

Intuitive and Reflective Foundations of Free Will and Scientific Determinism

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Introduction

Belief in free will has been examined across philosophy, psychology, and cognitive science, yet there remains little consensus regarding its cognitive foundations. Within free will research, psychology have primarily sought to address three core research questions: (1) in the absence of free will, what changes in human behavior (Vohs & Schooler, 2008); (2) in what sense does it exist (Bargh, 2008); and (3) why people believe in free will (Clark et al., 2014). However, this body of work has often not directly addressed the underlying cognitive processes that give rise to belief in free will and endorsement of scientific determinism (defined here as the view that human actions are fully caused by prior states of the world and governed by lawful, non-random processes). To our knowledge, no prior research has systematically examined the cognitive foundations of belief in free will and scientific determinism.

A substantial body of evidence suggests that human judgment and decision-making rely on two broad classes of cognitive processes: intuitive, fast, and affectively driven processes, often labeled System 1, and reflective, slow, and deliberative processes, often labeled System 2 (Kahneman, 2011). These dual-process frameworks have been widely applied to domains such as reasoning (Evans, 2011), moral judgment (Bago & De Neys, 2019), and belief formation (Fugelsang & Thompson, 2003). Despite the prominence of dual-process theories, little research

has directly examined whether beliefs about free will and scientific determinism are differentially grounded in intuitive versus reflective cognition. Addressing this gap is theoretically important, as such beliefs may not merely reflect abstract philosophical commitments but may instead emerge from the same cognitive mechanisms that shape everyday judgment and reasoning.

The present research program applies Dual Process Theory to investigate the cognitive origins of belief in free will and scientific determinism. Across three experiments, we experimentally manipulated intuitive and reflective processing and measured their effects on endorsement of free will and determinism using the Free Will and Determinism Plus Scale (FAD-Plus; Paulhus & Carey, 2011). To further examine the robustness and generalizability of these effects, we adopted a cross-cultural approach, comparing Turkish and Canadian samples (in line with open science practices, we registered all of our experiments in this research:

https://osf.io/p7gnz/overview?view_only=4f5d2f2d795642f0957e1685e4a5342e).

Hypotheses

We tested three primary hypotheses. First, intuitive processing induced through time pressure and emotion priming was expected to increase belief in free will and decrease belief in scientific determinism relative to control conditions. Second, reflective processing induced through debiasing training was expected to decrease belief in free will and increase belief in scientific determinism. Third, under time pressure, participants were expected to report higher belief in free will and lower belief in determinism compared to control trials.

Cultural differences were examined exploratorily.

Method and Results

Experiment 1

Experiment 1 tested these hypotheses in a large sample of Turkish adults ($N = 747$) using a mixed design. Participants were randomly assigned to reflection via long debiasing training, intuition via emotion priming, and time pressure (with an embedded within-subject time-delay manipulation after time pressure), or control conditions.

Results indicated that reflective training reduced endorsement of both free will and scientific determinism, while time pressure increased belief in free will and decreased belief in determinism. Effect sizes were small for determinism ($\eta^2 = .02$) and medium for free will ($\eta^2 = .09$). These findings led to the emergence of a novel proposal—the *Reflective Doubt Hypothesis*—suggesting that reflection may introduce doubt toward initially held intuitive beliefs, reducing endorsement of both metaphysical positions rather than selectively increasing determinism.

Experiment 2

Experiment 2 ($N = 344$ Turkish university students) employed a similar design but removed the within-subject time-pressure manipulation and added both active and passive control conditions. Reflective debiasing training and emotion priming both reduced endorsement of scientific determinism compared to active control ($\eta^2 = .03$), though no significant effects were observed for belief in free will.

Experiment 3:

Experiment 3 (N = 727) tested the Reflective Doubt Hypothesis by examining whether an analytical thinking manipulation reduced endorsement of free will and scientific determinism relative to active and passive control conditions in a Canadian student sample. No significant differences were observed between conditions for either belief, with all tests yielding nonsignificant results ($p > .05$). As an alternative analytic approach, we examined intellectual humility, a construct conceptually related to reflective doubt and epistemic openness. However, no condition differences emerged on this measure, suggesting that the impact of reflective processing on belief change may depend on specific contextual or procedural features.

Discussion

Across three experiments and two cultural contexts, the present findings suggest that reflective reasoning does not straightforwardly increase endorsement of scientific determinism, as initially hypothesized. Instead, when effects emerged, reflection was associated with a general weakening of endorsement of both free will and determinism. This pattern supports the Reflective Doubt Hypothesis, according to which reflective processing may introduce epistemic uncertainty toward initially intuitive metaphysical beliefs rather than selectively promoting one worldview over another.

Importantly, these results help clarify the psychological relationship between free will and scientific determinism. Rather than functioning as simple opposites, beliefs about free will and determinism appear to be jointly sensitive to changes in reflective engagement, with reflection

sometimes reducing confidence in both. This finding aligns with prior evidence that lay beliefs about free will and determinism are often compatibilist in nature and suggests that reflection may operate on belief certainty rather than belief content alone.

Intuition-based manipulations, particularly emotion priming, produced less consistent effects across studies, despite passing manipulation checks. This variability highlights potential boundary conditions for when intuitive processes shape belief endorsement.

More broadly, the present work contributes to the growing literature on the cognitive framework of belief systems by demonstrating that core beliefs are not fixed commitments but can be sensitive to cognitive processing modes. By integrating dual-process theory with research on free will and determinism, this research provides a process-oriented account of how such beliefs are formed and revised.

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