More than just logic tasks: New Approaches to understanding Reasoning

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New Directions

Reasoning research has long been associated with paper and pencil tasks in which peoples' reasoning skills are judged against established normative conventions (e.g., Logic). In this way researchers have tried to assess the extent to which we can think rationally, and of course how we deviate from normative conventions. The "fruit flies" of this domain have been the Wason selection task (Wason, 1966), and Syllogistic reasoning tasks (Johnson-Laird, 1984). The field has advanced in helping us to understanding the influence of context on the kinds of inferences we tend to make, and we have gained significant insights into the kinds of situations in which our biased thinking is aligned with normative thinking and the situations in which it conflicts with it.

While such gains have led to proposals that the underlying mechanisms that support reasoning are highly adaptive, outside of reasoning research, the most commonly known findings are from classic paper and pencil tasks. The field has significantly moved on and the range of empirical methods developed to examine reasoning behavior has broadened along with the empirical tools for measuring patterns in our inductive and deductive thinking.

This symposium brings to the fore new pioneering research and findings with the aim of stimulating discussion on innovative methods that are currently used to shed new light on old issues (How biased are we? Is there a relationship between our intuitive and analytical thinking?). Moreover, the overview of these new approaches in the reasoning field will allow us to highlight the links with ongoing research in other fields (e.g., memory, cognitive control, general neuroscience) to the cognitive science community. This should help to boost much needed interdisciplinary research efforts. Moreover, the aim is to generate new insights into theoretical issues concerning the relationship between heuristic-based inferences and deliberative-based inferences, and the possible meta-cognitive processes thought to arbitrate between the two. The talks range from using priming techniques, functional magnetic resonance imaging (fMRI), electrodermal recordings (SCR), event-related potentials (ERP), repetitive transcranial magnetic stimulation (rTMS), and memory probing through to incorporating clinical populations.

Wim De Neys has been using fMRI, EEG, and SCR to examine bias detection during thinking, Taeko Tsujii's work using rTMS is the first of its kind to use this method to examine brain regions associated with belief-biased reasoning. Magda Osman has pioneered the use of supraliminal and subliminal priming methods in reasoning research to uncover the rational status of people's underlying reasoning behavior. Simon Handley's developmental work has established a new line of research that has revealed the absence of belief biased reasoning in a clinical population, which in turn has helped to establish critical processes in non-clinical populations that show the bias.

Wim De Neys

People are often biased by heuristic intuitions when solving classic reasoning tasks. A key question is whether people detect that their judgments are biased: Do people know that their heuristic judgments conflict with normative

considerations in these task? The line of research developed by Wim De Neys has used a variety of new behavioral (e.g., memory-based tasks), psychophysical (e.g., SCR), and neuro-imaging (e.g., fMRI, ERP) techniques to address this issue. In contrast with popular beliefs, these findings suggest that people detect the unwarranted nature of their heuristic judgments.

De Neys, W., Moyens, E., & Vansteenwegen, D. (2010). Feeling we're biased: autonomic arousal and reasoning conflict. *Cognitive, Affective, and Behavioral Neuroscience, 10*, 208-216.

De Neys, W., Vartanian, O., & Goel, V. (2008). Smarter than we think: When our brains detect that we are biased. *Psychological Science*, *19,* 483-489.

Magda Osman

Is our default reasoning process ultimately rational? The amassing evidence in reasoning research for the past fifty years would argue that people tend to automatically rely on heuristics which in many situations is sensible, but actually highly biased. To examine this, this talk discusses findings from a novel paradigm in which we use a combination of priming techniques to uncover how biased and deep rooted people's default reasoning is. The evidence suggests that actually when primed directly (primes are deliberately processed) and primed indirectly (primes are incidentally processed) people responded most effectively to primes that encouraged rational thinking.

Van Opstal, F., Gevers, W., Osman, M., & Verguts, T. (2010). Unconscious task application. *Consciousness and Cognition, 19*, 999-1006.

Osman, M. (2007). Can tutoring improve performance on a reasoning task under deadline conditions? *Memory & Cognition*, *35*, 342-351.

Taeko Tsujii

What is the relationship between brain and behavior when reasoning? Belief-bias is an experience based form of reasoning in which people recruit their prior knowledge about general features in the world to help them make inferences. The advantage of using (rTMS) is that brain regions can be selectively stimulated or disrupted in such a way as to reveal whether belief-biased effects are enhanced or inhibited. Tsujii and collaborators have, for the first time shown that disrupting IFC activity eliminated the belief-bias effect. These findings pave the way for significant insights into the neurological mechanisms that help support reasoning processes.

Tsujii, T., Masuda, S., Akiyama, T., & Watanabe, S. (2010). The role of inferior frontal cortex in belief-bias reasoning: An rTMS study. *Neuropsychologica*, *48*, 2005-2008.

Simon Handley

Much of our reasoning is informed by our prior knowledge and experience of the world. Thus, our beliefs help us make inferences about unfamiliar contexts by drawing from what we know already. The study of reasoning has been pivotal in demonstrating situations in which this type of inferential process are biasing our thinking. Recent work by Handley and collaborators has revealed that a participant population showing autism spectrum disorder (ASD) do not show the same kinds of biases that are typical of young adults.

Mckenzie, R., Evans, J. St. B. T., & Handley, S. J. (2010). Conditional reasoning in autism: activation and integration of knowledge and belief. *Developmental Psychology*, *46*, 391-403.

Morsanyi, K., Handley, S.J. & Evans J.S.B.T. (2010). Decontextualised minds: Adolescents with autism are less susceptible to the conjunction fallacy than typically developing adolescents. *Journal of Autism and Developmental Disorders*, *40*, 1378-1388.