The Handbook of Rationality

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15.2 Rationality and Intelligence

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Summary

There are individual differences in rational thinking that are less than perfectly correlated with individual differences in intelligence because intelligence and rationality occupy different conceptual locations in models of cognition. A tripartite extension of currently popular dual-process theories is presented in this chapter that illustrates how intelligence and rationality are theoretically separate concepts. The chapter concludes by showing how this tripartite model of mind, taken in the context of studies of individual differences, can help to resolve the Great Rationality Debate in cognitive science—the debate about how much irrationality to attribute to human cognition.

1. What Intelligence Is—and Why It Is Not the Same as Rationality

Because both intelligence and rationality have a plethora of definitions that differ across the various disciplines, it is not surprising that our chapter will begin with some definitional clarifications. We take our definitions from cognitive science, so those defaulting to other fields and disciplines may be confused if they insist on stipulating definitions we are not using. Also, if rationality and intelligence are to be compared and contrasted, each must be defined at a similar grain size, which we do in this chapter. That is, rationality defined in some ways would be a category error if directly compared with intelligence. Because intelligence is an individual difference concept to a psychologist, rationality must be too. That rules out certain definitions that are popular in philosophy and in lay discourse.

We get surprised when someone whom we consider to be smart acts stupidly. When someone we consider to be not so smart acts stupidly, we tend not to be so surprised. But why should we be so surprised in the first case? A typical dictionary definition of the adjectival form of the word "smart" is "characterized by sharp quick thought; bright" or "having or showing quick intelligence or ready mental capacity." Thus, being smart seems a lot like being intelligent, according to the dictionary. Dictionaries also tell us that a stupid person is "slow to learn or understand; lacking or marked by lack of intelligence." Thus, if a smart person is intelligent and "stupid" means a lack of intelligence, then the "smart person being stupid" phrase seems to make no sense.

However, a secondary definition of the word "stupid" is "tending to make poor decisions or careless mistakes"—a phrase that attenuates the sense of contradiction. Thus, the phrase "smart but acting dumb"—intelligent people taking injudicious actions or holding unjustified beliefs—means that folk psychology is picking out two different traits: mental brightness (intelligence) and making judicious decisions (rational thinking). If we were clear about the fact that the two traits are different, the sense of paradox or surprise at the "smart but acting foolish" phenomenon would vanish. What perpetuates the surprise is that we tend to think of the two traits as one, or at least that they should be strongly associated. The confusion is fostered because psychology has a measurement device for the first (the intelligence test) but not the second. Psychology has a long and storied history (over one hundred years old) of measuring the intelligence trait. Although there has been psychological work on rational thinking, this research started much later and was not focused on individual differences.

Many treatments of the intelligence concept could be characterized as permissive rather than grounded conceptualizations. Permissive theories include in their definitions of intelligence aspects of functioning that are captured by the vernacular term "intelligence" (adaptation to the environment, showing wisdom, creativity, etc.) whether or not these aspects are actually measured by existing tests of intelligence. Grounded theories, in contrast, confine the concept of intelligence to the set of mental abilities actually tested on IQ tests. Adopting permissive definitions of the concept of intelligence serves to obscure what is absent from extant IQ tests. Instead, in order to highlight the missing elements in IQ tests, we adopt a thoroughly grounded notion of the intelligence concept in this chapter—one that anchors the concept in what actual IQ tests measure. Likewise, we ground the concept of rationality in operationalizations from current cognitive science.

2. Intelligence and Rationality in Cognitive Science

The closest thing to a consensus, grounded theory of intelligence in psychology is the Cattell–Horn–Carroll (CHC) theory of intelligence (Carroll, 1993; Cattell, 1963, 1998; Horn & Cattell, 1967). It yields a scientific concept of general intelligence, usually symbolized by *g*, and a small number of broad factors, of which two are dominant. Fluid intelligence reflects reasoning abilities operating across a variety of domains—including novel ones. It is measured by tests of abstract thinking such as figural analogies, Raven Matrices, and series completion. Crystallized intelligence reflects declarative knowledge acquired from acculturated learning experiences. It is measured by vocabulary tasks, verbal comprehension, and general knowledge measures.

