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Mike Oaksford (Birkbeck College, University of London)
Valerie Thompson (University of Saskatchewan, Canada)
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Location:
Birkbeck College, University of London
Malet Street, Bloomsbury
London WC1E 7HX
Location: Room B33 (Coffee: B04)

The 10th London Reasoning Workshop: July 24 - 26, 2017, Rm. 532 (talks) Rm. 534 (Coffee)

The 10th London Reasoning Workshop
Monday 24th of July 2017

09:00-09:20	**Tea & Coffee in room 534**
9:20	**Welcome by Mike Oaksford**
	SYMPOSIUM 1: CULTURE AND REASONING
9:30-10:00	**Hatice Karaaslan, Annette Hohenberger, Hilmi Demir, Simon Hall, and Mike Oaksford** Linguistic relativity in informal argument evaluation: Source reliability, evidentiality and a Bayesian epistemic model
10:00-10:30	**Hiroshi Yama** Explanations for cultural differences in reasoning: Easterners' dialectical reasoning and Westerners' rule-based reasoning
10:30-11:00	**Tea & Coffee in room B534**
	SYMPOSIUM 2: META-REASONING
11:00 -11:30	**Shira Elqayam** Grounded rationality and meta-reasoning
11:30-12:00	**Rakefet Ackerman** How can we detect factors that may bias Meta-Reasoning judgments?
12:00-12:30	**Valerie Thompson** Can I do it or not? Judgments of solvability in anagram problem solving
12:30-14:00	**Lunch**
	SYMPOSIUM 3: CONDITIONAL REASONING
14:00-14:30	**Reuben Stern** Reifying Modus Ponens
14:30-15:00	**Lupita Estefania Gazzo Castaneda & Markus Knauff** The role of phrasing in conditional reasoning
15:00-15:30	**Karolina Krzyżanowska, Peter Collins, Ulrike Hahn** How to phrase a conditional with true antecedent and true consequent?
15:30-16:00	**Tea & Coffee in room B04**

SYMPOSIUM 4: NEW APPROACHES AND METHODS	
16:00-16:30	**Palfi, B., Szaszi, B., Kieslich, P. J., & Aczel, B** Tracking changes of mind
16:30-17:00	**Niall Galbraith** The effect of ontological mistakes upon reasoning
17:00-17:30	**Steffen Hölldobler** Bounded skeptical reasoning
17:30-18:00	**Steve Sloman** The community of knowledge and knowing what we don't know

The 10th London Reasoning Workshop
Tuesday 25th of July 2017

BBK, University of London, Malet Street, Bloomsbury, London WC1E 7HX, Location: Room 532

SYMPOSIUM 5: COUNTERFACTUALS	
09:30-10:00	**Shane Timmons and Ruth M. J. Byrne** Counterfactual and pre-factual thinking about morally elevating memories
10:00-10:30	**Célia Rasga and Ana Cristina Quelhas** A priori true and false counterfactual conditionals
10:30-11:00	**Tea & Coffee in room 534**
11:00-11:30	**David Over, Nicole Cruz, and Mike Oaksford** Dynamic reasoning with counterfactuals: Extending the Thompson-Byrne technique
11:30-12:00	**Ruth Byrne and Orlando Espino** Counterfactual conditionals and suppression
SYMPOSIUM 6: BAYESIAN LOGIC	
12:00-12:30	**Momme von Sydow** Bayesian logic as intensional logic and generalised Bayesian Occam's razor
12:30-14:00	**Lunch**
SYMPOSIUM 7: DUAL PROCESSES	
14:00-14:30	**Jonathan Evans** In defence of default interventionist dual process theory
14:30-15:00	**Brett K. Hayes, Rachel Stephens, John Dunn** Re-thinking single- and dual-process models of reasoning
15:00-15:30	**Rachel G. Stephens, Brett K. Hayes, John C. Dunn** Testing single- and dual-process models of reasoning
15:30-16:00	**Tea & Coffee in room 534**
16:00-16:30	**Bence Bago and Wim De Neys** The smart system 1: Evidence for the intuitive nature of correct responding in the bat-and-ball problem

