

# **On falsification and Optimal Experimental Design approaches to the value of information**

**Jonathan D. Nelson**

University of Surrey, Guildford, United Kingdom

**Vincenzo Crupi**

University of Turin, Torino, Italy

**Flavia Filimon**

University of Surrey, Guildford, Surrey, United Kingdom

**Garrison Cottrell**

UCSD, La Jolla, California, United States

## **Abstract**

There is a great deal of discussion about whether people intuitively seek to falsify their working hypothesis. But there has been little consideration of the relationships between falsificationist and probabilistic Optimal Experimental Design (OED) approaches to evaluating the usefulness of possible experiments. Recent work has shown that a variety of important OED and heuristic models can be derived as special cases of the generalized Sharma-Mittal framework of information gain measures. We show how falsification-like behavior can also derive from a quasi-information gain model, based on high-degree Tsallis entropies. Our analysis shows that falsificationist and probabilistic approaches are not as far apart as the east and the west. Rather, they can be built out of virtually the same set of ingredients, within a probabilistic framework. We report simulation studies showing how important falsificationist, OED, and hybrid models could be differentiated as possible descriptive accounts of information-seeking behavior.