"Rationality" is a tortuous and tortured term in intellectual discourse (Stanovich, West, & Toplak, 2016). Many philosophical notions of rationality are crafted so as to equate all humans—thus, by fiat, defining away the very individual differences that a psychologist wishes to study. In contrast, rationality in the sense employed in cognitive science—and in this book—is a normative notion. Rationality thus comes in degrees defined by the distance of the thought or behavior from the optimum defined by a normative model (Etzioni, 2014). Thus, when a cognitive scientist terms a behavior less than rational, he or she means that the behavior departs from the optimum prescribed by a particular normative model.

We follow many cognitive science theorists in recognizing two types of rationality, instrumental and epistemic (Manktelow, 2004; Over, 2004). The simplest definition of instrumental rationality is the following: behaving in the world so that you get exactly what you most want, given the resources (physical and mental) available to you. Epistemic rationality concerns how well beliefs map onto the actual structure of the world.

More formally, economists and cognitive scientists define instrumental rationality as the maximization of expected utility. Expected utility is calculated by taking the utility of each outcome and multiplying it by the probability of that outcome occurring and then summing those products over all of the possible outcomes. In practice, assessing rationality in this computational manner can be difficult because eliciting personal probabilities can be tricky. Also, getting measurements of the utilities of various consequences can be experimentally difficult. Fortunately, there is another useful way to measure the rationality of decisions and deviations from rationality. It has been proven through several formal analyses that if people's preferences follow certain consistent patterns (the so-called axioms of choice), then they are behaving as if they are maximizing utility (Dawes, 1998; Edwards, 1954; Jeffrey, 1983; Luce & Raiffa, 1957; Savage, 1954; von Neumann & Morgenstern, 1944). These analyses have led to what has been termed the axiomatic approach to whether people are maximizing utility. It is what makes people's degrees of rationality more easily measurable by the experimental methods of cognitive science. The deviation from the optimal choice pattern according to the axioms is an (inverse) measure of the degree of rationality.

A substantial research literature—one comprising literally hundreds of empirical studies conducted over several decades—has firmly established that people's responses sometimes deviate from the performance considered normative on many reasoning tasks. For example, people assess probabilities incorrectly, they test hypotheses inefficiently, they violate the axioms of utility theory, they do not properly calibrate degrees of belief, their choices are affected by irrelevant context, they ignore the alternative hypothesis when evaluating data, and they display numerous other information-processing biases (Baron, 2008, 2014; Evans, 2014; Kahneman, 2011; Stanovich, 1999, 2011; Stanovich et al., 2016). Much of the operationalization of rational thinking in cognitive science comes from the heuristics and biases tradition, inaugurated by Kahneman and Tversky in the early 1970s (Kahneman & Tversky, 1972, 1973; Tversky & Kahneman, 1974). Thus, as measures of rationality, the tasks in the heuristics and biases literature, while tapping intelligence in part, actually encompass more cognitive processes and knowledge than are assessed by IQ tests. In the next section, we will outline the functional cognitive theory that we will use to interpret the rational thinking tasks in this literature and show how they relate to intelligence. We will show that rationality is actually a more encompassing mental construct than is intelligence.

3. Dual-Process Theory: The First Step toward a Model of Cognitive Architecture

There is a wide variety of evidence that has converged on the conclusion that some type of dual-process model of the mind is needed in a diverse set of specialty areas not limited to cognitive psychology, economics, social psychology, naturalistic philosophy, decision theory, and clinical psychology (Chein & Schneider, 2012; De Neys, 2018; Evans, 2008, 2010, 2014; Evans & Stanovich, 2013; Sherman, Gawronski, & Trope, 2014; Stanovich, 1999, 2004). Because there is now a plethora of dual-process theories (see Stanovich, 2011, 2012, for a list of the numerous versions of such theories), there is currently much variation in the terms for the two processes. For the purposes of this chapter, we will most often adopt the Type 1/Type 2 terminology discussed by Evans and Stanovich (2013) and occasionally use the similar System 1/System 2 terminology of Stanovich (1999) and Kahneman (2011). The defining feature of Type 1 processing is its autonomy—the execution of Type 1 processes is mandatory when their triggering stimuli are encountered, and they are not dependent on input from high-level control systems. Autonomous processes have other correlated features—their execution tends to be rapid, they do not put a heavy load on central processing capacity, and they tend to be associative—but these other correlated features are not defining (Stanovich & Toplak, 2012).

