On the conjunction fallacy and the meaning of and, yet again: A reply to Hertwig, Benz, and Krauss

Cognition 122 (2012) 123–134

Contents lists available at SciVerse ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

On the conjunction fallacy and the meaning of *and*, yet again: A reply to Hertwig, Benz, and Krauss (2008)

Katya Tentori [a,*], Vincenzo Crupi [b,c]

[a] DiSCoF, CIMeC, University of Trento, corso Bettini 31, 38068 Rovereto, Italy
[b] Department of Philosophy, University of Turin, via S. Ottavio 20, 10124 Turin, Italy
[c] Munich Center for Mathematical Philosophy, Ludwig Maximilian University, Ludwigstrasse 31, D-80539 München, Germany

ARTICLE INFO

Article history:
Received 25 July 2010
Revised 9 September 2011
Accepted 14 September 2011
Available online 12 November 2011

Keywords:
Conjunction fallacy
Pragmatic inferences
Probabilistic reasoning

ABSTRACT

In this paper we question the theoretical tenability of Hertwig, Benz, and Krauss's (2008) (HBK) argument that responses commonly taken as manifestations of the conjunction fallacy should be instead considered as reflecting "reasonable pragmatic and semantic inferences" because the meaning of *and* does not always coincide with that of the logical operator $\wedge$. We also question the relevance of the experimental evidence that HBK provide in support of their argument as well as their account of the pertinent literature. Finally, we report two novel experiments in which we employed HBK's procedure to control for the interpretation of *and*. The results obtained overtly contradict HBK's data and claims. We conclude with a discussion on the alleged feebleness of the conjunction fallacy, and suggest directions that future research on this topic might pursue.

1. Introduction

Since the early Eighties, about a hundred scientific papers on the conjunction fallacy (CF) have been published. Such wide interest is easy to understand, as the CF has become a key topic in the fervent debate on human rationality. Indeed, from the very beginning the CF phenomenon has been described as a violation of "the simplest and the most basic qualitative law of probability" (Tversky & Kahneman, 1983, p. 293; but already mentioned in Tversky & Kahneman, 1982, p. 90). The law at issue is the *conjunction rule*, a principle whose compelling nature appears unequivocal when stated formally: $\Pr(p \wedge q) \leqslant \Pr(p)$, i.e., the joint occurrence of a pair of events (p and q) cannot be more probable than the occurrence of anyone of them (e.g., p).

In contrast, what does seem surprising across more than 30 years of research is the recurrence of questions about the validity of CF experiments. A standard line of argument inspired by the pragmatics of communication has been that violation of the conjunction rule need not be irrational if it results from interpreting the experimental task in ways that rob it of normative relevance. The main sources of misinterpretation considered in the literature include participants' understanding of the isolated conjunct p, the term *probable*, and the connective *and*. Many techniques have been developed to control for each of these possible misinterpretations (see Moro, 2009, for a recent review), but none of them has dissipated the effect.

Nonetheless some concerns turned out to be important and should be credited for having fostered improvements in the experimental procedures by which the CF is investigated. To illustrate, the suspicion that the single conjunct p might be interpreted as p-and-not-q (Adler, 1984; Dulany & Hilton, 1991; Messer & Griggs, 1993; Morier & Borgida, 1984; Polizer & Noveck, 1991; but already discussed in Tversky and Kahneman, 1982, 1983) led to more careful control of stimuli, such as explicitly including the statement p-and-not-q in the judgment task along with p and p-and-q. When this technique is applied (as in Tentori, Bonini, & Osherson, 2004; Wedell & Moro, 2008), the rate

* Corresponding author.
E-mail address: katya.tentori@unitn.it (K. Tentori).

0010-0277/$ - see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.cognition.2011.09.002