SYMPOSIUM 8: MENTAL MODELS	
16:30-17:00	**Phil Johnson-Laird & Marco Ragni** What are the possibilities?
17:30	**WINE RECEPTION** ROOM 534
19:00	**DINNER AT OLIVELLI'S RESTAURANT** 35 Store Street

The 10th London Reasoning Workshop
Wednesday 26th of July 2017

BBK, University of London, Malet Street, Bloomsbury, London WC1E 7HX, Location: Room 532

SYMPOSIUM 9: EXPLANATION	
09:00-09:30	**Zachary Horne and Sangeet Khemlani** Principled connections underlie the inherence bias in explanatory reasoning
09:30-10:00	**Joanna Korman and Sangeet Khemlani** How people detect when an explanation is incomplete
10:00-10:30	**Patricia Mirabile and Igor Douven** Best, second best, and good enough explanations: How they matter to reasoning
10:30-11:00	**Tea & Coffee in room 534**
SYMPOSIUM 10: REASONING UNDER UNCERTAINTY	
11:00-11:30	**Nicole Cruz De Echeverria Loebell** Deduction in reasoning under uncertainty
11:30-12:00	**Niki Pfeifer** Modelling uncertain reasoning within mental probability logic
SYMPOSIUM 11: DEVELOPMENT OF REASONING	
12:00-12:30	**Margherita Daniele and Monica Bucciarelli** Children's utilitarian judgments to moral dilemmas
12:30-13:00	**Maggie E. Toplak, Richard F. West, and Keith E. Stanovich** The development of cognitive biases: Cross-sectional and longitudinal comparisons
CLOSE (COGSCI 2017 BEGINS)	

Fire instructions for students and visitors

Our fire alarms are tested between 08.00 and 08.40 on week-days.
Alarm tests involve intermittent bursts of sound of only a few seconds duration.

The main fire alarm is a *continuous* ringing bell or *continuous* siren in all Birkbeck buildings. When a *continuous* alarm sounds you must leave the building immediately.

There will be no other warning messages!

If you hear a continuous fire alarm

1. Leave the building immediately by the nearest exit. Do not delay to collect your belongings.
2. Do not use the lifts or the phone.
3. Follow the instructions of your tutor, course leader and/or fire marshals.
4. Move well away (100 metres) from the exits once outside
5. Do not stand in the road/street.
6. Do not re-enter the building unless told it is safe to do so

If you discover a fire

1. Operate the nearest fire alarm (red "break-glass" boxes on walls)
2. The Duty Attendant at Malet Street will be automatically contacted in every case and will immediately call the Fire Brigade.
3. Do not try to fight a fire unless you have been trained to use fire extinguishers.
4. Leave the building by the nearest exit

Explore the College. Get to know all the fire exit routes available to you. In the event of a fire you may need to use more than one.

Birkbeck's emergency number **555** may be dialled from any Birkbeck telephone (except Bedford and Tavistock Square) to **report** any safety/security emergency and/or to **request help. "555"** calls are routed to a dedicated 'phone manned at all times by a Duty Attendant who will summon the required assistance, by dialing 999 if need be. It is imperative that a **"555"** caller identifies him/herself, specifies the assistance required and states in which building and location in that building the emergency exists. Many classrooms and lecture theatres have phones within them for this and other purposes.

Thank you,
Birkbeck Fire Officer

Abstracts

***1. Phil Johnson-Laird (Princeton and New York Universities) & Marco Ragni (Albert-Ludwigs-Universität, Freiburg)**

Title: What are the possibilities?

Abstract:
Reasoning about possibilities is commonplace in daily life. It is formalized in modal logics, of which there are infinitely (sic) many. We outline a psychological theory of modal reasoning. It accounts for a variety of modal assertions, which include those with interpretations of *possibly* that form a rank-order scale and those with interpretations of *necessarily* that invoke explanations. It explains how people represent modal assertions in mental models, and how they use these models to make inferences. It reports experimental results that corroborate the theory. They establish that everyday reasoning differs from all modal logics: individuals make inferences that are invalid in all of them, and fail to make inferences that are valid in all of them. Finally, we discuss how inferences about possibilities could be a precursor to probabilistic reasoning.

***2. Steve Sloman**

Title: The Community of Knowledge and Knowing What We Don't Know.

***3. Shira Elqayam**

Title: Grounded rationality and meta-reasoning.

