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INTUITIVE AND REFLECTIVE FOUNDATIONS OF FREE WILL AND SCIENTIFIC DETERMINISM

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DPM: The Dual Process Model of the Mind

CRT: Cognitive Reflection Test

RP: Readiness Potential

FAD+: Free will and Determinism Plus Scale

AOT: Actively Open-Minded Thinking Scale

CS: Compatibility Scale

TP: Time-pressure

DE: Debiasing Training

EP: Emotion Prime

INTUITIVE AND REFLECTIVE FOUNDATIONS OF FREE WILL AND SCIENTIFIC DETERMINISM

ABSTRACT

Contrary to the past literature investigating the intuitive foundations of belief in free will and determinism, we offer a new way to empirically investigate the same topic using the dual-process model of mind. In an experiment using Turkish participants, where reliance on intuition and reflection was manipulated in a between-subjects design, we tried to estimate whether reflection increases or decreases the endorsement of free will and scientific determinism. In the experiment, participants were assigned to one of the four conditions, which are time-pressure (intuition), debiasing training (reflection), emotion induction (intuition), and control. In addition, in the time-pressure condition, we embedded a within-sample design in which participants were first asked to respond to belief in free will and determinism scales under time-pressure (i.e., allowing intuition) and then asked to revise their answers in no time-pressure condition (i.e., as control condition). Our main hypothesis posits that reflection would increase the endorsement of scientific determinism, and that it would decrease the endorsement of free will. On the other hand, we expect that intuition would decrease scientific determinism and increase free will. We also explore whether the individual propensity to think reflectively (as measured with the cognitive reflection test and the actively open-minded thinking scale) can serve as a boundary condition in understanding the effect of cognitive styles on free will and determinism beliefs. Also, the compatibility of free will and determinism beliefs was measured for exploratory purposes. Results indicated that between-subjects manipulations significantly affected belief in free will and determinism. Debiasing training diminished belief in free will but did not affect determinism beliefs. Time-pressure condition increased the endorsement of belief in free will and decreased determinism. Emotion prime and within-subject embedded condition did not produce significant results. The results partially support the view that intuition favors the belief in free will and impedes determinism.

Keywords: Free will, determinism, compatibilism, incompatibilism, intuition, reflection

ÖZGÜR İRADE VE BİLİMSEL BELİRLENİMCİLİĞİN SEZGİSEL VE BİLİŞSEL YANSIMAYAYA DAYALI KÖKENLERİ

ÖZET

Özgür irade ve determinizme olan inancın sezgisel temellerini araştıran geçmiş literatürün aksine, bu çalışmada özgür irade ve belirlenimciliğe olan inancın, çift süreçli zihin modelini kullanarak ampirik olarak araştırılması hedeflenmiştir. Türk bir örneklem üzerinde, denekler arası (*between-subject*) bir deneysel tasarımla sezgilere dayanma ve bilişsel yansımaya dayanma manipüle edilerek, bunun özgür irade ve belirlenimciliğin Kabul edilmesi üzerindeki etkisi incelenmiştir. Deneyde katılımcılar dört gruba ayrılmıştır: zaman baskısı (sezgisel düşünme), önyargısızlaştırma eğitimi (bilişsel yansıma), duyguları tetikleme (sezgisel düşünme), ve kontrol grubu. Ek olarak, keşif amaçlı, ilk grup (zaman baskısı grubu) denek içi şeklinde tasarlanmıştır. Bu grupta özgür irade ve belirlenimcilik sorularına zaman baskısı altında (sezgisel şekilde) yanıt verildikten sonra katılımcılardan zaman baskısı olmadan (bilişsel yansıma yoluyla) ilk verdikleri yanıtı gözden geçirmeleri istenmiştir. Temel olarak, bilişsel yansımanın bilimsel belirlenimciliği arttırıp özgür iradeye inancı azaltması beklenmektedir. Ayrıca, bireysel olarak bilişsel yansıma kullanmaya eğilimin, bilişsel sitiller ile özgür irade ve belirlenimciliğe inanç arasındaki ilişkide bir sınır koşulu olup olmadığına bakılmıştır. Ek olarak, özgür irade ve belirlenimciliğin uyumluluk ve uyumsuzluğuna dair inançlar keşif amaçlı incelenmiştir. Sonuçlar, denekler arası manipülasyonların özgür irade ve belirlenimciliğe inanç üzerinde etkili olduğunu göstermiştir. Önyargısızlaştırma eğitimi özgür iradeye inancı azaltmış ancak belirlenimcilik üzerinde etkili olmamıştır. Zaman baskısı grubunda ise özgür iradeye inançta artma, belirlenimciliğe inançta azalma gözlenmiştir. Duyguları tetikleme manipülasyonu, denekler içi tasarım uygulanan grupta anlamlı bir etki bulunmamıştır. Deneye dair çıkan karışık bulgular tartışma kısmında ele alınmıştır. Sonuçlar, sezgilerin özgür irade inancını arttırdığı, belirlenimciliği ise azalttığı argümanını kısmen desteklemektedir.

Anahtar kelimeler: Özgür İrade, Belirlenimcilik, Uyumluluk, Uyumsuzluk, Sezgisel Düşünme, Bilişsel Yansıma

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İTHAF

Beni bugüne kadar yalnız bırakmayan ve her anımda beni destekleyen aileme…

1. INTRODUCTION

Being a subject of heated debates for centuries, free will and determinism are some of the perennial questions that philosophers have been trying to answer. Whether we are free or not in our actions is a fundamental question that most humans asked themselves once in a lifetime. For giving meaning to our lives, or making moral decisions, belief in free will and problems about it has various ways that impact on our lives. The question could be investigated from two perspectives: one is the surface freedom, which implies the freedom to do what you want; and the other one is real freedom, that is, the freedom to choose and the freedom of the will, which implies the metaphysical concept of free will (Kane, 2005).

Determinism, the opposite view of free will, argues that we do not possess free will and proposes that our actions are determined by the laws of nature and external pressures; thus, we are not the ultimate sources of our actions. A deterministic universe imposes that we are not free in our actions. Imagine a universe where free will does not exist. How would it be? A place that lacks any moral obligation, or a place where there is not any meaning of living life because every action of a person is already predicted by nature or science.

Let's keep aside the philosophical concerns for the possible outcomes of belief in free will for a while. An *evolutionary* account posits that free will contributes to prosocial behavior (Baumeister et al., 2011). In addition, many studies revealed that individuals are inclined to believe in free will (Nadelhoffer et al., 2014; Paulhus & Carey, 2011). Therefore, it can be assumed that the existence of belief in free will could be the default for human nature. This assumption evokes many questions, such as what kind of cognitive thinking processes are we using when believing in free will. One account that can be used to investigate this question is the idea that the brain is run by using two separate cognitive systems, which are Type 1 and Type 2, which are heavily studied in different lines of research such as political and moral psychology but did not receive much research attention in terms of free will and determinism. There are many results indicating the intuitive nature of belief in free will. Denying the existence of free will or questioning the prevalence of free will could be the result of using analytical thinking instead of intuitive thinking. As a result, if the very nature of free will is innate and dependent on evolutionary older Type 1 thinking, then belief in determinism should be underlined by the analytical thoughts or Type 2 thinking since it would require the denial of intuitive free will beliefs and this requires reflection.

