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# Faith in intuition and cognitive reflection

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ABSTRACT

We compare two different measures of impulsive or intuitive behavior, the Cognitive Reflection Test (CRT) and a well-established psychological scale known as "Faith in Intuition" (FI), and investigate their relation to common biases in probability judgment. Using data from two laboratory experiments and a series of classroom experiments, the evidence we obtain is mixed. CRT scores and FI correlated in two data sets out of three. Both measures appear to be partially informative for some of the biases, but the effects are not systematic and depend on which exact probability-judgment question is used. Overall, CRT scores explain more variance in probability-judgment biases than FI scores. Further, gender effects interact with FI but not with CRT.



## 1. Introduction

Behavioral biases in decision making are an important topic for microeconomics. One area where deviations from normative prescriptions (i.e. from "rational" decision making) are often observed is the field of probability judgment. These deviations may lead to severe detrimental consequences in many real-life domains where human decision makers have to deal with information on uncertain outcomes, such as medical decision making, law, politics, and management. Hence, it is important to identify the determinants of behavioral biases in this domain, and accordingly there is a growing number of studies investigating interindividual differences regarding faulty probability judgments (e.g. Shiloh et al., 2002; Oechssler et al., 2009) and decision-making strategies in general (e.g. Epstein and Pacini, 1999; Betsch and Iannello, 2010).

When one considers probability judgments, a natural culprit is the elusive concept of intuition. The more abstract nuances associated with the concept of probability do not come naturally to the human mind, and intuitive thinking seems to often lead us astray in this domain. It is hence not surprising that individual heterogeneity concerning biases in probability judgments has generally been associated with differences in either impulsive or intuitive behavior. The question we are interested in is whether there are any simple, easy-to-measure individual correlates of intuitive thinking which provide insights into biases in this domain.

A first candidate coming from the economics literature is the Cognitive Reflection Test (CRT) introduced by Frederick (2005). In this test, participants answer three cognitive problems which have intuitively appealing but incorrect answers. The CRT is generally interpreted as a measure of reflective decision making, implying that those who give more correct answers are less prone to impulsive behavior (see e.g. Toplak et al., 2011; Kiss et al., 2015). This interpretation should bring it close to other, theoretically well-founded measures arising in psychology. Following one's impulses is often identified with acting intuitively (often in an informal sense) or "trusting your gut". In psychology, however, intuition is a very broad concept and hence many different models have been proposed to account for it. It has been argued that intuition can be regarded as an umbrella term for different processes with different characteristics (see e.g. Glöckner and Witteman, 2010). Still, there seems to be some consensus that intuition is, at least partly, based on automatic, unconscious processes, for instance the immediate subjective experience that a judgment is correct, without being able to specify the reasons for this experience. One measure that is often used in psychological studies to assess individuals' propensity to act and decide intuitively is Faith in Intuition (FI), a self-report questionnaire developed by Epstein et al. (1996), which includes items such as "I believe in trusting my hunches", "I am quick to form impressions about people", and "The first idea is often the best one" (see e.g. Alós-Ferrer and Hügelschäfer, 2012 for a 15-item version).

The FI questionnaire is based on the dual-process literature from psychology (see Evans, 2008 or Alós-Ferrer and Strack, 2014 for reviews), and especially on the Cognitive-Experiential Self-Theory (CEST) (Epstein, 1994; Epstein and Pacini, 1999), which distinguishes

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between a rational system and an experiential system in the human mind. In a nutshell, this theory postulates that decision makers are influenced by two "thinking styles". The first one (rational) operates in a conscious, deliberative, analytic, effortful, and slow way, requiring logical justification of beliefs. The second one (experiential) captures the idea of intuitive behavior: it is automatic, unconscious, holistic, effortless, and fast, and operates on the basis of beliefs derived from emotional experiences (Epstein et al., 1996). CEST assumes that the rational system is aware of the experiential system and also slower than the latter, hence it is able to correct for possible biases resulting from intuitions.[1] Accordingly, similar to the logic of the CRT, CEST takes into account that decision makers may reflect on their intuitive answers, recognize they are wrong, and replace them by alternative answers. In this framework, the Faith in Intuition scale is assumed to reflect an individual's reliance on the experiential system.

In summary, both FI and the CRT should be related to more or less impulsive or intuitive (i.e. automatic) thinking and hence affect the likelihood of committing biases in probability judgments. On the one hand, the CRT measures the ability to inhibit intuitive thinking and to engage in further reflection when appropriate. On the other hand, FI measures the general propensity to rely on intuitive thinking in the first place. In this article we examine both constructs as possible candidates to deliver insights on individual heterogeneity regarding behavioral biases in the domain of probability judgments. In addition, we examine possible correlations between these two measures. Indeed, given the logic behind them, one might *a priori* expect a negative correlation.