***4. Hiroshi Yama**

Title: Explanations for cultural differences in reasoning: Easterners' dialectical reasoning and Westerners' rule-based reasoning

Abstract
Since Peng and Nisbett (1999) showed Easterners' naïve dialectical thinking, which is contrasted with Westerners' rule-based thinking, many cross-cultural studies on human thinking have been conducted and explanations for the cultural differences have been proposed. Three possible explanations are discussed in this paper. The first is in the frame of Nisbett et al. (2001) that Easterners are more likely to use holistic cognition, whereas Westerners are more likely to use analytic cognition. This is related to the distinction between Westerners' independent self and Easterners' interdependent self. The second is based on the cultural tradition of Taoism, Confucianism, and Buddhism of China, which is contrasted with that of the philosophy of Ancient Greece. The third is based on the distinction between Westerners' low context culture and Easterners' high context culture (Hall, 1976). Finally, geographical and ecological factors are proposed for the distinction.

***5. Karolina Krzyżanowska**

Title: TBA

***6. Philipp Koralus**

Title: Bayesian updating in mental models.

Abstract
Bayesianism and mental model theory are often presented as explanatory paradigms that are fundamentally at odds. I present a model of probabilistic reasoning using mental models that allows for updating with data in a

Bayesian way but that also yields familiar fallacies. I propose that there is room for combining a Bayesian and a mental-model based outlook on human reasoning in a single explanatory paradigm.

***7. Margherita Daniele and Monica Bucciarelli**

Title: Children's utilitarian judgments to moral dilemmas

Abstract:
The mental model theory postulates that moral judgments rely on reasoning. In contrast, theories of moral grammar postulate that moral judgments rely on innate moral principles operating at an unconscious level; and the socio-intuitionist theory postulates that moral judgments come from immediate intuitions and emotions. We examined these predictions for children's moral judgments about the classical "trolley" dilemmas. The mental model theory implies that children should tend to rely on a single model of the possibility in which acting leads to killing one person to save five. They should therefore tend to be more utilitarian than adults, who can think about alternative possibilities. The theories of moral grammar imply that children and adults should rely on similar innate principles, and the social intuitions theory implies that children and adults should rely on the similar emotions. The results of a series of experiments corroborated the theory of mental models: children are more utilitarian than adults.

***8. Lupita Estefania Gazzo Castaneda & Markus Knauff**
Title: The role of phrasing in conditional reasoning

Abstract
Much research has been conducted to understand how people interpret, understand, and reason with conditionals. However, there is not much research on how differences in the phrasing of conditionals can affect their interpretation and the inferences drawn from them. We therefore present four experiments on the role of phrasing in conditional reasoning. In Experiment 1 we phrased conditionals either as universal or existential statements. In Experiments 2 and 3 we varied the specificity of conditionals and compared acceptability ratings for conditionals with specific (e.g., Jack) and non-specific agents (e.g., a person). Finally, in Experiment 4 we compared participants acceptance ratings to conclusions phrased as questions or as statements. Results show that specific agents and universal statements increase the acceptability of conditionals, whereas conclusions phrased as questions increase response times. Based on these findings, we discuss the interaction between phrasing, pragmatics, and background knowledge in human reasoning.

***9. Rakefet Ackerman**

Title: How can we detect factors that may bias Meta-Reasoning judgments?

***10. Niki Pfeifer**

Title: Modelling uncertain reasoning within mental probability logic

Abstract
Reasoning tasks are modelled by uncertain argument forms in mental probability logic (MPL). Consequently, the computational inference problem in a reasoning task consists in transmitting the uncertainty of the (possibly empty) premise set to the conclusion. Coherent probability propagation rules—which are derived within coherence-based probability logic—govern how to transmit the uncertainty rationally. In my talk, I will argue that MPL provides a unified framework for reasoning under incomplete knowledge. Specifically, I will present three important research areas of the new paradigm psychology of reasoning. These three areas are usually investigated within different theoretical frameworks. First, I present a probabilistic measure of argument strength and show how MPL provides a new solution to the Ellsberg paradox. Second, I argue why people's interpretations of different classes of epistemic conditionals are best modelled by argument forms involving conditional probability assertions. Third, I shed light on how quantified statements are generalised and negated

under coherence in the context of the square and the hexagon of opposition. Finally, I discuss experimental evidence concerning all three research areas: this provides strong empirical support for MPL.