Over the long-lasting debates, belief in free will and determinism was investigated and discussed from the perspectives of different disciplines such as philosophy, neuroscience, and psychology. With their varying perspectives and methods of investigating the issue, each has come up with several answers to unearth whether free will exists or not and how the existence of belief in free will impacts our decisions and behaviors. We first introduce different accounts on free will in the upcoming section, and after presenting these perspectives, we discuss the methodology commonly used in free will research in psychology. Then we present the aim of the current research and our hypotheses on the intuitive foundations of belief in free will and determinism.

1.1 Philosophical Perspectives on the Free Will Problem

What makes free will so unique? Over the centuries, each philosopher comes up with answers to this question. Jalaluddin Rumi said, "There is a disputation that will continue till mankind is raised from the dead, between the necessitarians and the partisans of free will" in his Masnavi. Two different perspectives have emerged to examine free will belief in the philosophy literature: surface freedom and metaphysical freedom. Surface freedom is what we experience every day as satisfying our desires and act accordingly to them. For example, buying a movie ticket, choosing clothing from a store, or voting for a party are all possible actions we can choose in a free society. Real or metaphysical freedom is more profound than the former; metaphysical freedom posits that what we choose is not manipulated or predetermined by external pressure or the law of nature. To act solely depending on our free will is not to satisfy some desire, nor is it predetermined or foreseen by any scientific method or device. So that the real freedom is a metaphysical construct and impossible to investigate, according to Kane (2005). On the other hand, surface freedom can be investigated. Surface freedom refers to the ability to act or choose, and that is the underlying concept of morality due to agents' blame or praiseworthiness. Think about a universe where everything is determined, then who could blame or praise one because of their actions or deeds. Therefore, in a free society, free will is considered one of the precedents of moral responsibility that produces the agency problem (Kane, 2005).

Determinism is the opposite of belief in free will, which is the inability to do otherwise, and postulates that "I am not the ultimate source of my actions." Determinism offers the causality

and the law of nature (such as genes and environmental pressure) as the forces shaping our behaviors. It also implies that, with the help of science, we can predict what will happen in one's actions in the future. So, the predictability of the future harms the moral responsibility of one's actions, at least for those who solely believe in free will (Pereboom, 1995). Determinism does not necessarily limit one's option of choosing the other possibilities; instead, its premises posits that we are free to choose as a political being; however, in a metaphysical sense, what we choose or decide is predetermined by the law of nature and external factors. This brings us to one of the aims of the current experiment: does free will conflict with determinism?

There are several philosophical stances for this question, namely, compatibilism and incompatibilism. If one accepts the existence of free will and determinism at the same time, then they are compatibilists (examples of some famous compatibilists: John Lock, David Hume, John S. Mill, Thomas Hobbs, Harry Frankfurt). However, those who do not accept this co-existence are grouped under incompatibilism which divides into two: hard determinists are those who believe in solely determinism and reject the existence of free will (famous hard determinists: Derk Pereboom;) or libertarians are those who believe solely in free will (a famous libertarian: Robert Kane). The philosophical debate of whether free will would be possible in a deterministic world and the existence of free will is still an ongoing debate among philosophers. However, this debate has not been resolved among philosophers yet. Some researchers tried to seek empirical evidence for the existence of free will (e.g., Bargh, 2008; Libet, 1999), while some others focused on investigating the impact of belief in free will on our lives (Nadelhoffer et al., 2014; Vohs & Schooler, 2008). While the former group corresponds to the neurological perspective, the latter one corresponds to the psychological perspective.

1.2 Neurological Experiments: A Brief Introduction to Libet's Classical Study

Benjamins Libet and his colleagues' series of neurologically inspired studies in the 1980s showed that readiness potential (RP) for a freely voluntary act begins at the 550 milliseconds (ms) before the act, and people became aware of the intention of this act 300-400 ms after the RP starts, but 200 ms before the motor action (Libet, 1985; Libet et al., 1983). In the experiment, participants were asked to do simple voluntary action, which is pressing a key whenever they want. While they were pressing the key, they were also observing a rotating clock, and participants were asked to note the time when they first experience the "urge" to press the key, and the participant's brain activity was measured with EEG (Libet et al., 1983).

This experiment presented that our conscious decision only appears at -200 ms before the movement, but the readiness potential was recorded even before our conscious intention to move, which happened in -550 ms before the action in the experiment. So, our control or initiating power on the action is not in accord with conscious decisions, and there is an internal process that happens around 350 ms before the conscious decision of intention to move. This experiment had an impact on the free will and determinism debates and is often interpreted as we do not have free will or free action because of the RP that occurred before conscious intention (Wegner, 2002). Nevertheless, Libet does not go this far as to say that we do not have free will; instead, he claims that we have the power to veto unwilled actions, meaning that we can reject the acts. So even if the source of the action is not human's will, people still have the power to stop the action that happens without their conscious will (Libet, 1999). Furthermore, some philosophers, such as Alfred Mele argued the deterministic implementation of the experiments by stating that intentions are not decisions and intentions are caused by urges, but decisions are free (Mele, 2010). To conclude, the existence of free will is a discussion which is held for a long time, and to some neuroscience studies will eventually disprove free will but for some cannot (for a more comprehensive review, Brass et al., 2019; Haggard, 2011), and it seems that the debate on the existence of free will be on-going.

1.3 The Folk Understanding of Belief in Free Will

Besides the philosophical and the neuroscientific investigation of free will, the psychologists and experimental philosophers investigate the free will issues from several perspectives, such as folk intuition of belief in free will (Nahmias et al., 2005), agency problem (Monroe et al., 2014), and the social consequences of belief in free will (Vohs & Schooler, 2008), and so on. The neurological findings and philosophical arguments on free will fail to provide concrete answers to the debates on free will. On the other hand, the folk understanding about free will could reflect people's intuition about free will and neuroscientific predictions. As a result, studying folk intuitions about free will could contribute to the unsolvable debate of free will.

The belief in free will has been shown to have an impact on our lives. For instance, Protzko et al. (2016) found that perception of whether free will influences cooperative behaviors, such that lower belief in free will resulted in less cooperative behavior. Shariff et al. (2014) found that belief in free will influences the punishment judgments deemed appropriate for others. First,

they found correlational evidence that those with a stronger belief in free will were more in favor of retributive punishment. In the next three studies, they found that when participants read articles about that, there is no free will or about underlying neural mechanisms that predict human behavior, their judgments of retributive punishment decreased. Similarly, Genschow et al. (2021) research on the disbelief in free will influence the professional judges' decision. Results indicated that disbelief in free will does not impact the sentences of judges even though the anti-free will messages reduced the belief in free will in judges. As a result, the everyday implications of free will can affect the decision of everyday people; thus, studying folk intuitions about free will could provide valuable resources for the areas such as artificial intelligence, the justice system, and so on. The belief in free will becomes subject to cross-cultural research in terms of the existence of free will, and the general attitude is that people tend to believe in free will (Cracco et al., 2020; Hannikainen et al., 2019; Sarkissian et al., 2010; Wisniewski et al., 2019). For example, Sarkissian et al. (2010) found that people from four different cultures believe that we live in an indeterministic universe where moral responsibility is not compatible with determinism. Cracco et al. (2020) presented that people are thinking positively about free will more than determinism and value free will more than determinism due to cultural pressures.

