Miscellaneous

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Conference Report: Probabilistic Reasoning in the Sciences, 29–31 August 2024

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The *Probabilistic Reasoning in the Sciences* conference was held at Marche Polytechnic University from August 29th to 31st, 2024. Organized by Michał Sikorski, Alexander Gebharter, and Barbara Osimani, the conference aimed to explore and discuss various aspects of probabilistic reasoning within scientific inquiry. It also served as the kick-off event for the *Controlling and Utilizing Uncertainty in the Health Sciences* project, funded by the Italian Ministry of Research, under the leadership of Principal Investigators Alexander Gebharter and Lorenzo Rossi. Furthermore, the event marked the inauguration of the new *Center for Philosophy, Science, and Policy* (*CPSP*) at Marche Polytechnic University. The conference attracted around 35 researchers and featured 29 presentations, including six plenary sessions.

Aligned with its broad aim, the conference showcased a diverse array of methodologies and viewpoints. Topics ranged from theoretical and applied analyses on the use of evidence to the study of social mechanisms underlying scientific inquiry, foundational work on causal inference and counterfactual reasoning, and contributions to science communication and policy. As a result, the conference brought together experts from various fields, including philosophy, economics, biology, and statistics. To give the reader a clearer sense of the discussions, I will briefly outline the content of the six plenary sessions.

The conference began with David Papineau's (King's College London) presentation of a novel metaphysical theory of causation. Papineau pointed out that, despite numerous existing theories about the nature of causation, none sufficiently explain why causation allows us to infer correlation. To address this, he introduced a new theory, which posits that one event causes another if and only if the former is an ancestor of the latter within a recursive structure of deterministic laws with independent exogenous error terms—what he calls an *RLI ancestry*. Papineau argued that this theory effectively bridges the gap between causation and correlation while

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also accounting for single-case causation, causal asymmetry, and the relationship between causation and rational action. He concluded by comparing his novel account to Woodward's interventionist approach.

Saana Jukola (University of Twente) led the second plenary session, which concluded the first day of the conference. She discussed how to manage *phronetic risks*—risks of epistemic error in activities related to empirical reasoning—particularly in setting research agendas and formulating science-based policy. To do so, she illustrated the case of nutrition science, where institutions and policymakers are tasked with deciding which research approach to prioritize between two alternative ones that appear equally valuable. Accordingly, she argued that such decisions involve phronetic risks, e.g., the risk of leaving unanswered a fruitful research question. In light of this case, Jukola argued that responsibility for phronetic risks should be assigned to institutions and organizations rather than individual members and suggested that institutional epistemology and collective responsibility literature could provide critical tools to deal with such risks.

Jan Sprenger (University of Turin) opened the second day with a presentation on the relationship between counterfactual reasoning and probabilistic models. He noted that while prominent theories like Lewis's minimal change semantics and modern versions of the strict conditional view explain how we assert and reason with counterfactuals, they do not accurately predict the probabilities of those counterfactuals. On the other hand, models of counterfactuals aligned with Bayesian reasoning are hard to integrate into a general semantic picture. To address this, Sprenger proposed a unified approach based on a "division of labor" between truth and assertion conditions of counterfactuals, where assertion conditions amount to truth at all worlds in a given context. He concluded that his view would bring the semantic analysis of counterfactuals much closer to their use in scientific reasoning.

In the afternoon plenary session, Jan-Willem Romeijn (University of Groningen) discussed how framing data transforms it into evidence. He demonstrated that, in the frequentist approach, the results of statistical analysis depend not only on the data but also on the sample space and the statistical model. Romeijn argued that the theoretical framing also significantly influences results in Bayesian statistics and the likelihoodist approach (Jeffreysian framework). Finally, he emphasized that this inherent theory-ladenness in statistical analysis underscores the importance of carefully designing and justifying the theoretical framework. By doing so, we ensure that evidence remains both relativized and objective, countering post-truth views on statistics.

On the third day, Katya Tentori (University of Trento) emphasized the importance of providing individuals with a solid understanding of uncertainty. She presented empirical evidence showing that many people struggle to draw correct conclusions from statistical evidence, highlighting misunderstandings that arose

during the COVID-19 pandemic, such as misconceptions about vaccine efficacy. Interestingly, these misunderstandings were not limited to laypeople but were prevalent across different segments of the population. She concluded that equipping individuals with better tools for understanding uncertainty could help prevent the spread of misconceptions, particularly in areas like public health.

The last presentation of the conference was by Elliott Sober (University of Wisconsin). Sober dedicated his talk to a formal discussion, based on the law of likelihood, of the use of evidence in Darwin's work. Sober first demonstrated how Darwin's claim that shared traits between species are evidence of common ancestry can be validated under widely accepted conditions. He then explored Darwin's argument that adaptive traits provide weaker evidence for common ancestry compared to neutral or deleterious traits. Sober noted that Darwin's reasoning holds if the species share a relatively recent common ancestor but may falter if a species evolves a trait due to selection for a majority trait. Sober concluded by explaining how Darwin used evidence of common ancestry to infer characteristics of ancestral species.

Finally, it is worth noting that Giacomo Molinari (University of Bristol) won the best paper award at the conference. In his paper, Molinari builds on Dorst's account of peer disagreement, which suggests that evidence must be ambiguous for peer disagreement to have epistemic force. Molinari introduces an additional feature that may characterize evidence: imprecision. He argues that ambiguity and imprecision are distinct and orthogonal features of a body of evidence. He then presents a principled approach to handling both ambiguous and imprecise evidence in cases of peer disagreement and illustrates how imprecise evidence can influence an agent's response to disagreement. His paper will soon be submitted for publication. The award committee included Hykel Hosni, Jan Sprenger, and Serena Doria.

As evidenced by the diverse range of presentations outlined above, the *Probabilistic Reasoning in the Sciences* conference provided a comprehensive overview of the many facets of probabilistic reasoning in scientific inquiry. Moreover, while it successfully brought together varied perspectives, it also allowed for lively and in-depth discussions. The success of the event is a testament to the excellent work of the organizers, to whom I extend my thanks on behalf of all the attendees. This success bodes well for the future of the newly founded *Center for Philosophy, Science, and Policy* (*CPSP*), which is likely to continue attracting attention from both policymakers and scientific experts.