***11. Shane Timmons and Ruth M. J. Byrne**

Title: Counterfactual and pre-factual thinking about morally elevating memories

Abstract
We report two experiments that examine moral reasoning about good deeds. When people witness a good deed, such as a colleague taking a homeless person to lunch, they experience an emotion of moral elevation and they appear to want to emulate moral goodness themselves. Our aim was to test whether moral emulation is affected by whether the good deed has a good outcome, e.g., the colleague and homeless person enjoy a good lunch together, or a bad outcome, e.g. the homeless person rejects the food and asks for money instead. Participants retrieved episodic memories about good deeds they had observed that either had a good outcome or a bad outcome. As a measure of moral emulation, after they had finished the experiment, the researcher 'accidently' knocked over a jar full of pens and the participants' helping behaviour was recorded. In the first experiment participants retrieved a memory and imagined how the events could turn out differently in the future. Corroborating the idea that pre-factual thoughts serve a preparatory function, participants were more likely to help to pick up the pens when they had retrieved a good deed that had a good outcome rather than a good deed that had a bad outcome, 82% vs. 34%, X^2 (N = 65, 1) = 15.06, $p < .001$, V = .48. In the second experiment, participants retrieved a memory and imagined how the events could have turned out differently in the past. Corroborating the idea that counterfactual thoughts serve an explanatory, rather than a preparatory function, participants' tendency to help to pick up the pens was unaffected by whether they had retrieved a good deed that had a good outcome rather than a good deed that had a bad outcome, 72% vs. 52%, X^2 (N = 63, 1) = 2.74, p = .098, V = .21. We consider the implications of the results for theories of moral reasoning and the growing literature on the distinct functions of counterfactual and pre-factual thinking.

12. Palfi, B., Szaszi, B., Kieslich, P. J., & Aczel, B.

Title: Tracking Changes of Mind

Abstract
In the current research project, we assess the potential of two mouse-tracking analysis techniques that aim to detect how often people change their mind in choice tasks and at what time points these changes of mind occur. We will compare two approaches and corresponding analysis methods that provide indicators for the number of choice commitments, the direction and the time point of these commitments based on mouse movement data of individual trials. The first method is based on the assumption that a mouse movement approaching one of the options indicates a commitment towards that option. In other words, this method estimates the number of CoM and choice commitments by exploring how many times a movement reached a pre-specified area in the proximity of a particular choice alternative. The second analysis method assumes that continuous movements towards a choice alternative represent a commitment towards choosing that alternative. Based on this, the complete mouse movement of a trial can be separated into different parts of homogeneous movements towards one of the choice alternatives. A commitment is assumed if the covered distance in an individual part exceeds a pre-specified threshold. We argue that this use of mouse trajectory data and the exploration of process dynamics can open new perspectives to approach old questions in reasoning.

***13. Célia Rasga and Ana Cristina Quelhas,**

Title: A priori true and false counterfactual conditionals

Abstract
An influential view due to the philosopher Quine is that there are no assertions that are true a priori or false a priori. We show to the contrary that there are counterfactual conditionals that naive individuals judge to be

true a priori, and others that they judge to be false a priori. They can be constructed on the basis of common knowledge. For example, as is well-known, Aristotle claimed wrongly that heavier objects fall faster than lighter objects. Hence, individuals who are familiar with his error should judge the following counterfactual conditional to be true:

If heavier objects had fallen faster than lighter objects then Aristotle would have been right.

Likewise, they should judge the following counterfactual conditional to be false:

If heavier objects had fallen faster than lighter objects then Aristotle would have been wrong.

We report experiments that investigated these predictions. In our first experiment, the participants, who were undergraduates, judged as true 79% of the counterfactuals predicted to be true, and they judged as false 81% of the counterfactuals predicted to be false. We discuss the implications of these results and our subsequent results for the semantics of conditionals.