We concentrate on classical biases from the literature that are known to be both prominent and robust, and hence of high relevance to economic decision making, such as base-rate neglect, conservatism, the conjunction fallacy (Kahneman et al., 1982), and incorrect conditioning (Stanovich and West, 1998). In our research, we build upon and extend previous studies, and specifically Oechssler et al. (2009) and Hoppe and Kusterer (2011). These studies found that higher test scores in the CRT are correlated with lower incidences of the conjunction fallacy (Tversky and Kahneman, 1983), base-rate neglect (Fiedler et al., 2000; Erev et al., 2008), and conservatism (Edwards, 1968; Erev et al., 1994).[2] We extend the research by Oechssler et al. (2009) and Hoppe and Kusterer (2011) by additionally measuring FI and examining further items on probability judgments. This allows us to compare the predictiveness of the two measures for biases in probability judgment and to investigate to what extent they are equivalent or capture different phenomena.

Although less known in the economics literature, Faith in Intuition has also been associated with behavioral biases in decision making. Klaczynski et al. (1997) showed that FI was significantly related to heuristic judgments as described by Kahneman et al. (1982), consistent with the assumption of CEST that heuristic processing is the experiential system's natural mode of operation (Epstein et al., 1996). Shiloh et al. (2002) reported a negative association between FI and responses considered as being normative, i.e. responses rational decision makers would have given. Epstein et al. (1996) found that people with a stable preference for intuition produced fewer logical responses to vignettes adapted from studies of judgmental heuristics, but were at the same time more prone to regard their heuristic responses as logical. Danziger et al. (2006) found that people with a high score in FI were more prone to use the subjective ease with which certain information comes to mind as a basis for judgment. Toyosawa and Karasawa (2004) found that a high score in FI was associated with a higher likelihood to give nonoptimal responses in the conjunction fallacy. Mahoney et al. (2011) showed a positive relationship between FI and framing effects. Alós-Ferrer and Hügelschäfer (2012) showed that FI was related to the representativeness heuristic (a form of base-rate neglect; see Kahneman and Tversky, 1972; Grether, 1980; Achtziger et al., 2014) and to an increased reliance on reinforcement learning, which is highly automatic (Achtziger and Alós-Ferrer, 2014).

We rely on three data sets. The first was collected during a series of laboratory experiments in Valencia (Spain). The second data set corresponds to a small-scale replication in Konstanz (Germany). The third data set was obtained as part of classroom questionnaires in Germany (Konstanz and Cologne) with hypothetical (non-incentivized) questions.

The results that we find are rather mixed. We observe a negative correlation between CRT and FI scores in two out of the three samples. Higher CRT scores are consistently linked to a lower likelihood of committing the conjunction fallacy, and also linked to a lower likelihood of exhibiting conservatism. Concerning base-rate neglect and incorrect conditioning, whether CRT scores are predictive of a bias depends on which exact probability-judgment question is used. Faith in Intuition seems generally to be less informative than the CRT as we only find selective and less consistent associations with biases in probability judgment. These results are generally confirmed by a regression analysis pooling all observations into a single data set.

The rest of the article is organized as follows. Section 2 briefly describes both the laboratory experiments and the classroom experiments. Sections 3, 4, 5, and 6 report the results on the conjunction fallacy, conservatism, base-rate neglect, and incorrect conditioning, respectively. Section 7 reports the results of the regression analysis. Section 8 summarizes the results and concludes.

## 2. The experiments

We report on three disjoint data sets which correspond to quite different samples. Our focus is not on sample differences, but merely on exploring the robustness of FI and CRT by analyzing the same questions across these different data sets. The differences in the samples, which include language (German vs. Spanish) and setting (laboratory vs. classroom), did not arise by design, but were merely the pragmatic result of cost-effective data collection opportunities.

### 2.1. Laboratory experiments

Experiment 1 was run at the experimental laboratory of the University of Valencia (LINEEX) in March 2012. The experimental sessions were run in Spanish and programmed in z-Tree (Fischbacher, 2007). Participants were 416 university students (172 females) recruited through ORSEE (Greiner, 2004). We excluded economists and psychologists as those might already have been familiar with our constructs of interest. Further, we recruited mainly participants with little or no lab experience (participants who had not participated in more than 3 experiments at this university; the majority of subjects had no lab experience at all). Data collection occurred at the end of unrelated experiments on social preferences.[3]

Experiment 2 was run at the experimental laboratory of the University of Konstanz (LakeLab) in the summer of 2012. The experimental sessions were run in German and we used the same z-Tree code as in Experiment 1, except for the necessary language

[1] CEST belongs to the class of parallel-competitive dual-process models which assume that automatic and controlled processes are always (simultaneously) activated and operate in an interactive way. In contrast, the CRT is based on more recent dual-process theories postulating that an automatic process operates by default and a more controlled process intervenes at a later stage only if the automatic process does not suffice for successful goal attainment (Kahneman, 2003; Evans, 2008).

[2] Other studies have examined the predictive value of the CRT beyond the field of probability judgments. For instance, Burnham et al. (2009) and Brañas-Garza et al. (2012) showed that higher CRT scores are associated with more strategically sophisticated behavior in the Beauty Contest Game.

[3] Those experiments included an ego-depletion task and are reported by Achtziger et al. (2015a, 2015b); there were no differences in CRT or FI across the different experimental groups.