In contrast with Type 1 processing, Type 2 processing is nonautonomous. It is relatively slow and computationally expensive. Many Type 1 processes can operate at once in parallel, but Type 2 processing is largely serial. One of the most critical functions of Type 2 processing is to override Type 1 processing. This is because Type 1 processing heuristics depend on benign environments providing obvious cues that elicit adaptive behaviors. In hostile environments, reliance on heuristics can be costly (see Hilton, 2003; Over, 2000; Stanovich, 2004).

Once detection of the conflict between the normative response and the response triggered by System 1 has taken place (De Neys & Pennycook, 2019; Stanovich, 2018), Type 2 processing must display at least two related capabilities in order to override Type 1 processing. One is the capability of interrupting Type 1 processing. The second is to enable processes of hypothetical reasoning and cognitive simulation that are a unique aspect of Type 2 processing (Evans, 2007, 2010; Evans & Stanovich, 2013). In order to reason hypothetically, we must, however, have one critical cognitive capability—we must be able to prevent our representations of the real world from becoming confused with representations of imaginary situations. The so-called cognitive decoupling operations (Stanovich, 2011; Stanovich & Toplak, 2012) are the central feature of Type 2 processing that make this possible, and they have implications for how we conceptualize both intelligence and rationality, as we shall see. The important issue for our purposes is that decoupling secondary representations from the world and then maintaining the decoupling while simulation is carried out is a Type 2 processing operation. It is computationally taxing and greatly restricts the ability to conduct any other Type 2 operation simultaneously.

A preliminary dual-process model of mind, based on what we have outlined thus far, is presented in figure 15.2.1. The figure shows the Type 2 override function we have been discussing, as well as the Type 2 process

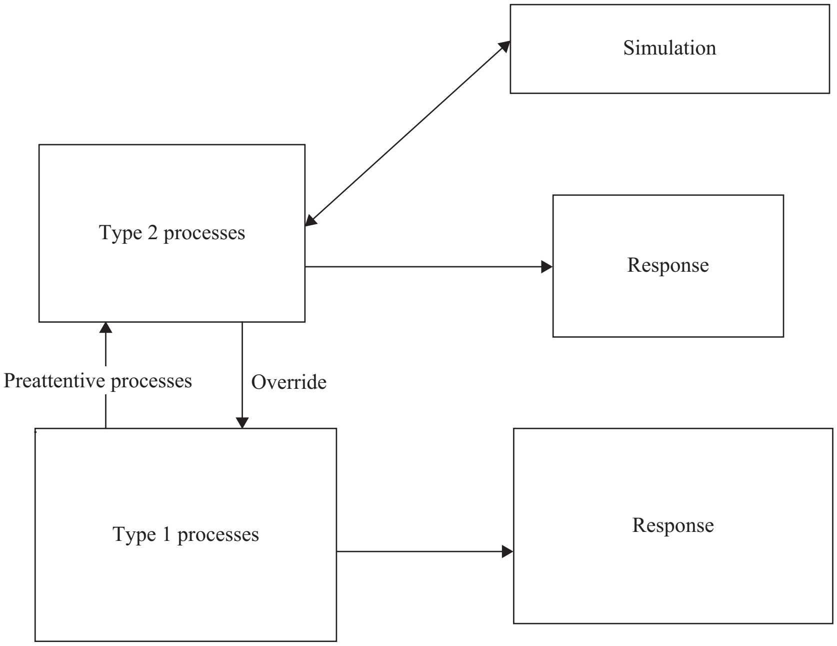

Figure 15.2.1
A preliminary dual-process model.

of simulation. Also rendered in the figure is an arrow indicating that Type 2 processes receive inputs from Type 1 computations. These so-called preattentive processes (Evans, 2008) establish the content of most Type 2 processing.

4. Differentiating Type 2 Processes: The Reflective and Algorithmic Minds

In this section, we will explain why rational thinking stresses a level in the hierarchical control system of the brain that is only partly tapped by IQ tests. This is because the override mechanism depicted in figure 15.2.1 needs to be conceptualized in terms of two levels of processing—what are sometimes termed the algorithmic and reflective levels of processing (Stanovich, 2011).