***14. Niall Galbraith**

Title: The effect of ontological mistakes upon reasoning

Abstract

Ontological mistakes (such as assigning intentionality to non-sentient entities) sometimes underpin misconceptions in science and medicine (Lindeman, 2011). Research suggests that people's ability to identify ontological mistakes diminishes when decision time is limited, presumably because the required system 2 processing capacity is restricted (Keleman & Rosset, 2009). We aimed to test whether ontological mistakes, easily identifiable when presented alone, would be overlooked when participants were simultaneously engaged in reasoning. Experiments 1 and 2 simply presented a mixture of ontologically correct and incorrect statements which participants judged as either valid or invalid. Believability was also manipulated. Participants were successful in identifying ontological mistakes whether they were pre-briefed about the nature and presence of such mistakes or not. Experiments 3 and 4 embedded the ontologically correct and incorrect statements in the conclusions of syllogisms, with instructions to judge only the logical validity of the conclusions. In experiment 3, with no prior briefing as to the nature and presence of ontological mistakes in the materials, there was an interaction between ontology and problem-type: where belief and logic did not conflict, ontological correctness biased responding, but when belief and logic did conflict ontology did not bias responding at all. In experiment 4 however, after being briefed on the nature and presence of ontological mistakes in the materials, the effect of ontology was evident on both non-conflict and the more cognitively challenging conflict problems. The findings suggest that, unlike mere believability, ontological mistakes become less obvious when people are simultaneously engaged in computationally demanding reasoning, perhaps because of competition for processing capacity. Simple psychoeducation on ontological mistakes might mitigate this effect. The implications for misconceptions in science and medicine are discussed.

***15. Valerie Thompson (PUT ACKERMAN AND VALERIE IN SAME SESSION)**

Title: TBA

***16. David Over, Nicole Cruz, and Mike Oaksford**

Title: "Dynamic reasoning with counterfactuals: Extending the Thompson-Byrne technique"

***17. Sangeet Khemlani**

Title: How people detect when an explanation is incomplete

Abstract

Humans judge some explanations more complete than others (Zemla et al., 2017), and they place bounds on the sorts of explanations they formulate. Nevertheless, no definitive measure of explanatory completeness exists. Any arbitrary causal chain of the form A causes B and B causes C, can be construed as incomplete in at least

two general ways: the antecedent cause of A is left unspecified, and the consequent effect of C is unspecified. In addition to these general features of any causal chain, we argue that chains that contain "gaps", i.e., unspecified causal relations anywhere between A and C in the chain, should be deemed more incomplete than those that do not. A plausible metric of explanatory completeness may thus depend on these interstitial causal relations.

Two experiments test this prediction. Experiment 1 provided participants with a set of causal relations which formed a causal chain akin to the one above. The study varied whether the set of causal relations contained an interstitial gap or not, e.g., A causes B and B causes C vs. A causes X and B causes C. Participants evaluated a putative explanation that connected the beginning of the chain, A, with its end, C. They overwhelmingly rated chains without interstitial gaps as more correct. Experiment 2 concerned the search for a causal explanation. Participants were provided a premise that specified the beginning and end of a causal chain, e.g., A leads to C, and were then provided an explanation in the form of a set of premises akin to those above. The study once again varied whether or not the set of premises contained an interstitial gap. Participants' task was to select the question from the choices provided (e.g., What leads to A? What leads to B?) whose answer was most informative about the phenomenon. They overwhelmingly preferred to inquire about antecedent causel, e.g., "What leads to A?", but participants who considered explanations with an interstitial gap chose to ask about the gap itself. Both studies suggest that reasoners prefer explanations that fully specify interstitial causal relations

***18. Brett K. Hayes, Rachel Stephens, John Dunn**

Title: Re-thinking single- and dual-process models of reasoning

Abstract

We derived a set of single-process and dual-process models based on an overarching signal detection framework and used signed difference analysis (SDA) to test each model against data from argument evaluation tasks, in which both induction and deduction judgments are elicited for a set of valid and invalid arguments. This approach was first applied to data from Singmann and Klauer (2011) and then to a large database of argument evaluation studies. The results were remarkably consistent across both sets of analyses: While we were able to reject relatively simple signal detection models, we found that a three-parameter single-process model and a three-parameter dual-process model were able to account for all existing results. A new series of experiments confirmed that the single process model could account for data that is problematic for dual process theories. Despite the popularity of dual-process accounts, the current results suggest that some versions of a single-process model remain viable explanations of inductive and deductive reasoning.