The studies that use psychometric scales for measuring belief in free will indicated that most laypeople strongly endorse the existence of free will (Nadelhoffer et al., 2014; Paulhus & Carey, 2011). Also, studies that are conducted with vignette-type situational measurement tools indicated that people believe in free will (Nahmias et al., 2005). In the literature, in addition to studying free will and determinism, their philosophical co-existence (compatibility) is also intensely studied. Folk belief in free will and the compatibility and incompatibility of free will with determinism has been subjected to investigations (Feldman & Chandrashekar, 2018; Nadelhoffer et al., 2020a; Nahmias et al., 2005). Much research demonstrated that people's intuitive judgments (lay judgments) hold beliefs regarding compatibilism or incompatibilism of free will and determinism. One of which, Nahmias et al. (2005) empirically investigated the intuitiveness of incompatibilism with a methodology where they examined the ordinary intuitions of people (i.e., lay intuitions). The reason behind examining "folk intuitions" was that philosophers have conflicting intuitions that may have been influenced by their knowledge on the free will debate. Since philosophers are sophisticated and have knowledge on the ongoing debate of free will, their judgments could be interfered with by their sophisticated ideas, such as one could believe in a deterministic world and do not declare it because determinism can

lead to denying of moral responsibility. On the other hand, experimental philosophers and psychologists want to examine this issue empirically; thus, they wanted to know to lay intuitions about free will. Past research showed that people do not have incompatibilist intuitions by using three different descriptions of determinism (Nahmias et al., 2005); in the study, the majority of people judged that one could be free and morally responsible in a deterministic universe scenario. Later, the investigation of compatibilist and incompatibilist intuitions is continued. While some research supported the view that people have compatibilist intuitions in the sense that individuals can be both free and morally responsible in a deterministic world (Bear & Knobe, 2016; Cova et al., 2012; Dennett, 1984; Nahmias, 2014; Nahmias et al., 2005; Nahmias et al., 2006; Nahmias, 2006), some other findings, however, showed that people have incompatibilist intuitions in the sense that the co-existence of free will and that determinism is not possible, and one cannot be free in a deterministic world (Nadelhoffer et al., 2020c; Rose et al., 2017; Turri, 2017). This position (incompatibilism) is split into two domains, one being libertarians, who are the supporters of free will, and the other being hard determinists (Nadelhoffer et al., 2020a, 2020c).

The change in the intuitions regarding belief in free will has been explained with several different arguments such as high vs. low effect conditions (Feltz et al., 2012; Nichols & Knobe, 2007), abstract vs. concrete explanations (Nichols & Knobe, 2007) of conditions or scenarios in experiments, and by-passing (Nahmias et al., 2014). A meta-analysis from Feltz and Cova (2014), which investigated the emotional content's influence in judgments on free will and determinism's relation to free will and moral responsibility, found a significant effect on the emotional contents' impact on free will judgments, but this effect was of little importance and only explained 1% of the variance. Moral attribution is affected by abstract and concrete conditions in free will and determinism scenarios and impacts the decisions of individuals. Abstract vs. Concrete conditions' influence contextualized opinions on the moral matter which does not solely belong to free will topic and moral judgments; concrete scenarios lead to more attribution of the moral responsibility to the agents compared to abstract scenarios (Mandelbaum & Ripley, 2012; Nichols & Knobe, 2007). This effect has been observed in several cases; for example, in Nichols and Knobe experiment, found that the agent is morally responsible for his action even in a deterministic universe (which was killing his wife and children) in a concrete scenario and gave a compatibilist answer, on the contrary, in the abstract condition with the same deterministic universe, participants concluded that it is not possible to morally responsible for an action which was incompatibilist response. Murray and Nahmias

(2014) and Nahmias et al. (2014) argued that people confused determinism because of bypassing. Bypassing is the term used for when the individual's actions are caused by a force which is suppressed, or bypassed, as the authors use, the agent's conscious self (by saying agent, author's mean that the agents in the vignettes which used for the measurement of belief in free will). Therefore, we could deduce that people's intuitions about free will and determinism could be affected by situational or contextual cues. These cognitive factors that influenced the individual's belief in free will and moral decision lead us to what could be other potential factors that have an impact on the belief in free will (as well as compatility and incompatibility) decisions.

An extensive body of research had been conducted with intention-based contextual measures such as vignettes which mostly describe a universe, either determinist or indeterminist. Then, ask whether the person in the scenario is morally responsible and does the protagonist has free will (Nadelhoffer et al., 2020a). As for the stable opinions on belief in free will, Paulhus and Carey (2011) argue that contextual assessments of free will and determinism beliefs have two main limitations: one of them is a constraint of variables, suggesting that the contextual measurements connect with only a subset of variable and these measurements have prior incompatible or compatible assumptions about the relationship between free will and determinism. These limitations questioned the reliability of contextualized measurement devices such as vignettes. Accordingly, recent research uncovered the problems of these contextualized measures more directly (e.g., the activation of indeterministic metaphysic in deterministic scenarios, such as in supercomputer and rollback scenarios that are used very commonly, and causing people to misinterpret the vignettes, that is why these contextual measurement devices are not capable of what they actually measure; Nadelhoffer et al., 2020a), and showed that the measurement devices were not completely dependable because these vignettes had pre-requirements regarding determinism for the understandability of the issues for the participants as Nadelhoffer et al. (2020a, 2020b) discussed. Although the usage of contextual measurements has some merits, some of them showed problems such as replicability (Iula, 2016; Open Science Collaboration, 2015). In order to completely understand the vignettes, participants have to understand the basics of determinism. However, scales such as free will and determinism plus (FAD+) that measure the stable opinions on free will did not have the weakness as a contextualized measurement does. In our experiment, to evade the possible understandability issues, we choose to use stable opinion measurements such as FAD+.

1.3.1 Roots of Free Will

Baumeister et al. (2011) claim that free will is an evolutionary concept that led people to be more prosocial or let humans' function better in society. Supporting this notion, there are studies showing a link between belief in free will and prosocial behavior such as cooperation in economic games (Protzko et al., 2016). Although free will and determinism are usually discussed within philosophical discourse, they have important implications for individuals' behaviors in daily life. As a result, implications of free will and determinism have been studied in fields of experimental philosophy, developmental psychology, moral psychology, and even behavioral economics.

Belief in free will is found to be related to some individual-level behaviors. There is correlational and experimental evidence that lower belief in free will predicts lower altruism and higher aggression (Baumeister et al., 2009), reduced learning from emotional experiences (Stillman & Baumeister, 2010), and higher prejudice toward outgroups (Zhao et al., 2014). In Vohs and Schooler (2008), when deterministic beliefs were triggered experimentally, there was an increase in the cheating behavior of participants. Also, when participants who received deterministic manipulation and free will manipulation were compared, those who received deterministic manipulation cheated more, while those who received free will manipulation did not. However, findings such as free will increasing the person's likelihood of not cheating, promoting helpfulness, and increasing job performance exist, further replication of these studies proved to be these results were not replicable (Baumeister et al., 2009; MacKenzie et al., 2014; Crone & Levy, 2019; Giner-Sorolla et al., 2019; Monroe et al., 2017). Even though some of these studies are failed the replicate (e.g., Crone & Levy, 2019; Giner-Sorolla et al., 2019), there are studies indicating the effect of belief in free will on cooperation, punishment, etc. (e.g., Protzko et al., 2016; Shariff et al., 2014). These studies relied on evolutionary roots.

