Why is a typical proportion of incorrect solutions at least 30% for Cognitive Reflection Test tasks?

"If it takes 5 machines 5 minutes to make 5 widgets, how long it would take 100 machines to make 100 widgets?"

The Cognitive Reflection Test (CRT) serves as a measure to distinguish between the tendency to offer answers that align with either Type 1 or Type 2 information processing. In this brief essay, I will explore the reasons why nearly one-third of participants frequently provide incorrect answers to tasks that, at first glance, appear simple.

Type 1, or System 1, is characterized by "intuitive", "fast" thinking is the most prevalent in everyday life. According to the cognitive miser theory, humans tend to conserve cognitive resources whenever possible, which often results in reliance on heuristics. For instance, in the CRT, participants might apply the availability heuristic and use the first data they see (such as "100 machines, 100 widgets"), apply syllogistic logic and consequently arrive at the incorrect response (100 minutes).

System 2, in contrast, is traditionally perceived as uniquely human, rule-based and hypothetical thinking. Solutions to CRT tasks may arise from various cognitive mechanisms. Mental logic theories propose the application of a comprehensive set of formal rules, such as computation rules. Alternatively, individuals may engage mental models to visualize 5 machines working for 5 minutes to produce 5 widgets. Both mechanisms result in a realisation that a machine produces one widget per 5 minutes which simply extrapolates to 100 machines.

Within this theory, errors emerge when an inadequate System is employed for the task. This manifests in the reliance on automated reactions or heuristics when addressing the CRT.

But is intuitive thinking as flawed as it appears in CRT tasks? In real-life situations, System 1 often proves beneficial. Additionally, participants may deliberate on their answers and still utilize incorrect or incomplete logical rules, or inaccurate mental model estimations. If adaptability or correctness and speed of processing do not clearly differentiate Type 1 from Type 2, then what makes them distinct?

According to Krugalski and Gigerenze, not much. The unified theory conceptualizes "fast" and "slow" thinking as a spectrum and attributes errors to the selection of inappropriate rules rather than a System. Rules are not universally correct, nor are heuristics inherently flawed—their effectiveness depends on how well they are adapted to the context. The authors propose a two-step process: the task itself, along with the individual's familiarity with it, constrains the set of rules, while processing potential and perceived ecological rationality guide the final selection of the rule.

The unified theory helps explain why experienced chess players select the best moves in the current game state. However, how does it account for relatively the low success rate in the CRT? Even when participants deliberate on the problem, they may still choose the wrong answer because they do not recognize the most contextually appropriate rule. Several factors may contribute to this: lack of familiarity with such problems in real life, the complexity of tasks requiring advanced skills such as logical reasoning or mental modelling, and insufficient motivation or an underestimation of the task's complexity - all of those explainable by the unified theory.

Even if the participants deliberate on the task, they might choose the wrong answer, because they do not perceive the correct rule for the given context as the best. There can be many reasons for that, they might not step upon such problems in real life, so the familiarity with the task and the context is low. Furthermore, tasks are complex and often require highly developed skills such as logic, computation and/or mental modelling. Finally, people might not be motivated enough or underestimate the task (high complexity, low perceived required effort).

As demonstrated, many factors can account for the low success rate on the CRT. If individuals avoid settling on the first answer that comes to mind and engage in deeper reflection, they may arrive at an explanation that is more ecologically rational. However, intuition remains valuable when the ecological rationale is right.