***18. Reuben Stern**

Title: Reifying Modus Ponens

***20. Nicole Cruz De Echeverria Loebell**

Title: Deduction in reasoning under uncertainty

Abstract

The advent of the new probabilistic paradigm in the psychology of reasoning raised the question of what role, if any, deduction plays in reasoning. The central deductive concepts in the old paradigm, borrowed from classical logic, were logical consistency and validity. If the binary definitions of these concepts are retained, then the fundamental insight that most reasoning takes place under uncertainty renders them obsolete for the study of real world reasoning. However, these concepts can be generalised to cover uncertain reasoning: consistency can be generalised to coherence, and validity to probabilistic validity, or p-validity for short. This talk gives a brief introduction to the deductive and probabilistic concepts of coherence and p-validity, as well as to the relation between them, which is argued to be complementary. It then reports recent empirical work on the extent to which people take the constraints set by coherence and p-validity into account in reasoning.

***21. *Rachel G. Stephens[1], Brett K. Hayes[1], John C. Dunn[2]**

Title: Testing single- and dual-process models of reasoning

Abstract

Recent theoretical work in our laboratory found that a "single-process" model which proposes a single dimension of argument strength, but separate decision criteria for induction and deduction judgments can explain a large body of reasoning data. We report two novel experimental tests of this model against a dual-process alternative, searching for the pattern of data that is uniquely forbidden by each model. By manipulating response bias instructions, we show that induction and deduction decision criteria change independently, ruling out the dual-process model. We also used logic training to test whether people's ability to distinguish valid and invalid arguments could be independently manipulated for induction and deduction judgments. The results were consistent with the single-process model. These findings pose a challenge for popular dual-process theories, and highlight important novel data patterns that reasoning theories need to be able to explain.

***22. Isabel Orenes, Juan Antonio García Madruga, Isabel Gómez-Veiga, Orlando Espino, Ruth M.J. Byrne**

Title: The comprehension of affirmative and negative counterfactual conditionals

Abstract

We report an experiment to examine how people understand affirmative and negative counterfactual conditionals. Participants listened to short stories, for example, Miguel went to a flower shop and did not know whether to buy roses or carnations. They heard a critical sentence, such as 'if he had arrived early, he would have bought roses'. We compared affirmative causal assertions, e.g., 'Because he arrived early, he bought roses', negative causal assertions, 'Because he did not arrive early, he did not buy roses', to affirmative counterfactual conditionals, 'if he had arrived early, he would have bought roses', and negative counterfactual conditionals 'if he had not arrived early, he would have not bought roses'. Participants listened to the stories while looking at four printed words on a computer screen, e.g., roses, no roses, carnations, no carnations. We used eye-tracking methods to examine where their eyes looked while they heard the target sentences. The results showed that participants looked at the target word 'roses' when they heard the affirmative causal assertions and the negative counterfactual conditionals, whereas they looked first at the word 'roses' and then at the word 'carnations' when they heard the negative causal assertions and the affirmative counterfactual conditionals. We discuss the implications of the results for the dual meaning account of counterfactuals.

***23. Zachary Horne and Sangeet Khemlani**

Title: Principled connections underlie the inherence bias in explanatory reasoning

Abstract

Recent research suggests that people's explanations of everyday (Cimpian & Salomon, 2014) and scientific (Horne & Cimpian, 2015) observations tend to oversample easily-accessible inherent properties of the phenomena they aim to explain. However, research on this inherence bias has not directly examined the contents of inherent explanations people produce. Prasada and colleagues (2013) present a novel conceptual framework that distinguishes between two types of connections between kinds and properties: principled and statistical connections. For example: tanginess is principally connected to orange juice, whereas coldness is statistically connected to orange juice. Principled connections license normative expectations (e.g., orange juice should be tangy, or else it might not be orange juice), whereas statistical connections do not (e.g., orange juice needn't be cold to be considered orange juice). Here, we examine whether people reason that the behavior of novel scientific entities is best explained by principally or statistically connected inherent properties. We find that even when, for instance, a novel chemical is reported to have behaved anomalously, people explain these patterns in terms principally connected inherent properties. These findings have significant implications for understanding the structure of conceptual representation and explanatory reasoning more generally.

