

## **A new test for rationality: Contributions and Outstanding Issues.**

### **Review of *The Rationality Quotient. Toward a Test of Rational Thinking***

By K.E. Stanovich, R.F. West, and M.E. Toplak, 2016, MIT Press.

Review by Laura Macchi and Maria Bagassi

Department of Psychology, University of Milano-Bicocca

[laura.macchi@unimib.it](mailto:laura.macchi@unimib.it)

maria.bagassi@unimib.it

Stanovich, West and Toplak have conducted a wide and deep investigation of individual differences in rational thinking processes. An analysis of the different components of rational thinking and how it differs from intelligence is proposed. The focus on the psychological mechanisms that underly rational thought represents the novelty of their approach.

The authors review the empirical literature on the nature of human judgment and decision making and theoretical discussions of rationality and intelligence in cognitive science, adopting an updated Dual Process approach. According to their perspective, rationality encompasses but does not identify with fluid intelligence, intended as a process mainly of decoupling, with working memory as indicator of a person's ability to sustain decoupling operations (algorithmic mind). Fluid intelligence is actually the necessary but not sufficient condition to guarantee rationality, since it depends on algorithmic efficiency as well as on thinking dispositions of the reflective mind (actively open-minded thinking, needed for cognition, conscientiousness, curiosity, diligence).

They use the theoretical concepts of epistemic and instrumental rationality in the literature of philosophy and decision science and the empirical work in the heuristics and biases tradition, since the skills of judgment and decision making are, according to the authors, the foundation of rational thought and action. The authors investigate the individual differences in rational thinking, bridging the gap between individual intelligence and the general human tendency toward biases and irrational thought.

Research on heuristics and biases shows violations of both instrumental rationality and epistemic rationality, which are due to the 'cognitive miserliness', the basic tendency of humans to default to processing mechanisms with low computational expense. The

authors use this literature to develop an assessment of rational thinking, called the Comprehensive Assessment of Rational Thinking (CART test). It is noteworthy that the authors claim that the components of rationality on the test (adaptive responding, behavioral adaptiveness, good judgment, and decision making) are not assessed by standard tests of intelligence. The rationality test should thus be able to detect the *thinking dispositions* of the reflective mind, concerned with the goals of the system, beliefs relevant to those goals, and the choice of action that is optimal given the system's goals and beliefs. Differently from the IQ, the Rationality Quotient measures the components of rational thought by the CART, which concerns probabilistic and scientific reasoning, the avoidance of miserly processing, and the knowledge structures needed for rational thinking. In the test, we are taken through paradigmatic issues such as 'cognitive reflection', base-rate and conjunction fallacies, verification bias, ratio bias and framing effect.

The aim of CART is important and justified, but the conception of rationality is still a very critical issue in the actual debate in the psychology of thinking. Rational thinking has a unique history grounded in philosophy and psychology, but what is rationality? Aware of the numerous rationality distinctions, the authors adopt a strong conceptual definition drawn from decision theory and cognitive science, as the distance of the thought or behaviour from the optimum defined by a normative model.

In doing that, the book proposes something very innovative, summarized in the "thinking dispositions", about the ability to identify relevant goals and beliefs, even if it still maintains the frame of the traditional logical-deductive paradigm of the psychology of thinking. Actually, the relevance of goals and beliefs depends on the normative theory.

### **Logical language vs. Natural language**

Traditionally, the psychology of thinking considered rational thinking as an abstract formal process, according to the logical-deductive paradigm that considered crucial extra-psychological disciplines as normative parameters and idealized models of thought.

It is worth noting that the development of formal logic, in fact, became a gradual process of "depsychologization" of logical language and of disambiguated simplification compared to natural language, intentionally pursued and programmatically declared by modern logic. The psychology of thought has inherited this tradition. Logic and natural language share a common aim, that of transmitting meaning efficaciously or, in other words, of

communicating, of expressing thought. However, this objective is achieved by these two language forms in opposite ways. Logic achieves a univocal communication, through simplification, eliminating any meanings that might interfere with the univocal meaning to be communicated, whereas natural language exploits the expressive richness of words. It avoids slipping into chaos and tripping over misunderstandings, by relying on the relevance of the meaning to the context.

They simply reflect different needs (in the first case, the need to ensure the efficacy of the communication; in the second, the need to guarantee the rigour of the inferential process). One of the constants in the history of logic is the tendency towards the elimination of psychological aspects and the simplification of the ambiguity of language (a justified simplification, but that is often anti-economic from a psychological point of view). Logical discourse derives from common or natural discourse by a process of differentiation which, in a certain sense, establishes it as a specialist discourse. The two systems are differentiated (and in this sense different), but not in the sense of being completely separate or lacking a common basis, and even less in the sense that they represent the opposition rationality/irrationality. There is no hierarchical order between conversational rules and logical rules, in the sense that the former are 'inferior' or subordinate to the latter. If this is the way things stand, it is in some respects unreasonable to expect subjects to formulate their responses on the basis of logic, and not according to the discursive rules.

What unavoidably emerged from the logical approach adopted by experimental psychology of thought was an unexpected counterpoint: the dilemma of how to explain a pervasive presence of errors, and discrepancies from the classical logic and the other normative disciplines (classical logic, probability theory, expected utility theory). This result has been considered a demonstration of our irrationality or natural tendency to adopt heuristics instead of exhaustive processing and to be misled by context and content of the task.

