we will see that the boundaries between reasoning research on the one hand, and JDM and moral cognition research on the other, have been largely blurred by the recent evolution of reasoning research. These observations will provide us with a road map towards putting reasoning research at the service of humanity: By embracing the identity crisis of reasoning research we should be able to carve our field a new territory, in which inferences, preferences, and moral conflicts are simultaneously addressed in an integrated approach to thinking.

Note that this article focuses on the subset of reasoning research which was substantially impacted by the current paradigm shift. Research on analogical reasoning, causal reasoning, inductive reasoning, and hypothesis testing was less impacted than research on deductive reasoning (although see Evans & Over, 2013). Accordingly, the conclusions of this paper apply to these subfields to a lesser extent than to the subfield of deductive reasoning. In particular, research on these other forms of reasoning might already be more applied (e.g., in the domain of education) than research on deductive reasoning. Furthermore, even the use of a deduction paradigm does not prevent an applied focus. Individual differences research, in particular, can be partly inspired by the deduction paradigm while offering links to educational issues and IQ testing.

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<sup>1</sup> Although I will argue later in this paper that there is little substantial difference between reasoning, decision-making, and moral judgement, it may be useful at this point to sketch some superficial differences between these three activities. Very roughly, (a) to reason is to form a conclusion about what, is, or will be the case, based on currently held assumptions; (b) to make a decision is to form an intention about what to do, based on the expected consequences of various actions and how desirable they are; (c) to issue a moral judgement is to form an attitude about whether an action is morally acceptable, based on the intrinsic characteristics of this action and/or its expected consequences.

## CASE STUDIES

In this section I attempt to assess the influence of reasoning research in three contexts that put a strong emphasis on applied value: the monographs published in *Psychological Science in the Public Interest*, the policies introduced in the book *Nudge* and the governmental reports it inspired, and the programmes undertaken in relation to the UN “Millennium Development Goals”. It would seem necessary to define first what would count as “reasoning research”. For example, we could decide that reasoning research chiefly investigates (or used to chiefly investigate) the way people use connectives and quantifiers to deduce new propositions. As it turns out, though, the definition matters little, in view of the dearth of anything that might be considered reasoning research in all three case studies. Finally, note that the choice of the three case studies was mostly determined by convenience and chance encounters with informants. They do not constitute a “representative” sample in any sense of the term.

### Psychological Science in the Public Interest

The aim of *Psychological Science in the Public Interest* (PSPI) is to publish monographs on psychological topics of pressing national importance, which meet current and intense public interest (it is not clear whether “national” refers to the USA or to any nation). Accordingly, PSPI seems to be a good place to look for a survey on reasoning that would highlight the applied potential of reasoning research. Unfortunately, or tellingly, no such survey appeared in 12 years of publication. Even more tellingly, a 2002 article that surveyed the evidence for the cognitive enhancing properties of *Ginkgo biloba* did not make a single mention of reasoning as a cognitive ability to be enhanced (Gold, Cahill, & Wenk, 2002)..

Whereas one is hard pressed to find articles on reasoning in PSPI, the task is much easier for papers on moral cognition or JDM. For example, moral cognition was a central topic of at least two issues of PSPI. A monograph on counterterrorism (Kruglanski, Crenshaw, Post, & Victoroff, 2007) explored at length the idea that the battle between terrorism and counterterrorism is in part a fight for the moral high ground: terrorist organisations strive to portray their actions as morally warranted, while counterterrorism organisations strive to instil the opposite idea. Another monograph devoted to the psychopathic personality (Skeem, Polaschek, Patrick, & Lilienfeld, 2012) addressed in detail the question of whether psychopaths are unable to appreciate the difference between right and wrong, or whether they can but do not care—a question that has very direct consequences in legal contexts.

In parallel there has been a slew of PSPI papers inspired by JDM research. To give just a few examples, the very first issue of PSPI offered a

survey on how psychological science can improve diagnostic decisions (Swets, Dawes, & Monahan, 2000), and subsequent issues featured monographs on helping doctors and patients make sense of health statistics (Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin, 2007), on understanding adolescent risky decision making in order to devise appropriate policies (Reyna & Farley, 2006), and on the role of psychological factors in the recent financial crisis (Gärbling, Kirchler, Lewis, & van Raaij, 2009).