There are pieces of evidence from studies that are done on children that indicate that children have a rudimentary understanding of free will. For example, Nichols (2004) found both children (in Experiment 1, N= 18, 4 years, 10.5 months; in Experiment 2 N = 9, 5 years, 3 months old children) have incompatibilist attitudes when they tend to deal with moral choices. Which indicates children have a rudimentary understanding of belief in free will. Similarly, Chernyak et al. (2019) investigated the cultural roots for the free will belief in three cultural groups, which are Singaporean Chinese, Singaporean Malay, and the US in 4 to 11 years old children. For their research, they operationalized free will as freedom to do otherwise, and results indicated 4-year-old children from the US had endorsed the freedom to act against norms compared to

the Singaporian 4-year-old children. In older ages, these differences were more prevalent. However, this relation could be inferred with that submission to authority differs among cultures. Still, the understanding of free will belief is researched in children. These found that children have the understanding of rudimentary free will with relation to agency and moral cognition (Srinivasan et al., 2016; Yau & Smetana, 2003).

We still do not have compelling evidence regarding the psychological mechanisms of belief in free will. However, investigating the cognitive roots of belief in free will could be detrimental to the understanding of free will and determinism. Hence, there is a long body of research on how attitudes are influenced by reflection vs. intuition (Bahçekapili & Yilmaz, 2017; Gärtner et al., 2020; Isler et al., 2018; Yilmaz et al., 2016; Yilmaz & Saribay, 2017). We planned to investigate both intuitive and reflective foundations of the belief in free will to better understand the cognitive foundations of free will and determinism. To our knowledge, none has ever investigated the intuitive and reflective foundations of belief in free will and determinism as operationalized in the dual-process model of mind (DPM; Evans & Stanovich, 2013; Kahneman, 2011) literature. It is important to address whether people intuitively or reflective endorse belief in free will and determinism because we are not sure what are the roots of free will and determinism. In the next section, we explain what we mean by intuition and reflection in the context of DPM.

1.4 Dual-Process Model of Mind (DPM)

According to DPM, neither of the previous studies on lay "intuitions" of free will does correspond to the intuition as it has been referred in the DPM. Instead, by the term intuition, previous studies were referring to either folk knowledge or folk perspective and used contextualized opinions of people as a source of their intuition. However, intuition, as it has been referred to in the DPM literature, is a cognitive style that corresponds to evolutionary older parts of the brain representing automatic and quick responses (Evans, 2003).

According to the dual-process model, our mental operations are carried out by two interacting yet separate systems, which are called Type 1 and Type 2. Type 1 is an evolutionarily older system and corresponds to an intuitive and automatic decision-making system, whereas Type 2 refers to analytical and reflective thought processes which thought to be evolved later compared to Type 1(Evans, 2003; Frederick, 2005; Morewedge & Kahneman, 2010).

The term intuition could be referred to as the inhibition of deliberative processes and a process based on automatic and effortless thinking. On the other hand, analytical thinking requires deliberative thought processes derived from reflection and reasoning. It is, by its nature, an effortful process and needs to deactivate the intuitive system to make analytical, critical, or reflective responses. As Stanovich and West (2000) described and introduced, Type 1 thinking is a universal cognitive capacity and observed in human and animal species, which includes instinctive behaviors that are internally programmed. Type 2 is believed to be developed later in human evolution. Type 2 thinking is slower and cognitively demanding than Type 1 thinking; for instance, Type 2 requires the use of working memory (Baddeley, 2000; Gathercole, 2003). On the other hand, Type 2 thinking allows abstract reasoning and simulating hypothetical situations such as predicting future events (Evans, 2003). Although they are distinct systems, Type 1 and Type 2 can work complementarily as well. For example, belief in paranormal, conspiratorial, or religious concepts are associated with intuitive thinking; while, disbelief in paranormal, conspiratorial, or religious concepts are more heavily dependent on the usage of Type 2 thinking (Pennycook et al., 2015). Although it is easy and more natural to accept the concept such as religious belief or paranormal concepts, rejecting the existence of them is effortful and requires a deliberative thought process. In a similar way, believing the free will could be intuitive, yet questioning the existence of a free will and believing determinism could rely on analytical and reflective thinking, which is Type 2. Moreover, in certain processes, Type 1 and Type 2 thinking can work together as well. De Neys and Pennycook (2019) showed that contrary to the DPM framework that Type 2 control and correct the errors of Type 1 while monitoring, deliberative reasoning is not always correct and type 1can provide logical cues for the intuitive responses. So, even without the usage of Type 2, logical answers could be reached, and extensive usage of Type 2 may lead to errors despite reflection (Pennycook et al., 2018). However, the usage of Type 1 and Type 2 presents a difference when it comes to decision-making. The regulation of distinct cognitive systems led people to make different decisions on various subjects such as religious beliefs, racial biases and medical decisions, political decisions, cognitive reflection (Deppe et al., 2015; Gervais & Norenzayan, 2012; Pennycook & Ross, 2016; Stepanikova, 2012; Yilmaz & Saribay, 2016). The cognitive performance of individuals, as studies revealed, affects our everyday decisions as well. To search for the impact of these different cognitive styles has proved to be efficient and important. Lawson et al. (2020) ran a pre-registered study on slow (intuitive, Type 1) and fast (analytic, Type 2) thinking. While solving statistical judgment and decision-making problems, they found that fast thinking is

prone to cognitive biases, and slow thinking improved the answers to the problems. Previous works also provide evidence that intuitive thinking diminishes performance. Evans and Curtis-Holmes (2005) found that requiring participants to answer fast results in increased belief bias in a syllogistic reasoning task. Villejoubert (2009) also founds that, in problems similar to the Linda Problem, judgments based on representativeness are formed deliberately.

In the current study, we aim to investigate how cognitive thinking styles proposed by DPM play a role in belief in free will. After reviewing the methods used to activate Type 1 and 2 thinking, how DPM is applied to belief in free will research is reviewed in the following sections.

1.4.1 Experimentally Activating Type 1 and Type 2 Cognitive Styles

Since Type 1 is a fast-thinking route and Type 2 requires slower thinking, one of the most widely used methods of activating Type 1 and Type 2 thinking is imposing time pressure or time delay (Evans et al., 2015; Yilmaz & Isler, 2019). To activate Type 1 thinking, in this method, participants are given a strictly limited amount of time to produce a response in order to enable instinctive responses. On the other hand, to activate Type 2, participants are given an amount of time that is sufficient to think about their responses. Although there are other ways to trigger analytical thinking and intuitive thinking, research indicates that they are not reliable enough. For instance, Gervais and Norenzayan (2012) tried to activate analytical thinking with Rodin's "The Thinker" in one study and with a scrambled sentence task in another study. Although they found a significant effect, Deppe et al. (2015) failed to replicate these findings, and their manipulation check indicated that these manipulations did not produce a significant effect. Another technique Gervais and Norenzayan (2012) used for activating analytic thinking was giving participants a cognitive disfluency test, for which they found a significant effect. However, this technique also failed to replicate by other researchers (Meyer et al., 2015; Yilmaz & Saribay, 2016). Another method used by researchers is to give participants the Cognitive Reflection Test (CRT). However, CRT is conventionally used for measuring the level of analytic thinking, and it produces unreliable effects (Yonker et al., 2016). Thus, time pressure and time delay appeared to be one of the most reliable manipulation techniques used for activating intuition and reflection in individuals so far. As a result, one of the manipulations we use in the current study is time pressure and time delay.