However, now this perspective is at the center of a debate. The psychology of thinking, by adopting a de-psychologized standard leaves outside some important psychological characteristics, such as sensitivity to context, content, implicit presuppositions and conversational rules, that instead to be considered as causes of biases have to be considered fundamental adaptive factors (at least as well the formal reasoning capacity), the bases of an "interactional intelligence". From this perspective many factors that were formerly seen as biases or shortcuts appear as legitimate inferences and rational

procedures (see for instance, the experiments on the 'postal employee' reported in Bagassi and Macchi, 2016 and Mosconi, 2016).

### **A relevance informed rationality and the interpretative function of thought**

An eclipse of the conception of a mind informed by extra-psychological theoretical models is in action, toward a less strong, but more 'genuinely' psychological conception of rationality. To cope with all the uncertainty in the real world, thinking must consider probabilities, implicit presuppositions, degrees of belief, in accordance to pragmatic conversational rules (see for instance experiments with a pragmatic approach to some paradigmatic tasks of judgment and decision making).

This issue can be further explored by revisiting the classic studies conducted on probabilistic reasoning with people trained in logic and mathematics, inviting further speculation about the type of cognitive capabilities of those gifted people who solved the same tasks without such training.

A first critical question emerges from an analysis of the results obtained by Tversky and Kahneman (1983) working with *informed* and even *sophisticated* subjects in the field of statistics. Paradoxically, when attempting to solve the well-known *Linda* problem, the majority of these subjects committed the *conjunction fallacy*. In our view, the fact that people trained in decoupling failed to recognize the inclusion rule, which is a relatively elementary logical rule, raises questions that need to be addressed. These results suggest that the skills of these subjects did not help them in focusing on the logical relationships of the items in the *Linda* problem. In this case, the misleading contextualization of the task, which focused on an irrelevant sketch of personality, hindered even statistically sophisticated subjects from grasping the intention of the experimenter concerning the inclusion-class rule.

We could further speculate that the few who gave the correct answer to the *Linda* problem (but also in the *Wason Selection Task*, or the syllogisms, see Bagassi and Macchi, 2016) had a particular aptitude for grasping the intention of the researcher and the aim of the task rather than the ability to decouple from contents and contexts. In doing so, they seem to reveal a special form of competence that does not seem to be overcoming the context of the task toward an abstract structure, but to overcome *the default context* toward an even more *relevant context*. We suggest that rational thinking could be seen as a form of sophisticated interpretative ability that permits the subject to decouple from the default interpretation and identify that which is most pertinent to the task on hand.

From our perspective, we wonder if the crucial concept of *thinking disposition* that considers “goals and beliefs relevant to those goals” has something to do with this interpretative function, informed by relevance. “Maximizing the thinking dispositions, as deliberativeness and belief flexibility, is *not* the criterion of rational thought itself. Rather, there must be a balance.” (p.28) Anyway, how to achieve the ‘balance’ is an open question. We suggest that this crucial goal can be reached by a maximization of relevance.

It would be important to introduce in the CART a test for pragmatic competence, given that in many tasks expertise did not influence the results, although a more felicitous pragmatic formulation of the tasks did produce more rational behavior. We could speculate that people who do well in the original tasks are high in pragmatic competence. From our perspective, the Reflection versus Intuition subtest of the Cart is functional to explore an important dimension of human rationality, involving insight problem solving (CRT problems). The insight problem solving does not appear to involve the working memory capacity, nor the conscious retrieval from memory of solutions to reproduce, but it requires of necessity a restructuring process, which could be seen as a *re-interpreting* process. The issue of human rationality is a controversial one, but it is important that it has been promoted a dialogue between different approaches.

## References

- Bagassi, M., & Macchi, L. (2006). Pragmatic Approach to Decision Making under Uncertainty: the Case of the Disjunction Effect. *Thinking & Reasoning*, 12(3), 329-350.
- Johnson-Laird, P. N., Legrenzi, P., & Sonino Legrenzi, M. (1972). Reasoning and a sense of reality. *British Journal of Psychology*, 63(3), 395–400.
- Hilton, D. J. (1995). The social context of reasoning: Conversational inference and rational judgment. *Psychological Bulletin*, 118, 248-271.
- Macchi, L. (1995). Pragmatic aspects of the base-rate fallacy. *The Quarterly journal of experimental psychology. A, Human experimental psychology*, 48(1), 188-207.

Macchi, L. (2000). Partitive formulation of information in probabilistic problems: Beyond heuristics and frequency format explanations. *Organizational Behavior and Human Decision Processes*, 82(2), 217-236.

Macchi, L., & Bagassi, M. (2007). The underinformative formulation of conditional probability. *The Behavioral and Brain Sciences*, 30(3), 274-275.

Macchi, L., & Bagassi, M. (2014). The interpretative heuristic in insight problem solving. *Mind & Society*, 13(1), 97–108.

Macchi, L., & Bagassi, M. (2015). When analytic thought is challenged by a misunderstanding. *Thinking & Reasoning*, 21(1), 147–164.

Macchi, L., Bagassi, M., & Passerini, G. (2006). *Biased communication and misleading intuition of probability*. International Workshop on “Intuition and affect in risk perception and decision making,” Bergen (Norway), November 3-4, oral presentation.

Mosconi, G., & D’Urso, V. (1975). *The selection task from the standpoint of the theory of double code*. In International Conference on “Selection Task,” Trento.

Passerini, G. Macchi, L. & Bagassi, M. (2012), A methodological approach to ratio bias. *Judgment and Decision Making*, 7 (5), 602–617.

Politzer, G. & Macchi, L. (2000). Reasoning and pragmatics. *Mind & Society*, 1(1), 73-93.

Sperber, D., Cara, F. & Girotto V. (1995). Relevance theory explains the selection task. *Cognition*, 57 (1):31-95.