In sum, reasoning has not been a monograph topic in PSPI in 12 years, whereas JDM and moral cognition were featured on a regular basis in the pages of the journal. As we will see, this pattern will be common to our three case studies.

## Nudge

The global best-seller *Nudge*, by Richard Thaler and Cass Sustein (2008), made a strong case for the use of behavioural science in public policy making. The book contained many suggestions for policies based on insights into human behaviour, in varied domains such as health, retirement savings, or energy use. Quite naturally, *Nudge* made extensive use of JDM research. It also showed ties with moral cognition when it considered how people might be nudged towards altruistic behaviour such as organ donation and charity giving. However, the book did not make a single mention of reasoning research.

The strategy advocated in *Nudge* has been adopted by several governments. In the UK in particular, the Behavioural Insights Team (the BIT, also known as the “nudge” unit) has been tasked to find intelligent ways to encourage, support and enable people to make better choices for themselves. One would naturally expect JDM research to play a large role in the recommendations of the BIT. And indeed a great many of the policies described in the 2010–11 annual report of the BIT (available from [cabinetoffice.gov.uk/behavioural-insights-team](http://cabinetoffice.gov.uk/behavioural-insights-team)) utilise JDM results in general, and insights into risk perception in particular. Other policies are inspired by moral cognition research, especially policies that have to do with tax fraud. As noted in the BIT report, fraud is often committed by people who see themselves as law-abiding citizens. Understanding how people can cheat without self-identifying as cheaters is key for reducing tax fraud; that is, for devising policies that do not allow people to turn a blind eye on their own cheating.

Reasoning research is not featured in the BIT report, nor in the BIT website. The situation is quite similar with the French *Conseil d'Analyse Stratégique* (CAS), a think tank attached to the prime minister, whose functions include nudge-style analyses of the role of behavioural sciences in policy making ([strategie.gouv.fr/en](http://strategie.gouv.fr/en)). The CAS has produced papers and held meetings on topics that bear on JDM research (psychological factors in

the financial crisis, health and prevention), on moral cognition research (advances in the neurobiology of moral cognition and its consequences for the law), or both (green nudges that contribute to environmental sustainability). To the best of my knowledge, though, the CAS has never considered reasoning research as an inspiration for policy making.

## The UN Millennium Development Goals

In the year 2000 the United Nations established a blueprint for global action that consisted of eight Millennium Development Goals (MDGs), to be achieved by year 2015. These goals ranged from *eradicating extreme poverty and hunger* to *developing a global partnership for development*. The fact sheets provided by the UN (available from [un.org/millenniumgoals/](http://un.org/millenniumgoals/)) provide an interesting perspective on the type of psychological research that is likely to inform ongoing effort towards achieving the MDGs. None of these fact sheets features any action that would involve reasoning research.

One easily finds, however, ongoing actions that could be informed by JDM and moral cognition research. For example, the fact sheet attached to MDG#6 (*Combat HIV/AIDS, Malaria and Other Diseases*) describes the introduction of a nationwide reproductive health and HIV prevention curriculum for secondary school students. Psychological research in JDM and moral cognition is clearly highly relevant to such an endeavour, for example by providing hard data on the link between perceived vulnerability and HIV precautionary behaviour (Gerrard, Gibbons, & Bushman, 1996), or on interventions based on moral agency, aimed at reducing transmission risk (O'Leary & Wolitski, 2009).

In like vein, the fact sheet for MDG#7 (*Ensure Environmental Sustainability*) describes a programme seeking to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. Once more JDM and moral cognition research can straightforwardly inform such a programme, by answering questions such as: to what extent do people share the fundamental values of sustainable development (Shepherd, Kuskova, & Patzelt, 2009)? How does the adherence to these values translate into behavioural intentions (Eyal, Sagristano, Trope, Liberman, & Chaiken, 2009)? How does it translate in stable consumption patterns (Thøgersen & Olander, 2002)? The psychology of reasoning, once more, does not seem in a position to provide comparably useful information.

In sum, the same pattern is found here that we encountered in the two previous case studies. Whether we look at the table of contents of *Psychological Science in the Public Interest*, at the nudges considered in the eponymous book and in think tanks inspired by the book, or at the ongoing actions under the framework of the UN Millennium Development Goals, we find that

JDM and moral cognition research is straightforwardly relevant, and reasoning research is thoroughly ignored.