Another technique used for activating analytic thinking is having participants written a personal memory where they think through a decision carefully, and the decision they made benefitted them. This technique is called memory recall and administered in many studies in order to activate reflection by reminding participants of a memory about it (Cappelen et al., 2013; Forstmann & Burgmer, 2015; Ma et al., 2015; Rand et al., 2012; Shenhav et al., 2012). However, two preregistered large scale replication studies failed to find an effect for the memory recall manipulation (Isler et al., 2020; Saribay et al., 2020)

Another method we used in the current study to activate analytic thinking is debiasing training. This method is relatively new and not widely used. However, it produced a significant effect in a few laboratory experiments (Yilmaz & Saribay, 2017a, 2017b), which was then conceptually replicated in a high-powered, preregistered experiment (Isler et al., 2020). Debiasing training consists of first giving participants CRT questions (Frederick, 2005) and base-rate problems (De Neys & Glumicic, 2008), then giving an explanation on the rationale of the correct answer. This method has been successful in its use in laboratory settings (Sellier et al., 2019). It also has been used in online experiments and was found to increase analytic thinking measured by CRT (Isler et al., 2020; Yilmaz & Saribay, 2017a, 2017b).

Finally, another technique that is used in the current study is emotion prime. Emotion is found to be related to intuitive thinking. Levine et al. (2018) have participants played prisoner dilemma games. They found that when participants relied on emotion, they were more cooperative. When others signaled emotion, they expected more cooperation from those. Gärtner et al. (2020) also found that relying on emotion, compared to relying on reasoning, while playing economic games (trust game, dictator game, public goods game), there was an increase in cooperation. Since emotion is a more instinctive cognitive component, and previous work links intuition with higher cooperation in economic games (e.g., Bear & Rand, 2016), inducing emotion seems to be a reliable way of activating intuition.

1.4.2 The Usage of Dual-Process Model of Mind in Free Will

Over the long-lasting literature, we could not find much research that addresses the cognitive roots of free will. In this regard, there are some experimental research and some philosophical ideas presented. One of the proposals was from Baer et al. (2008), free will should have cognitive grounds as any other mental processes, and according to his idea, free will relied more

on Type 2 processes. Yet, he also adds that free will is a concept that arises from the cooperation of both Type 1 and Type 2 thinking. Although his claim depends on the basis of his philosophical intuitions, there is some research that tries to embed the concept of cognitive processes into their investigation in terms of free will.

The association between cognitive styles and free will beliefs did not receive much research attention until recently. Nonetheless, there are some studies investigating this relationship. In one of the few studies, Hannikainen et al. (2019) run a cross-cultural study across 20 countries. The study primarily looked at the relationship between perceptions of free will and punishment judgment. One of the findings was that those who engaged in cognitive reflection were more likely to be incompatibilist (meaning that viewing free will and determinism incompatible), and this finding was consistent across countries. However, this was a correlational study. Protzko et al. (2016) ran an experimental study and found that perception of whether free will exists influences cooperative behaviors. They ran a study where participants play an economic contribution game as an indicator of cooperative behavior. When there was no manipulation (control group), participants donated more money under time pressure, which indicates an intuitive tendency for cooperation. When participants read a text about the fact that there was no free will before the economic game, they donated lower in the game, indicating that the perception of having no free will lower the cooperative behavior. However, this effect was only present in the time pressure condition; when participants had time to think about their decisions beforehand, manipulation about not having free will did not affect the amount of money donated in the economic game. Results showed that believing there is no free will reduces intuitive cooperation. To our knowledge, there is no other research that used the relation of Type 1 and Type 2 thinking on belief in free will. That is why experiments manipulating intuitive vs. reflective thinking need to test the conjecture of whether people intuitively endorse belief in free will and determinism. In this research, we examine the intuitive and reflective foundations of free will and determinism from the perspective of DPM.

The belief in free will is highly associated with the belief in free choices (Shepherd, 2012). Thus, the decision-making process is highly important when it comes to choosing. As well as believing in the possibility of free to choose as certain choices in a situation that requires decision-making, there are some external pressures such as time-limit, emotions. The feeling of belief in free will is not explicitly existent in every state of our mental process. So, the innate mechanisms of the belief in free will could take part in our decisions, and in the post-decision

process, we could argue about why or how we made our decisions which might further impact our attitudes. A similar example could be given on Pascal's Wager; you might not believe there is God, but what if there. If there is a god and you don't believe, then you will be in hell. On the contrary, if you believe in a god and if there is one or not, you will not end up in hell. Yilmaz and Isler (2019) showed that the reflection increased belief in God when they question their stances in non-believers. We thought the same relationship could be existent between free will and determinism. In the current study section, we presented the aims of our study.

1.5 The Current Study

Belief in free will is rarely studied under the framework of DPM, and the current research investigates the intuitive foundations and reflective foundations of belief in free will in an experiment. More specifically, in the current experiment, we aim at investigating the effect of intuitive vs. reflective cognitive styles on belief in free will and determinism from the DPM perspective. To detect the intuitive belief in free will and determinism, we used one of the most commonly used psychometric tools to operationalize these beliefs (i.e., the FAD+ scale's free will and determinism sub-scales), developed by Paulhus and Carey (2011). Yilmaz and Isler (2019) previously showed that under time-pressure, participants responded intuitively to the belief in God question, and when they were asked to re-evaluate their position in time-delay conditions which allows for reflection, they significantly changed their initial belief. In a follow-up study, Yilmaz et al. (2021) compared the effectiveness of between-subjects and within-subjects time-limit manipulation on group bias in prosocial behavior among American liberals and conservatives, and they found that only within-subject manipulation of time-limit significantly influences group bias. In a large-scale preregistered experiment, Isler et al. (2021) further compared the effectiveness of between and within-subjects time-limit manipulations on actual reflective thinking performance, and the results showed that it is the time-pressure (i.e., intuition) having an effect, not the time-delay (i.e., reflection) which serves as the control condition. This method was later used by many researchers (e.g., Bago et al., 2020; Raoelison et al., 2021). More generally, there is also a current debate that within-subjects designs are more effective than those between-subjects (Clifford et al., 2020; Lambdin, 2009). Therefore, we used the two-response paradigm in one of the conditions of a between-subjects experiment, keeping up with these recent advances in the literature. In the experiment, we used a between-subjects design with one of the conditions had a within-sample design to test the effectiveness of this method in a Turkish sample. In the between-subjects experiment, we only used the first

time-pressured response as the intuition manipulation. However, we also examined the within design embedded condition on its own. We propose three main hypotheses regarding the intuitive and reflective foundations of belief in free will and determinism.

- (H1) We expect that intuition manipulations (i.e., time-pressure and emotion prime) increase the endorsement of belief in free will (free will sub-scale of FAD+ scale) and decrease the endorsement of scientific determinism (scientific determinism sub-scale of FAD+ scale) compared to the control condition.

- (H2) We expect that reflection manipulation (i.e., debiasing training) decreases the endorsement of belief in free will (free will sub-scale of FAD+ scale) and increases the endorsement of scientific determinism (scientific determinism sub-scale of FAD+ scale) compared to the control condition.

- (H3) We expect that time pressure increases the endorsement of belief in free will (free will sub-scale of FAD+ scale) and decrease the endorsement of scientific determinism (scientific determinism sub-scale of FAD+ scale) compared to the control condition in the within-subject comparison.

We also explore whether these effects are stronger for those who are better at individual capacity to think reflectively as was operationalized in two ways: a performance-based measure of reflective thinking ability (Cognitive Reflection Test, CRT; Frederick, 2005), and an intention-based measure of actively open-minded thinking (The Comprehensive Thinking Styles Questionnaire, AOT-subscale; Newton et al., 2021). We also explore whether both CRT and AOT predict belief revision (the difference between post-test and pre-test) in within-subjects comparison.