Our attempt to differentiate the two levels of control involved in Type 2 processing is displayed in figure 15.2.2. The psychological literature provides much converging evidence and theory to support such a structure. First, psychometricians have long distinguished typical performance situations from optimal (sometimes termed "maximal") performance situations (Ackerman & Kanfer, 2004). Typical performance measures implicate, at least in part, the reflective mind—they assess goal prioritization and epistemic regulation. In contrast, optimal performance situations are those where the task interpretation is determined externally. The person performing the task is told the rules that maximize performance. Thus, optimal performance tasks assess questions of the efficiency of goal pursuit—they capture the processing efficiency of the algorithmic mind. All tests of intelligence or cognitive aptitude are optimal performance assessments, whereas measures of critical or rational thinking are often assessed under typical performance conditions.

The difference between the algorithmic mind and the reflective mind is captured in another well-established distinction in the measurement of individual differences—the distinction between cognitive ability (intelligence) and thinking dispositions. The former are, as just mentioned, measures of the efficiency of the algorithmic mind. The latter travel under a variety of names in psychology—thinking dispositions or cognitive styles being the two most popular. Examples of some thinking dispositions relevant to rationality that have been investigated by psychologists are actively open-minded thinking, need for cognition, consideration of future consequences, need for closure, and dogmatism (see Stanovich et al., 2016).

In short, measures of individual differences in thinking dispositions are assessing variation in people's goal management, epistemic values, and epistemic self-regulation—differences in the operation of the reflective mind. People have indeed come up with definitions of intelligence that encompass the reflective level of processing, but nevertheless, the actual measures of intelligence in use assess only algorithmic-level cognitive capacity.

Figure 15.2.2 represents the classification of individual differences in the tripartite view. The broken horizontal line represents the location of the key distinction in older, dual-process views. Figure 15.2.2 identifies variation in fluid intelligence with individual differences in the efficiency of processing of the algorithmic mind. To a substantial extent, fluid intelligence measures the ability to cognitively decouple—to suppress Type 1 activity and to enable hypothetical thinking. The raw ability to sustain such simulations while keeping the

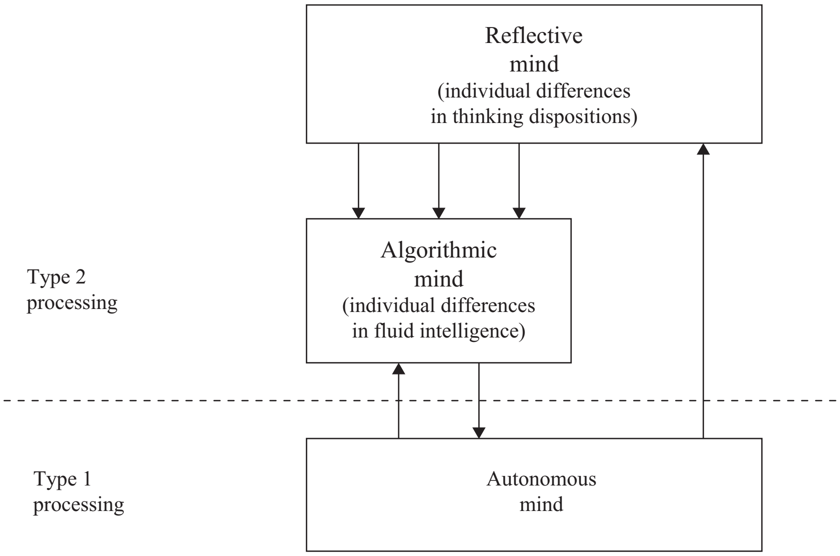

Figure 15.2.2
The tripartite structure and the locus of individual differences.

relevant representations decoupled is one key aspect of the brain's computational power that is being assessed by measures of fluid intelligence. This is becoming clear from converging work on executive function and working memory, which both display correlations with fluid intelligence that are quite high (Duncan et al., 2008; Jastrzębski, Ciechanowska, & Chuderski, 2018; Stanovich et al., 2016). This is because most measures of executive function, such as working memory, are direct or indirect indicators of a person's ability to sustain decoupling operations. Thus, Type 2 processes are strongly associated with fluid intelligence. Finally, the reflective mind is identified with individual differences in thinking dispositions related to beliefs and goals.