Hopefully what we observe here is only the legacy of the deduction paradigm. As long as the psychology of reasoning ignored uncertainty, preferences, and individual differences, it did not have much to contribute to matters of pressing public interest. The paradigm change that the field has undergone might change things for the better, as we will now consider.

### OPENING THE BORDERS

The psychology of reasoning was long characterised by a strong focus on deduction (Evans, 2002), and one of its main goals was to offer a cognitive account of why some deductions were harder than others (Braine & O'Brien, 1998; Johnson-Laird & Byrne, 1991). While the deduction paradigm was largely successful in achieving this goal (and, more generally, in providing descriptive and explanatory theories of deduction), this success came at a cost. Indeed the deduction paradigm imposed strong constraints on the tasks and models developed in the field, which limited its ability to account for everyday reasoning. The transition to the New Paradigm psychology of reasoning consisted, in a large part, of relaxing three of these constraints.

The first constraint concerned the quality of the information used for the premises of reasoning problems. Reasoners were typically encouraged to consider this information as perfect (i.e., precise, certain, and complete), in contrast to the imperfect, probabilistic nature of the typical premises of a JDM task. Although this assumption was not too problematic when reasoning from abstract premises, it could clash with reasoners' world knowledge when reasoning from everyday contents. Notorious puzzles such as the *suppression effect* were a direct consequence of the clash between world knowledge and the perfect information assumption (Byrne, 1989; De Neys, Schaeken, & d'Ydewalle, 2003; Politzer & Bonnefon, 2006; Politzer & Bourmeau, 2002; Stevenson & Over, 1995).

The second constraint concerned the disinterested nature of reasoning. When considering premises and assessing conclusions, reasoners were typically thought to disregard the utility entailed by the realisation of these premises and conclusions, in contrast to the typical requirements of a JDM or moral cognition task.<sup>2</sup> Once more this assumption was not too problematic when reasoning from abstract premises, but it missed a whole dimension

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<sup>2</sup> There were at least two early exceptions to this general rule, which I only mention briefly in this footnote: studies of the deontic selection task (e.g., Hilton, Kimmelmeier, & Bonnefon, 2005; Manktelow & Over, 1991), and studies of conditional inducements such as threats and promises (e.g., Beller, Bender, & Kuhnmünch, 2005; Evans & Twyman-Musgrove, 1998).

of reasoning from everyday contents (e.g., Bonnefon & Hilton, 2004; Thompson, Evans, & Handley, 2005).

The third constraint concerned the importance given to individual differences in reasoning. When lay persons think about reasoning tasks they are likely to think of IQ tests (Stanovich, West, & Toplak, 2011), whose main aim is to capture individual differences. In stark contrast, the psychology of reasoning used to focus on the *modal* response in reasoning tasks, rather than analysing intra- or inter-individual differences (Bonnefon, Eid, Vautier, & Jmel, 2008; Bonnefon, Vautier, & Eid, 2007). The postulate that people all reasoned the same, or that they would all engage broadly the same cognitive processes to form conclusions, limited the ability of the field to connect with instances of everyday reasoning by everyday reasoners.

The transition to the New Paradigm psychology of reasoning relaxed these three constraints, with two major consequences. First, the “reasoning” studied by the psychology of reasoning became much more similar to the reasoning that people engaged in in everyday life. Second, the boundaries between the psychology of reasoning and its neighbours (JDM and moral cognition) became increasingly blurred. We will now take a closer look at this phenomenon. We first examine what happens when constraints 1 and 2 are relaxed; that is, what happens when probabilities and utilities are introduced in reasoning tasks. We then consider what happens when constraint 3 is relaxed, and what happens in particular when dual-process models of individual differences are introduced in theories of reasoning.

### Probabilities and utilities

In order to develop descriptive and explanatory theories of deduction, the deduction paradigm strived in particular to explain why some deductive problems were harder than others. In other and more general terms, the deduction paradigm aimed to explain human performance against the implicitly or explicitly recognised background of classical bi-valued logic as a model of rationality. Because probabilities (and utilities) are alien to this classical formalism, the study of uncertain reasoning had to be conducted at the periphery of the field. This state of affairs changed gradually, as more and more researchers studied uncertain reasoning, and finally claimed that the main project of the field was not to understand deduction but to understand probabilistic reasoning (e.g., Oaksford & Chater, 2001). Whereas the deduction paradigm considered uncertain reasoning as a degraded form, the new paradigm made it the central notion of the field, turning deduction from a core issue to a limit case. More generally, the new paradigm shifted focus from reasoning about arbitrary assumptions to reasoning from actual degrees of belief, as well as updating or revising these degrees of beliefs (Baratgin, Politzer, & Over, 2013; Oaksford, 2013).