2. METHOD

2.1 Participants

A mixed design is employed for this experiment. Since there was no previous experiment on this subject, we took f = .10 effect size, which is considered a small effect size, to estimate the required sample size to detect a significant effect. G*Power analysis (Faul et al., 2009), with the effect size of f = 0.10, set alpha 0.05, power at .95, and correlation among measures (free will and scientific determinism subscales of FAD+) at .292 (Yilmaz et al., 2018) to detect a difference between four conditions in a mixed-design ANOVA, indicated that at least 612 participants are required. Overall, 747 participants attended the link of the experiment sent via e-mail, WhatsApp, Twitter, Facebook, and LinkedIn in return for a gift lottery draw. Prior to data collection, we preregistered all the details which we were going to apply in this experiment, including data analysis and details of the method. We uploaded the raw data, analysis, and survey composition to the OSF; the required materials could be found there (https://osf.io/p7gnz/).

Seventy-five of the participants who clicked the link did not fill the main tasks in the experiment; two of the participants were removed from the data because they had a duplicate attempt in the experiment. Thus, as planned, their second trial was excluded from the data. As a result, 670 participants' answers remained for the investigation of the data. Participants who revealed their gender in the study were 632 in total, 462 of whom being female (Mean age = 28.6, *SD* = 9.55), 164 being male (Mean age = 32.1, *SD* = 12.9), and 6 identifying themselves as other which are genderfluid, transgender, non-binary, or genderqueer (Mean age = 24.5, *SD* = 3.27). Education level (M = 3.90, *SD* = 0.75), 339 (53.6%) participants declared that they either graduated from university or still getting a university education, 178 (28.2%) of the declared that they get the high school education, and 110 participants stated their education as either in master's degree (14.9%) or doctoral degree (2.5%). The participants were predominantly Muslim (N = 347, 54.9%) which followed by atheist (N = 132, 20.9%), deist (N = 65, 10.3%), Christians (N = 2, 0.3%) and other such as agnostic, pantheism or sceptic (N= 86, 13.6%). In addition to religion, we also asked the religious orientation on a 7-point Likert scale (1 - I am not religious at all and 7 - I am very religious). The general examination declared that the religious belief is low (M = 2.77, *SD* = 1.71), Muslim participants had a higher belief rate (M = 3.89, *SD* = 1.40) than other religious groups (M = 1.69, *SD* = .985), atheism (M = 1.08, *SD* = .547) and deist (M = 1.68, *SD* = .903). In terms of socio-economic status (SES),

participants on a scale of 10 (10 is the highest and 1 is the lowest SES) were predominantly from the middle class (M = 5.63, *SD* = 1.55). On a seven-point Likert scale (1 - Left-wing and 7 - Right-wing), we measured the political orientation, and data indicated that participants were more from leftist view (M = 2.81, *SD* = 1.29; see Table 2.1 for descriptives).

Table 2. 1 Descriptives

	Age	SES	Gender	Education	Religion	Religious Oriantation	Political Oriantation
N	632	632	632	632	632	632	632
Missing	111	111	111	111	111	111	111
Mean	29.5	5.63	1.28	3.90	2.83	2.77	2.81
Median	25.0	6.00	1.00	4.00	1.00	2.00	3.00
Standard deviation	10.6	1.55	0.469	0.755	2.08	1.71	1.29
Minimum	18.0	1	1	1	1	1	1
Maximum	64.0	10	3	6	6	7	7
Skewness	1.50	-0.130	1.26	0.280	0.367	0.511	0.630
Std. error skewness	0.0972	0.0972	0.0972	0.0972	0.0972	0.0972	0.0972
Kurtosis	1.29	-0.217	0.281	0.665	-1.68	-0.941	0.473
Std. error kurtosis	0.194	0.194	0.194	0.194	0.194	0.194	0.194

2.2 Materials

2.2.1 Free Will and Determinism Scale (FAD+)

This scale was developed by Paulhus and Carey (2011) and contains four subscales which are fatalistic determinism ("I believe that the future has already been determined by fate"; original Cronbach's α = .82), scientific determinism ("Your genes determine your future"; original

Cronbach's α = .69), free will ("People have complete control over the decisions they make"; original Cronbach's α = .70) and unpredictability ("No one can predict what will happen in this world"; original Cronbach's α = .72) adapted by Yilmaz et al., (2018) For the Turkish versions, Cronbach's α values are respectively .83 for fatalistic determinism, .63 for scientific determinism, .75 for free will and .74 for unpredictability. Responses were measured on a 5-point Likert-type scale (1= *strongly disagree*, 5 = *strongly agree*). The adaptation of the FAD+ scale is composed of 27 items on a 5-point Likert-type scale. The original fit indexes for FAD+ scale is not the best, $x^2(317) = 506.17, p < .001$, RMSEA = .06, 90% CI = [.05–.07], CFI = .82. For the Turkish version, well fit to data as indexes indicates $x^2 (290) = 766.83, p < .001$, CFI = .83, AGFI = .84, RMSEA = .06. We used only free will α = .66 (e.g., People's biological makeup determines their talents and personality) and scientific determinism α = .62 (e.g., People have complete control over the decisions they make.) sub-scales for our experiment (see Appendix-A for Turkish version). We check the reliability analysis of each group's free will subscale scores. Results indicated that debiasing training has a Cronbach alpha of .76, emotion prime has a Cronbach alpha of .70, time-pressure has a Cronbach alpha of .51, and control condition has a Cronbach alpha of .79. Also, we check the reliability analysis of each group's scientific determinism subscale scores. Results indicated that debiasing training has a Cronbach alpha of .66, emotion prime has a Cronbach alpha of .58, time-pressure has a Cronbach alpha of .59, and control condition has a Cronbach alpha of .64. Lastly, we check the reliability for no time-pressure condition, and for free will, it has a Cronbach alpha of .54 and for determinism Cronbach alpha of .62. In general FAD+ scale revealed Cronbach alpha of .77 for debiasing training, Cronbach alpha of .71 for the emotion prime, Cronbach alpha of .69 for time-pressure, and Cronbach alpha of .76 for the control group.

The results indicated similarity with the Yilmaz et al.'s (2018) experiment, in which we used their translation for the experiment, except for the time-pressure group. We predict that intense time pressure could lead to such low-reliability scores.

2.2.2 Manipulation

The first experiment consists of three experimental and one control condition.

Time-pressure condition. A within-subjects design was used for this condition. In this condition, those in the time-pressure phase (intuition phase) were required to answer items on both Free Will and Scientific Determinism subscales in 5 sec. for each question. For the

between-subjects comparison in the Experiment, we only used this response as the intuition manipulation. In the no time-pressure phase (as a control condition), the participants are given a second chance to revise and re-evaluate their initial decision while seeing their initial decision with no time limit presence. The duration of time-pressure and no time-pressure is decided based on Yilmaz and Isler (2019). Participants who agreed to participate in this experiment, first asked to respond to the free will and scientific determinism subscales with 5 seconds time-pressure for each question to induce intuitive thinking. Then, they were given a chance to revise and reevaluate their initial response in no time-pressure for each question as control. As in Yilmaz and Isler (2019), participants informed before asking to revise their responses that "you do not have to but may choose to revise your initial response" to minimize potential demand effects. While under no time pressure, participants could see their initial decision.