5. Why Rationality Is a More Encompassing Construct than Intelligence

Figure 15.2.2 highlights an important sense in which rationality is a more encompassing construct than intelligence: as previously discussed, to be rational, a person must have well-calibrated beliefs and must act appropriately on those beliefs to achieve goals—both of these depend on the thinking dispositions of the reflective mind. The types of cognitive propensities that these thinking disposition measures reflect are the tendency to collect information before making up one's mind, the tendency to seek various points of view before coming to a conclusion, the disposition to think extensively about a problem before responding, the tendency to calibrate the strength of one's opinion to the degree of evidence available, the tendency to think about future consequences before taking action, the tendency to explicitly weigh pluses and minuses of situations before making a decision, and the tendency to seek nuance and avoid absolutism.

In order to achieve both epistemic and instrumental rationality, an individual must also, of course, have the algorithmic-level machinery that enables him or her to carry out the actions and to process the environment in a way that enables the correct beliefs to be fixed and the correct actions to be taken. Thus, individual differences in rational thought and action can arise because of individual differences in fluid intelligence (the algorithmic mind) or because of individual differences in thinking dispositions (the reflective mind), or from a combination of both.

To put it simply, the concept of rationality encompasses thinking dispositions and algorithmic-level capacity, whereas the concept of intelligence (at least as it is commonly operationalized) is largely confined to algorithmic-level capacity. Intelligence tests do not attempt to measure aspects of epistemic or instrumental rationality, nor do they examine any thinking dispositions that relate to rationality. Thus, as long as variation in thinking dispositions is not perfectly correlated with variation in fluid intelligence, there is the statistical possibility of rationality and intelligence explaining at least partially separable variance.

In fact, substantial empirical evidence indicates that individual differences in thinking dispositions and intelligence are far from perfectly correlated. Studies (e.g., Ackerman & Heggestad, 1997; Cacioppo, Petty, Feinstein, & Jarvis, 1996) have indicated that measures of intelligence display only moderate-to-weak correlations with some thinking dispositions (e.g., actively open-minded thinking, need for cognition) and near-zero correlations with others (e.g., conscientiousness, curiosity, diligence). Other important evidence supports the conceptual distinction made here between algorithmic cognitive capacity and thinking dispositions. For example, across a variety of tasks from the heuristics and biases literature, it has consistently been found that rational thinking dispositions will predict variance after the effects of general intelligence have been controlled (for a discussion and citations, see Stanovich et al., 2016).

6. The Fleshed-Out Model

The functions of the different levels of control are illustrated more completely in figure 15.2.3. There, it is clear that the override capacity itself is a property of the algorithmic mind, and it is indicated by the arrow labeled A. However, previous dual-process theories have tended to ignore the higher-level cognitive operation that initiates the override function in the first place. This is a dispositional property of the reflective mind that is related to rationality. In the model in figure 15.2.3, it corresponds to arrow B, which represents the instruction to the algorithmic mind to override the Type 1 response by taking it offline. This is a different mental function than the override function itself (arrow A), and the evidence cited above indicates that the two functions are indexed by different types of individual differences.

The override function has loomed so large in dual-process theory that it has somewhat overshadowed the simulation process that computes the alternative response that makes the override worthwhile. Thus, figure 15.2.3 explicitly represents the simulation function as well as the fact that the instruction to initiate simulation originates in the reflective mind. The decoupling operation itself (indicated by arrow C) is carried out by the algorithmic mind. The instruction to initiate