A founding result of the new paradigm is that reasoners perceive the probability of a conditional “if  $p$  then  $q$ ” as being the conditional probability  $\Pr(q|p)$  (e.g., Evans, Handley, & Over, 2003; Oberauer & Wilhelm, 2003). For our present purpose, and as we will see in a moment, this result is important because it allows us to consider the uncertainty that an action  $p$  will produce a consequence  $q$ , and, subsequently, the expected utility of  $p$ .

The shift in focus from truth to probability corresponds to what Evans (2012) called the narrow definition of the new paradigm. The broad definition introduces another (formally independent) dimension of propositions, in addition to their probability. This additional dimension is that of utility: Are there some agents whose preferences are satisfied, and to what extent, by the realisation of a given proposition? Consider again the case of a conditional “if  $p$ , then  $q$ ”, where  $p$  is an action and  $q$  is a consequence of this action. In order to account for the inferences drawn from this conditional, the new paradigm psychology of reasoning not only considers the conditional probability of  $q$  given  $p$ , but also the costs and benefits attached to  $p$  and  $q$  for various agents (Bonneton, 2009, 2012; Bonneton, Girotto, & Legrenzi, 2012; Corner, Hahn, & Oaksford, 2011; Demeure, Bonneton, & Raufaste, 2009; Evans, Neilens, Handley, & Over, 2008; see also Blanchette & Caparos, 2013, on reasoning about emotional materials).

The descriptive power of the new paradigm is greatly enhanced by the consideration of probabilities and utilities. Consider for example a typical JDM problem, lottery choice:

If one pays 1 euro to participate in lottery A, one wins 5 euros with a probability of .5, and 0 euro otherwise. If one pays 10 euros to participate in lottery B, one wins 1 euro with probability .2, and 0 euro otherwise.

Within the deduction paradigm, this pair of conditionals could not be used as the premises of a reasoning process, for lack of a way to represent probability and utility. The description of the two lotteries, though, appears to generate a very strong inference: Nobody in their right mind would choose lottery B over lottery A. However strong, this inference could not be captured by the deduction paradigm. By allowing reasoning scholars to describe problems in terms of probabilities and utilities, the new paradigm blurs the line between reasoning and JDM research. Providing a common language to the two fields allows researchers to simultaneously consider a problem through the lenses of JDM (which decisions are made?) and of reasoning (which inferences are derived?). In this respect it is interesting to note that lotteries (the backbone of JDM research) have now spread to reasoning research in the guise of conditional bets (Politzer, Over, & Baratgin, 2010).

Considerations of probability and utility also blur the line between reasoning and moral cognition research, or at least that part of moral cognition



research that is concerned with probability and utility. Moral thinking does not always entail considerations of utility. Purity violations in particular (e.g., eating one's dead pet) seem morally wrong for reasons that have apparently nothing to do with benefits and costs. The overwhelming majority of moral cognition research, though, deals with issues of harm and fairness that involve the infliction of costs and the distribution of benefits (Haidt, 2007). Probabilistic considerations are less frequent in moral cognition research than considerations of utilities, but they are most likely to appear at the policy-making level. For example, policies must be defined for adjudicating limited supplies of organs for transplantations, and some policies give priority to patients with the greatest amount of *expected* life years, generating ethical controversies as they restrict older patients' access to transplants (Reese, Caplan, Bloom, Abt, & Karlawish, 2010).

In sum, the introduction of probabilities and utilities has considerably extended the purview of reasoning research. Reasoning researchers now share a common language with JDM and moral cognition researchers, which gives them an opportunity to tackle the same applied problems. Furthermore, as we will now see, the transition to the new paradigm psychology of reasoning introduced models and manipulations which are used across the full spectrum of reasoning, JDM, and moral cognition.

### Dual-process models and methods

The deduction paradigm did not grant significant importance to the fact that different reasoners might arrive at different responses to the same problem, or to the fact that a single reasoner could, on different occasions, arrive at different responses to the same problem. Deviations from the modal response, as well as interpersonal and intertemporal variations, were commonly explained away as stemming from momentary inattention or pragmatic ambiguity. In contrast, the new paradigm pays close attention to individual differences in reasoning: The different responses that different reasoners produce are typically thought to reflect the engagement of different mental processes.