Debiasing training. As explained in the current study section, Isler et al. (2021) found that the time-delay condition as a reflection training did not work as intended and acted as a control group. In this condition, we wanted to use a stronger reflection manipulation which is the debiasing training used by Isler et al. (2020). Debiasing training consists of "learning about and describing three cognitive biases" (Isler et al., 2020). Participants were asked to answer three questions first, which are on semantic illusion ("How many of each animal did Moses take on the ark?"), base rate fallacy ("In a study, 1000 people were tested. Among the participants, there were 5 engineers and 995 lawyers. Mehmet is a randomly chosen participant in this study. Mehmet is 36 years old. He is not married and is somewhat introverted. He likes to spend his free time reading science fiction and writing computer programs. What is most likely?" Mehmet is a lawyer or engineer[1]) and availability bias ("Which cause more human deaths?" sharks or horses; see Appendix-B for the questions). After the questions, a screen displayed the correct answer and explained the biases for each question. Finally, participants were asked to write 4 sentences to summarize what they learned and instructed to rely on their reflections in the next tasks. We used the same manipulation for the second condition. Then, participants answered Free Will and Scientific Determinism subscales without any time limit.

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[1] In the experiment we made a typing error in the multiple selection section. The body of the question nd two of the options were written with the name "Mehmet". However, two of the option were accidentally written with the name "Ahmet". In these faulty options, instead of writing Mehmet is an engineer or lawyer, we wrote Ahmet as the name of the subject accidentally. We discover this situation while the experiment was on-going and corrected it. But some of the participants noticed this mistake and reported it at the end of the section while writing 4 sentences. In the end of the debiasing training, we asked participants to report what they have learned in 4 sentences and even thought 5 participants noticed the errors and reported it in one of the sentence spaces, overall examination of the sentences indicate that participants understand the general idea of our training.

Emotion prime. For intuition manipulation, we used emotion induction training as manipulation, which is based on Levine et al. (2018, Study 3) to invoke intuition in individuals. Levine et al. (2018) gave participants a passage about relying on emotions on cooperation decisions. Then during a prisoner's dilemma game, participants were told either that their partner relied on emotion or that their partner relied on reason. Participants were more likely to predict that their partner was more cooperative in the prisoner's dilemma when they were told their partner relied on emotion compared to reason. The use of emotions is highly related to intuition, as Gärtner et al. (2020) also discussed. They showed that emotion induction manipulation checks revealed a reliance on intuition more compared to reason induction manipulation checks, indicating that emotion induction led to the use of intuition in the participants. The reason for comparing two intuition manipulation in this experiment is the evidence that emotion induction manipulation is significantly more effective than time-pressure in cooperation studies (Kvarven et al., 2020). We wanted to test whether this is the case for free will and determinism beliefs.

For emotion induction manipulation, participants presented a text which emphasizes the reliance on emotion when deciding and instructs the participants to use their emotions when giving answers to the questions in the experiment (see Appendix-C). Then, participants answered Free Will and Scientific Determinism subscales without any time limit.

Control Condition. Lastly, a passive control condition was used to identify the baseline scores, where participants did not receive any treatments. Participants in this condition took the surveys without any manipulation.

2.2.3 Cognitive Reflection Test (CRT)

We used two measures for the assessment of analytic thinking with are CRT and AOT. Firstly, participants were administered to cognitive reflection test, which was developed by Frederick (2005) and a widely used measure of cognitive style (Toplak et al., 2011). This scale is used for the assessment of analytic cognitive style, which contains three different questions designed to measure predisposition to think analytically. Each question has one correct answer, which is identified with analytic thinking (Type 2) and a wrong, intuitive answer (Type 1 thinking). The original questions could be seen below (see Appendix-D for the Turkish version). In this experiment, we measured CRT by using multiple-choice questions (Sirota & Juanchich, 2018).

2.2.4 Actively Open-Minded Thinking Scale (AOT)

Later, the participant received the AOT scale, which consists of 6 items 5-point Likert type measurement (Absolutely disagreed 1 – 5 Absolutely agreed), which measures the importance of being open to revisiting one's convictions where there is contrary evidence (see Appendix-E for the Turkish version). This scale was originally developed by Stanovich and West (1997) which was a long scale, and a shorter version of it was developed by Haran et al. (2013; consist of 7 items) and Baron et al. (2015; consist of 8 items) and found to be effective measure (Baron, 2019). The 8-item version of the scale has a Cronbach alpha of .67 (Baron et al., 2015). Unlike CRT, this measure does not measure the reflectiveness of individuals; instead, it concerns the direction of thinking. In this experiment, we adopt the scale is that taken from The Comprehensive Thinking Styles Questionnaire's actively open-minded subscale, which consists of 6 questions that have a Cronbach alpha of .86 (Newton et al., 2021).

2.2.5 Compatibilism Scale

We created a Compatibilism Scale (CS) to measure attitudes toward the compatibility of free will and determinism. In a three-item scale, we aimed to measure the participants' attitudes toward the compatibility of free will and determinism. The scoring of the questionnaire is based on the 5-point Likert-type scale (1 = *strongly disagree, 5 = strongly agree*). After reading a prompt explaining the philosophical understanding of free will and determinism, participants were asked to respond to three-item questions measuring compatibilism (e.g., "free will and determinism are compatible with each other -so both could be true at the same time-"). After solving the CRT, AOT, and CS scale, the participants received the demographic form (see APPENDIX-F).

2.2.6 Demographic Form

In the demographic form (see APPENDIX-G), we asked participants to indicate their religiosity (1- not religious at all, 7- highly religious) while reporting their religion and political affiliation (1- left wing is used as Turkish equivalent of liberal in the US, the 7-right wing is used for the cultural equivalent of conservative) with single-item questions; the method is valid and used by several different works (Yilmaz et al., 2020; Yilmaz & Isler, 2019; Yilmaz et al., 2018).

2.3 Data Exclusions

As preregistered, submissions with incomplete main outcome measures (i.e., free will and scientific determinism) and duplicate submissions were excluded from the analyses.

2.4 Design and Procedure

The experiment employs a between-subjects design, where there are three experimental (time-pressure, emotion prime, debiasing training) and one control condition. In the time-pressure condition, the participants are given to chance to revise their initial time-pressured decisions under no time pressure in a within-subjects design to allow for revising the initial response for the main DV question for investigating belief revision. Participants in the emotion induction, debiasing training, and control group had the same procedure. All of the three groups received manipulations at first; after the manipulation, they expected to respond to series of questions that start with the FAD+ scale, and later they received CRT, AOT, CS, and demographic scales, respectively. In the within-subjects design, participants received the free will and scientific determinism subscale of the FAD+ scale twice, in the first time-pressure (to induce intuition) and then in the no time-pressure (which acted as a control condition because we do not give a direct prompt about reflection). Participants were invited to experiment via an internet link. Firstly, participants administered a consent form, and if they agreed to involve in the experiment, they would be taken into the experiment. Otherwise, they led to the final page of the experiment. The experiment was prepared and spread using Qualtrics survey software via a web link. The experiment was done in an online setting, and participants were debriefed about the aim of the experiment and were rewarded for their participation at the end of the experiment with a gift lottery draw. As a manipulation check, in all the conditions a relevant face valid questions were asked. We asked two face valid questions measuring self-reported thinking style for each condition: "To what extent did you rely on reason when making decisions" and "To what extent did you rely on your feeling or gut reactions when making your decisions" (reverse-coded), on a 0 (not at all) to 10 (very much) point scale. The average score of these two questions comprises the self-report measure of reflective thinking as in Isler et al. (2020).