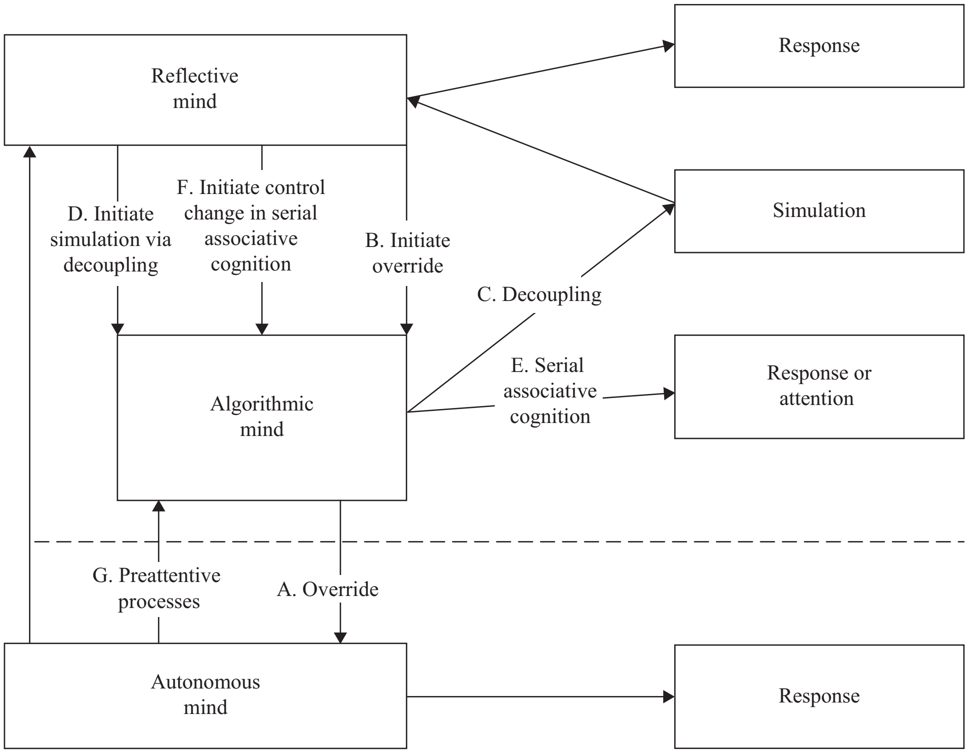

Figure 15.2.3
A more complete model of the tripartite structure.

simulation (indicated by arrow D) is carried out by the reflective mind. Again, two different types of individual differences are associated with the initiation call and the decoupling operator—specifically, thinking dispositions with the former and fluid intelligence with the latter. Also represented is the fact that the higher levels of control receive inputs from the autonomous mind (arrow G) via so-called preattentive processes.

The arrows labeled E and F reflect the decoupling and higher-level control of a kind of Type 2 processing (serial associative cognition) that does not involve fully explicit cognitive simulation, but we will not review its function here (see Stanovich, 2011). In figure 15.2.3, we can now identify a third function of the reflective mind: initiating an interrupt of serial associative cognition (arrow F). This interrupt signal alters the next step in a serial associative sequence that would otherwise direct thought. This interrupt signal might stop serial associative cognition altogether in order to initiate a comprehensive simulation (arrow C) or start a new serial associative chain (arrow E) from a different starting point.

Although taking the Type 1 response priming offline might itself be procedural, the process of synthesizing an alternative response often utilizes stored knowledge of various types. During the simulation process, declarative knowledge and strategic rules (linguistically coded strategies) are used to transform a decoupled representation. The knowledge, rules, procedures, and strategies that can be retrieved and used to transform decoupled representations have been referred to as “mindware,” a term coined by David Perkins in a 1995 book. The mindware available for use during cognitive simulation is in part the product of past learning experiences.

Because the Cattell–Horn–Carroll (CHC) theory of intelligence is one of the most comprehensively validated theories of intelligence available, it is important to see how two of its major components miss critical aspects of rational thought. Fluid intelligence will, of course, have some relation to rationality because it indexes the computational power of the algorithmic mind to sustain decoupling. Because override and simulation are important operations for rational thought, fluid intelligence will definitely facilitate rational action in some situations. Nevertheless, the tendency to initiate override (arrow B in figure 15.2.3) and to initiate simulation activities (arrow D in figure 15.2.3) are both aspects of the reflective mind not assessed by intelligence tests, so the tests will miss these components of rationality. Such propensities are instead indexed by measures of typical performance (cognitive styles and thinking dispositions) as opposed to measures of maximal performance such as IQ tests.

The situation with respect to crystallized intelligence is a little different. Rational thought depends critically on the acquisition of certain types of knowledge. That knowledge would, in the abstract, be classified as crystallized intelligence. But is it the kind of crystallized knowledge that is assessed on actual tests of intelligence? The answer is "no." The knowledge structures that support rational thought are specialized. They cluster in the domains of probabilistic reasoning, causal reasoning, and scientific reasoning. In contrast, the crystallized knowledge assessed on IQ tests is deliberately designed to be nonspecialized. The designers of the tests, in order to make sure the sampling of vocabulary and knowledge is fair and unbiased, explicitly attempt to broadly sample vocabulary, verbal comprehension domains, and general knowledge. In short, crystallized intelligence, as traditionally measured, does not assess individual differences in rationality.