I will assume that the reader is familiar with dual-process models of thinking and reasoning (for reviews, see Evans, 2008; Kahneman, 2011; Sloman, 1996; Stanovich, 2004). In a nutshell (and at the risk of oversimplification), dual-process models postulate that individuals can engage both Type 1 (fast, effortless, implicit) and Type 2 (slow, effortful, explicit) processes when they reason their way through a problem. These two sets of processes do not necessarily produce the same output, hence the possibility that some reasoners give Type 1 responses while others give Type 2 responses, or the possibility that a single reasoner might give a Type 1 response on one occasion, and a Type 2 response on another occasion.

Dual-process models are found across the whole spectrum of reasoning, JDM, and moral cognition research. Although the exact theoretical specification of these models can be different from one field to another, the criteria for (empirically) determining that a given response is the output of Type 1 or Type 2 processes are broadly the same for the three fields. This is a very important point, because it means that students of reasoning, JDM, and moral cognition now use methods from a common toolbox, and broadly agree on how results should be interpreted (Evans, 2012).

One common criterion is that Type 2 responses are more likely to be given by individuals of high cognitive capacity. For example, reasoners with higher working memory spans or higher SAT scores are more likely to give logical responses in the belief bias task, which features syllogisms whose conclusion conflicts with prior beliefs (De Neys, 2006; Stanovich & West, 1998). Individuals who score higher on the Cognitive Reflection Test show lesser temporal discounting in decision tasks (Fredericks, 2005), and they are also more likely to give utilitarian responses to moral dilemma (Paxton, Ungar, & Greene, 2012). On this basis, students of reasoning, decision making, and moral cognition can agree that reasoning logically on the belief bias task, resisting temporal discounting, and choosing the utilitarian response to a moral dilemma, are different manifestations of reflective, Type 2 cognitive processes.

In addition to measures of cognitive capacity, researchers in the three fields share a common toolbox of manipulations and measures aimed at tracking the nature of the cognitive processing underlying behaviour. This common toolbox includes manipulations of cognitive load (a response that disappears under cognitive load is likely to result from Type 2 processing), manipulations of time pressure (a response that survives time pressure is likely to result from Type 1 processing), and brain-imaging measures (broadly similar brain structures are activated when a Type 2 response is produced, independently of the domain under consideration). For example, studies in the three fields confirmed that concurrent cognitive load decreased logical responding in the belief bias task (De Neys, 2006), increased temporal discounting (Hinson, Jameson, & Whitney, 2003), and decreased utilitarian responding to moral dilemma (Trémolière, De Neys, & Bonnefon, 2012). Time pressure manipulations yielded similar findings (Ebert & Prelec, 2007; Evans & Curtis-Holmes, 2005; Suter & Hertwig, 2011). Finally, brain-imaging studies showed that Type 2 responses activated similar brain areas across the three domains, related to the detection of conflict (anterior cingulate cortex) and the engagement of control (prefrontal cortex). To continue with our running examples, brain activity in these two areas is higher for individuals who reason logically in the belief bias task (De Neys, Vartanian, & Goel, 2008), individuals who make difficult intertemporal choices (J. Peters & Büchel, 2011), and individuals who choose the utilitarian

response to a moral dilemma (Greene, Nystrom, Engell, Darley, & Cohen, 2004). In sum, the new paradigm psychology of reasoning acquired a set of experimental and theoretical tools that largely blurred its boundaries with JDM and moral cognition research. As we will now see, this blurring of the boundaries provides a unique opportunity to carve a new territory for reasoning research, and to increase its relevance to people's daily challenges and societies' greater ambitions.

### CARVING A NEW TERRITORY

The psychology of reasoning used to be a very identifiable subfield, in terms of tasks, methods, and theories—but this strong identity came at the risk of insularity. The core tasks of the psychology of reasoning (e.g., selection, syllogisms) were seldom used in other fields;<sup>3</sup> and theories of reasoning (e.g., mental rules, mental models) showed limited interoperability with that developed in other fields. The situation has changed greatly with the new paradigm psychology of reasoning. The psychology of reasoning now shares a common language with JDM and moral cognition (probabilities and utilities), a common set of manipulations and covariates (e.g., concurrent load, time pressure, cognitive capacity), and a common theoretical framework based on dual processes.

