The authors walk readers through key concepts, mathematical models, and statistical techniques for testing rationality and provide examples using the methods and data of prominent published articles on animal choice behavior as their case studies. They explain how these papers tackled the five hurdles to varying degrees of success.

The overview tackles five significant obstacles. One challenge lies in spelling out what transitivity of latent preferences says and what it implies about observable choice behavior. "This step is fraught with aggregation artifacts, in that aggregated behavior can be profoundly misleading about individual behavior," they note.

Another hurdle comes from mathematical problems associated with characterizing the properties of heterogeneous transitive populations. A third challenge is the prevalence of straw man hypotheses in this area of research, such as when different scholars rely on rejecting the same null hypothesis to support a variety of different and even mutually incompatible target hypotheses. "In our view, this happens routinely in rationality research," write the authors. The fourth difficulty is associated with adopting appropriate statistical inference tools that correctly accommodate the idiosyncratic mathematical properties of order-constrained statistical hypotheses. Finally, the fifth hurdle arises with the role of scientific parsimony in rationality research.

"Despite seeming narrow and simple on the face of it, the transitivity paradigm requires great care with a huge range of complicated and deeply nuanced logical, mathematical, and data-analytical concepts," write the authors. They aim to endow animal scientists with the prerequisite knowledge and critical perspective to navigate these challenges. The authors note that they use "every
effort to tackle a technical research question with
maximally concrete examples and with as much
simplicity as possible, while also unpacking and
explaining the numerous errors that plague the
literature in this research program." While claims of
(ir)rational animal behavior in the literature have
typically been insufficiently substantiated, rigorous
tools are now available to better understand
whether and when animal choice violates
transitivity.

More information: Michel Regenwetter et al,
(Ir)rationality of animal choice? A guide to testing
DOI: 10.1086/717165

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