***24. Maggie E. Toplak, Richard F. West, and Keith E. Stanovich**

Title: The Development of Cognitive Biases: Cross-Sectional and Longitudinal Comparisons

Abstract
Many cognitive abilities show a steady increase throughout childhood and adolescence. However, previous research has found that performance on some heuristics and biases tasks show improvement with age, but others do not (Davidson, 1995; Jacobs & Potenza, 1991; Klaczynski, 2001; Morsanyi & Handley, 2008; Reyna & Farley, 2006). Likewise, our research group has found that performance on some heuristics and biases tasks are associated with cognitive ability in adults, and some are not (Stanovich & West, 2008). We have used a taxonomy of heuristics and biases tasks that predicts which tasks will associate with development and cognitive ability and which will not (Stanovich, West, & Toplak, 2011, 2016). Our taxonomy predicts that only tasks necessitating cognitive decoupling and analytic override will be significantly associated with cognitive ability and development. We report cross-sectional analyses and longitudinal comparisons to further examine the development of cognitive biases.

The current study is a longitudinal follow-up of a developmental sample of 156 youth aged 11-17 years of age (86 males and 70 females; Time 2), which were first reported on previously in another study (Time 1; Toplak, West, and Stanovich, 2014). In the follow-up at Time 2, we examined performance on several tasks (ratio bias, belief bias syllogisms, resistance to framing, baserate sensitivity, cognitive reflection, probabilistic numeracy, and temporal discounting). Dispositions related to rational thinking (actively open-minded thinking, need for cognition and consideration of the future) and measures of cognitive ability and executive function were also included. Based on the cross-sectional analyses from Time 2, we found that older youth tended to show better performance than younger youth on several heuristics and biases tasks, including belief bias syllogisms, cognitive reflection and numeracy. Actively open-minded thinking and cognitive abilities were both significant unique predictors of performance on several tasks. In our longitudinal comparisons, we directly compared Time 1 to Time 2 performance on our measures. We found that scores at Time 2 were significantly higher on all of the cognitive ability and heuristics and biases measures.

These results provide converging findings with our Toplak et al. (2014) study showing developmental differences in cognitive biases (especially using the longitudinal comparisons) and significant associations with cognitive ability. One unique finding in the Time 2 follow-up was that actively open-minded thinking scores entered as unique predictor of the degree of cognitive bias. This finding was less consistently obtained in the Time 1 data, suggesting that individual differences in actively open-minded thinking may emerge as a stronger predictor later in development.

25. Bence Bago and Wim De Neys

Title: The smart system 1: evidence for the intuitive nature of correct responding in the bat-and-ball problem.

Abstract
Influential work on reasoning and decision making has popularized the idea that sound reasoning requires correction of fast, intuitive thought processes by slower and more demanding deliberation. We present seven studies that force us to revise this corrective view of human thinking. We focused on the very problem that has been widely featured as the paradigmatic illustration of the corrective view, the notorious bat-and-ball problem. A two-response paradigm in which people were required to give an initial response under time-pressure and cognitive load allowed us to identify the intuitively generated response that preceded the final response given after deliberation. Across our studies we observe that correct final responses are typically non-corrective in nature. The majority of reasoners who manage to answer the bat-and-ball problem correctly after deliberation already solved it correctly when they reasoned purely intuitively in the initial response phase. This implies that sound reasoners do not need to deliberate to correct their intuitions, their intuitions are already correct. Pace the corrective view, findings suggest that we do not deliberate to correct our intuitions but to verify correct intuitive insights. We discuss implications for the dual process framework of thinking.

26. Steffen Hölldobler

Title: Bounded Skeptical Reasoning

Abstract

The weak completion semantics is a new cognitive theory which has been applied to model — among others — the suppression task, the selection task, and syllogistic reasoning. In each of these applications it was necessary to apply skeptical abduction. The application of credulous abduction leads to either wrong conclusions in the suppression and the selection task or to an overall weaker performance in syllogistic reasoning. On the other hand, from a complexity point of view, computing skeptical conclusions is quite expensive. If reasoning tasks and, in particular, the sets of abducibles considered in abductive reasoning tasks become larger, then skeptical reasoning appears to be infeasible. Hence, I will argue for bounded skeptical reasoning.