This increase in interoperability inevitably comes with a diluted identity. If scholars of reasoning describe problems in the same language as their colleagues in JDM and moral cognition, use the same set of manipulations and covariates, and draw on the same theoretical framework, can reasoning research still stand firmly apart from JDM and moral cognition? I would say that the answer is “No”, and that it is a good thing. Reasoning researchers have a unique opportunity to lever this identity crisis into gaining the same outreach as JDM and moral cognition. In this final section, I consider three possible ways to do so:

- Use the language of probability and utility to study reasoning in the same specific *domains* that gave JDM and moral cognition much of their applied traction (e.g., health, finance, the environment).
- Investigate reasoning performance in *intuitive- and analytic-adverse* situations, as identified by the dual-process models common to reasoning, JDM, and moral cognition.
- Embrace the identity crisis and adopt a systematic, integrative approach to reasoning, JDM, and moral judgement.

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<sup>3</sup>One famous exception is the use of the selection task by evolutionary psychologists (Cosmides, 1989).

## High-stakes domains

The Case Studies section showed that JDM and moral cognition research could and did contribute to a vast array of important applied issues. Arguably, this capacity is partly due to JDM and moral cognition research not limiting themselves to abstract problems. Indeed, although there is no lack of research on abstract lottery choices or abstract moral dilemmas, students of JDM and moral cognition also regularly investigate concrete problems, rooted in important domains such as health, justice, or environmental sustainability.

In contrast, the psychology of reasoning has been more likely to limit itself to abstract problems, keeping the contents of the premises as neutral as possible. This constraint made sense within the deduction paradigm, in which content effects were likely to be treated as noise, just as they once were in memory research. As a consequence, the deduction paradigm made it odd to investigate specific domains such as *deductions about health* or *deductions about environmental sustainability*.

One additional reason why the deduction paradigm did not investigate reasoning in high-stakes, specific domains was its weak descriptive power. Within the deduction paradigm, propositions are *true or false* (and nothing in between) and of *neutral valence* (and nothing on either side). These two constraints make it hard to represent the kind of problems that reasoners tackle when they think of climate change, health care, or the financial crisis. If we are to study reasoning in these domains we must be able to describe the probability and utility of propositional contents such as “climate change results from human activity” or “unnecessary prescriptions of antibiotics increases the resistance of pathogens”. Although this was very difficult within the deduction paradigm, the new paradigm has given us the tools we need.

In sum, the deduction paradigm made it both irrelevant and impractical to study reasoning in specific domains such as health, finance, and environmental sustainability. JDM and moral cognition research did not operate under such constraints, and their investigations of specific, high-stakes domains, gave them much of their applied traction. The new paradigm has cleared the way for the psychology of reasoning to investigate similar domains.

## Intuitive- and analytic-adverse situations

Dual-process models assume that beliefs, attitudes, and decisions can reflect the engagement of automatic Type 1 processes, or reflective Type 2 processes, but they are usually agnostic about whether Type 1 or Type 2 processes tend to deliver the best output. Depending on the content and context of the problem at hand, either Type 1 or Type 2 processing might be instrumental in a successful resolution. Accordingly, if we seek to help people to

think better, we need to identify the risk factors for Type 1 processing (i.e., intuitive-adverse situations), the risk factors for Type 2 processing (i.e., analytic-adverse situations), and the problems which specifically require intact Type 1 or Type 2 processing. Note that a risk factor is simply a context that increases the likelihood of using either Type 1 or Type 2 processes inappropriately. This terminology should not invite the implicit assumption that Type 2 processing is inherently better than Type 1 processing.

This dual-process-driven identification of specific risk factors is already common in JDM and moral cognition research. The JDM literature pinpointed populations which are specifically at risk for impaired Type 2 processing, for example older adults (E. Peters, Hess, Västfjäll, & Auman, (2007) ) or ADHD patients (Mäntylä, Still, Gullberg, & Del Missier, 2012). In parallel, other research identified analytic-adverse contexts which can disrupt Type 2 processing in the general population, such as circadian mismatching (making a decision at an off-peak time of the day; Dickinson & McElroy, 2012). Conversely, other populations have been shown to be at risk for impaired Type 1 processing of emotions, with detrimental effects on decisions (e.g., manic patients showing impaired performance on the Iowa Gambling Task; Adida et al., 2008).