Finally, there is one particular way the autonomous mind supports rationality that we would like to emphasize. It is that the autonomous mind contains rational rules and normative strategies that have been tightly compiled and are automatically activated due to overlearning and practice. This means that, for some people, in some instances, the normative response emanates directly from the autonomous mind rather than from the more costly Type 2 process of simulation.

Figure 15.2.4 illustrates more clearly the point we wish to make here. This figure has been simplified by the removal of all the arrow labels and the removal of the boxes representing serial associative cognition, as well as the response boxes. In the upper right is represented the accessing of mindware that is most discussed in the literature. In the case represented there, a nonnormative response from the autonomous mind has been interrupted, and the computationally taxing process of simulating an alternative response is under way. That simulation involves the computationally expensive process of accessing mindware for the simulation.

In contrast to this type of normative mindware access, indicated in the lower left of the figure, is a qualitatively different way that mindware can determine the normative response. The figure indicates the point we have stressed earlier: that within the autonomous mind can reside normative rules and rational strategies that have been practiced to automaticity and can automatically compete with (and often immediately defeat) any alternative nonnormative response that is also stored in the autonomous mind (De Neys & Pennycook, 2019; Stanovich, 2018).

So it should be clear from figure 15.2.4 that it does not follow from the output of a normative response that System 2 was necessarily the genesis of the rational responding. According to the model just presented, rationality requires three different classes of mental characteristics:

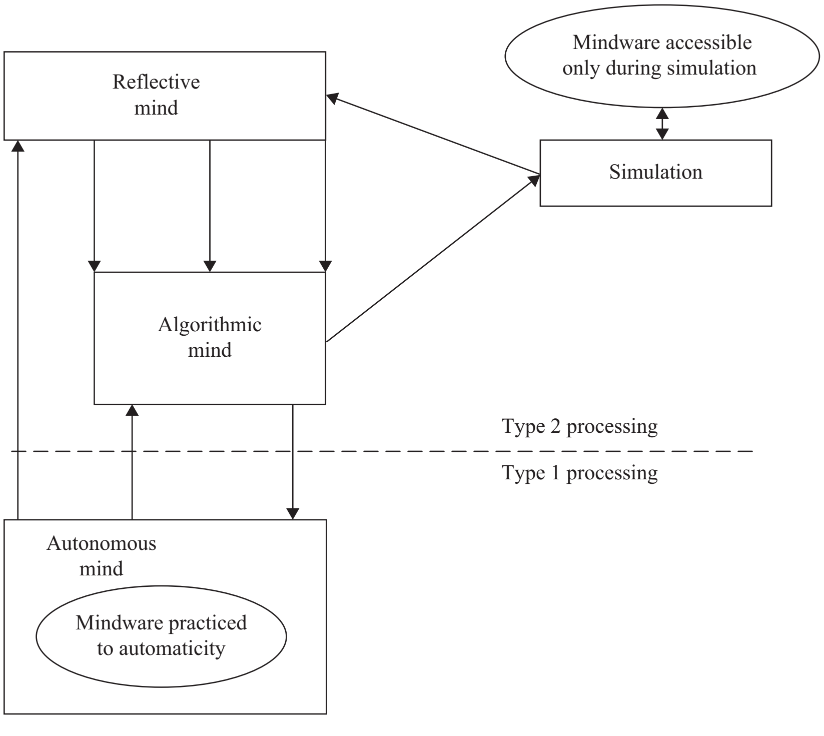

Figure 15.2.4
A simplified model showing both automatized mindware and mindware accessible during simulation.

first, algorithmic-level cognitive capacity (fluid intelligence) is needed for override and sustained simulation activities. Second, the reflective mind must be characterized by the tendency to initiate the override of suboptimal responses generated by the autonomous mind and to initiate simulation activities that will result in a better response. Finally, the mindware that allows the computation of rational responses needs to be available and accessible during simulation activities or be accessible from the autonomous mind because it has been highly practiced (see figure 15.2.4).