Similarly, moral cognition research identified populations at risk for Type 1 processing, and more specifically for atypical integration of emotions in moral judgement, such as polysubstance-dependent individuals (Carmona-Perera, Verdejo-García, Young, Molina-Fernández, & Pérez-García, 2012), or antisocial personalities (Bartels & Pizarro, 2011). Moral cognition research also identified contextual factors leading to similar disruptions of Type 1 processing (e.g., sleep deprivation; Killgore et al., 2007) or Type 2 processing (e.g., stress or mortality salience; Trémolière et al., 2012; Youssef et al., 2012).

In sum, JDM and moral cognition research levered dual-process models in order to identify specific risk factors, either in terms of populations or contexts. Identifying which type of cognitive processing is impaired in a given population or context makes it easier to develop interventions or protocols aimed at repairing cognition and improving rational thought. By adopting a dual-process framework (broadly comparable to that used in JDM and moral cognition research), the New Paradigm psychology of reasoning has created opportunities to develop similar protocols and interventions, aimed at repairing reasoning in intuitive-and analytic-adverse situations.

### An integrative approach

Now that it has abandoned its focus on deduction, the psychology of reasoning faces an identity crisis. The inputs of reasoning experiments have become very similar to the inputs of JDM and moral cognition experiments: all three

fields present individuals with information about the probability and utility of various states of the world. In similar vein, the manipulations and covariates used in reasoning experiments have become very similar to that used in JDM and moral cognition experiments: all three fields draw on dual-process frameworks that utilise time pressure, concurrent cognitive load, correlations with individual differences measures, and brain imaging.

Reasoning experiments still differ from JDM and moral cognition experiments in terms of measured output. Reasoning experiments focus on the formation of beliefs, whereas JDM and moral cognition experiments focus on the formation of decisions and attitudes, respectively. Accordingly, one way for the psychology of reasoning to retain its distinct identity would be to put strong emphasis on this difference in output. Another road for the field, though, would be to fully embrace its identity crisis, and to extend its investigations to decisions and attitudes, in addition to beliefs.

Indeed, JDM and moral cognition are already converging at a fast pace. For example, a rapidly growing literature in JDM research is currently investigating decisions that involve moral attitudes. Within that line of research, economists and psychologists alike have given considerable attention to the phenomenon of *moral wiggle room*; that is, the preference that some individuals have not to appear selfish in their own eyes, when they make an economic decision (Dana, Weber, & Kuang, 2007). In parallel, recent models have given equal footing to moral rules and cost–benefit analysis as predictors of individual economic decisions (Bennis, Medin, & Bartels, 2010). Furthermore, moral cognition research is progressively downplaying the distinction between moral and non-moral cognitive processes. For example, Shenav and Greene (2010) showed that moral decisions that feature both probabilities and utilities appear to depend on the same neural circuitry as non-moral, economic decisions: Brain regions that track probability are the same whether the problem is moral or not, and the same goes for brain regions that track utility. In like vein, Cushman and Young (2011) suggested that many patterns of moral judgement derived from the non-moral psychological processes already evidenced in JDM research.

In view of this rapid convergence between JDM and moral cognition research it would seem ill-advised to maintain a strong separation between these two fields and reasoning research. The psychology of reasoning should rather embrace its identity crisis, and seek to close the gap between inferences, decisions, and attitudes. One way to close this gap would be to give more attention to the inferences that reasoners derive *from* decisions and attitudes, and to the inferences that reasoners derive *about* decisions and attitudes. While this strategy will not have the same immediate applied impact as the two other strategies we reviewed in this section, it is the one that will likely lead to the greatest long-term benefits, inside and outside the field.

## CONCLUSION

Three case studies suggested that the psychology of reasoning failed to make itself as relevant to the welfare of humanity as its closest fields, JDM and moral cognition research. This state of affairs is arguably the legacy of the deduction paradigm that long dominated the field, and things might change for the better with the advent of a new paradigm. On the basis of its three pillars (probability, utility, and dual processes), this new paradigm has largely blurred the boundaries between reasoning, JDM, and moral cognition. As a consequence the psychology of reasoning has acquired brand new opportunities to investigate high-stakes domains and risk factors, and to pursue full integration with JDM and moral cognition. These new opportunities will likely bring a rapid increase in the relevance of reasoning research to people's daily challenges and societies' greater ambitions.

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