7. Our Tripartite Cognitive Architecture Reconciles the Opposing Positions in the Great Rationality Debate

Researchers working in the heuristics and biases tradition tend to be so-called Meliorists (Stanovich, 1999, 2004, 2010). They assume that human reasoning is not as good as it could be and that thinking could be improved. Thus, a Meliorist is one who feels that education and the provision of information could help make people more rational. This optimistic part of the Meliorist message derives from the fact that Meliorists see a large gap between normative models of rational responding and descriptive models of what people actually do. Over the past several decades, an alternative interpretation of the findings from the heuristics and biases research program has been championed. Contributing to this alternative interpretation have been philosophers, evolutionary psychologists, adaptationist modelers, and ecological theorists (Cohen, 1981; Cosmides & Tooby, 1996; Gigerenzer, 2007; Oaksford & Chater, 2007, 2012; Todd & Gigerenzer, 2000). They have reinterpreted the modal response in most of the classic heuristics and biases experiments as indicating an optimal information-processing adaptation on the part of the subjects. This group of theorists—who argue that an assumption of maximal human rationality is the proper default position to take—have been termed the Panglossians. The Panglossian theorists often argue either that the normative model being applied is not the appropriate one because the subject's interpretation of the task is different from what the researcher assumes it is or that the modal response in the task makes perfect sense from an evolutionary perspective. The contrasting positions of the Panglossians and Meliorists define the differing poles in what has been termed the Great Rationality Debate in cognitive science—the debate about how much irrationality to attribute to human cognition (Gigerenzer, 1996; Kahneman & Tversky, 1996; Kelman, 2011; Lee, 2006; Polonioli, 2015; Samuels & Stich, 2004; Stanovich, 1999, 2004; Stanovich & West, 2000; Stein, 1996).

A reconciliation of the views of the Panglossians and Meliorists is possible, however, if we take two scientific steps. First, we must consider data patterns long ignored in the heuristics and biases literature: individual differences on rational thinking tasks. Second, we must understand the empirical patterns obtained through the lens of the modified and updated dual-process theory we outlined in this chapter.

We have argued (Stanovich & West, 2000) that the statistical distributions of the types of goals being pursued by Type 1 and Type 2 processing are different. Specifically, there is a difference between the goals at the level of the gene and the goals at the level of the individual, and important consequences for the pursuit of rationality follow from this fact. The greater evolutionary age of some of the mechanisms underlying Type 1 processing accounts for why it more closely tracks ancient evolutionary goals (i.e., the genes' goals), whereas Type 2 processing instantiates a more flexible goal hierarchy that is oriented toward maximizing overall goal satisfaction at the level of the whole organism. Type 2 processing (especially at the reflective level) is more attuned to the person's needs as a coherent organism than is Type 1 processing. As a result, in the minority of cases where the outputs of the two systems conflict, people will often be better off if they can accomplish a system override of the Type 1–triggered output (the full argument is contained in Stanovich, 2004).

Instances when there is a conflict between the responses primed by Type 1 and Type 2 processing are thus interpreted as reflecting conflicts between two different types of optimization: fitness maximization at the subpersonal genetic level and utility maximization at the personal level. A failure to differentiate these interests is at the heart of the disputes between researchers working in the heuristics and biases tradition and their critics in the evolutionary psychology camp. First, it certainly must be said that the evolutionary psychologists are on to something with respect to the tasks they have analyzed, because in each case, the adaptive response is the modal response in the task—the one most subjects give. Nevertheless, this must be reconciled with a triangulating data pattern relevant to this discussion—an analysis of patterns of covariation and individual differences across these tasks. Specifically, we have found that cognitive ability often (but not always) dissociates from the response deemed adaptive from an evolutionary analysis (Stanovich & West, 1998, 1999, 2000).

The evolutionary psychologists are probably correct that most Type 1 processing is evolutionarily adaptive in the ancestral environment. Nevertheless, their evolutionary interpretations do not impeach the position of the heuristics and biases researchers that the alternative response given by the minority of subjects is rational at the level of the individual. Subjects of higher analytic intelligence are simply more prone to override Type 1 processing in order to produce responses that are epistemically and instrumentally rational. This rapprochement between the two camps was introduced by Stanovich (1999), and subsequent research has only reinforced it (see Kahneman & Frederick, 2002; Kelman, 2011; Samuels & Stich, 2004; Stanovich, 2004, 2011).

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