For each condition, we used a behavioral manipulation check which measures the reaction times of the participants to check the compliance with our manipulation. To assess participants' compliance with the manipulation checks, we compared the means of reaction time measurements and self-reported thinking style reports for four conditions using two one-way ANOVAs. More specifically, for each condition, we first used reaction times, that is, the amount of time passed until participants complete a dependent variable as the manipulation check (e.g., for time-pressure, we expect lower mean scores for reaction time compared to control groups, debiasing training, and emotion prime). In addition, we also add the whole duration of the study as a manipulation check too (e.g., reflection is time-consuming; thus, one

must expect debiasing training had a longer duration in the study). As an outlier criterion, we create a cut-off point for z score +3 and -3 to detect outliers in the manipulation check.

2.5 Analysis

Confirmatory Tests. A 4 (manipulation: time pressure, emotion, training, or control) x 2 (belief: free will, determinism) mixed ANOVA, where the latter factor is within-subjects, used for the data analysis to detect a significant difference between four different conditions, which followed up by pairwise comparisons. Scientific determinism and free will subscales are treated as two separate outcome measures. In this mixed ANOVA, the time-pressure condition used for the focal analysis in between-subjects comparisons (time pressure, emotion, debiasing vs. control) as an intuitive thinking manipulation. The within-subjects factor embedded in the time-pressure condition was analyzed separately. For that goal, two paired-samples t-test were used to detect a significant difference between the time-pressure and control conditions on free will and scientific determinism sub-scales.

Exploratory Tests. Besides, we explored whether both the Cognitive Reflection Test (CRT) and the Actively Open-Minded Thinking (AOT) scale predict belief revision (the difference between the two measures taken in the presence versus absence of time pressure). As an exploratory analysis, we also control for the moderating effect of CRT, CS, and AOT on the confirmatory analysis by using a two-way ANCOVA. We also conducted a one-way ANOVA to test whether our between-subjects manipulations have an effect on the compatibilism score.

3. RESULTS

To better understand the outcomes of the data, we ran several investigations on manipulation checks, confirmatory tests, and exploratory tests in the JAMOVI version 1.6.9. In the following section, we begin to report and explain the results of the manipulation checks, main analysis, and exploratory analyses that have been explained in the analysis section (see Table 2 for variables, and to see the correlation among them, see Table 3.1).

Table 3. 1 Descriptive statistics of variables

	Free Will Subscale	Determinism Subscale	AOT	CRT	Compatibilism
N	668	670	649	619	637
Missing	75	73	94	124	106
Mean	3.07	3.27	2.46	2.16	2.79
Median	3.00	3.29	2.33	2	3
Standard deviation	0.657	0.566	0.793	0.783	1.19
Minimum	1.00	1.00	1.00	1	1
Maximum	5.00	5.00	5.00	3	5
Skewness	0.132	-0.207	0.473	-0.279	0.101
Std. error skewness	0.0946	0.0944	0.0959	0.0982	0.0968
Kurtosis	0.0848	0.648	0.182	-1.32	-1.18
Std. error kurtosis	0.189	0.189	0.192	0.196	0.193

Table 3. 2 Correlation Matrix

	Free Will Subscale	Scientific Determinism Subscale	AOT	CRT	Compatibility	Libertarianism	Hard Determinism	Politic Orientation	Religious Orientation
Free Will Subscale	—								
Scientific Determinism Subscale	0.333 ***	—							
AOT	-0.128 **	-0.165 ***	—						
CRT	-0.074	-0.052	0.235 ***	—					
Compatibility	0.064	0.101 *	-0.162 ***	-0.034	—				
Libertarianism	0.194 ***	0.068	-0.144 ***	-0.081 *	-0.369 ***	—			
Hard Determinism	0.001	0.081 *	-0.047	-0.042	-0.331 ***	0.037	—		
Politic Orientation	0.141 ***	0.092 *	-0.177 ***	-0.064	0.102 *	0.029	0.011	—	
Religious Orientation	0.158 ***	0.105 **	-0.269 ***	-0.150 ***	0.055	0.092 *	-0.016	0.533 ***	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

3.1 Manipulation Checks

We analyzed the self-reported manipulation questions for each group with an ANOVA. There were two questions about participants' current attitudes ("To what extent did you rely on reason when making decisions" and "To what extent did you rely on your feeling or gut reactions when making your decisions" (reverse-coded)) when making decisions about the dependent variable on a 10-points scale ranging from 0 to 10 (higher scores indicate reliance on reflection). The results of one-way ANOVA with the dependent variable of self-reported manipulation check revealed significant differences among means of four different groups, $F(3, 660) = 24.9$, $p < .001$, $\eta^2 p = .102$. Tukey's posthoc test revealed that participants who get the debiasing training condition ($M = 6.06$, $SD = 1.65$; %95 CI [5.79, 6.33]), $t(660) = .367$, $p = .98$, $d = .041$, and the time-pressure condition ($M = 5.92$, $SD = 1.47$; %95 CI [5.71, 6.14]), $t(660) = -.396$, $p = .97$, $d = -.042$ did not significantly differ from the control condition ($M = 5.99$, $SD = 1.35$; %95 CI [5.79, 6.20]). Participants who were in the emotion prime condition ($M = 4.80$, $SD = 1.73$; %95 CI [4.55, 5.06]) had a significantly lower self-reported reflection scores compared to the control condition ($M = 5.99$, $SD = 1.35$; %95 CI [5.79, 6.20]), $t(660) = -7.58$, $p < .001$, $d = -.76$ (see Figure 3.1).
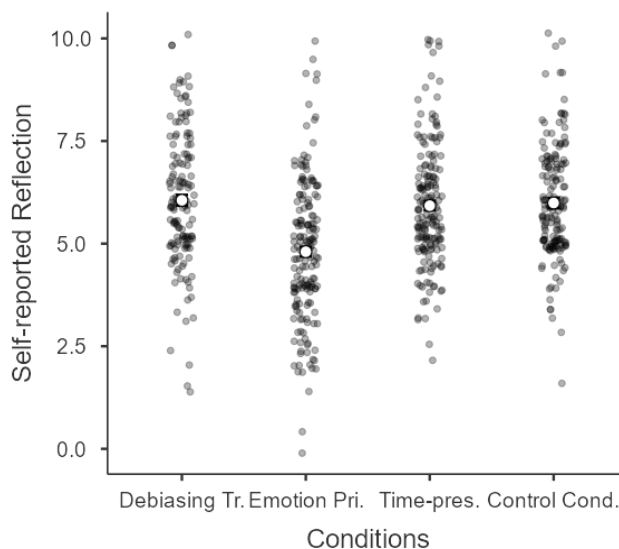

Figure 3. 1 Estimated standard error of marginal means plot for four conditions, debiasing (DE), emotion prime (EP), time-pressure (TP), and control condition, on self-reported manipulation questions.

We also analyzed the response-time (the time calculated according to the page submission time of main dependent variable which is FAD+) differences among between-subjects conditions. The results of an ANOVA with the dependent variable of reaction-time manipulation check revealed significant differences among four different groups, $F(3, 666) = 14.9$, $p < .001$, $\eta^2 = .063$. Tukey's posthoc test revealed that time-pressure condition ($M = 63.4$, $SD = 69.3$; %95 CI [53.5, 73.4]) had a significantly lower reaction time scores compared to control group ($M = 141$, $SD = 165$; %95 CI [116, 165]), $t(666) = -5.75$, $p < .001$, $d = -.612$ (see Figure 3.2).
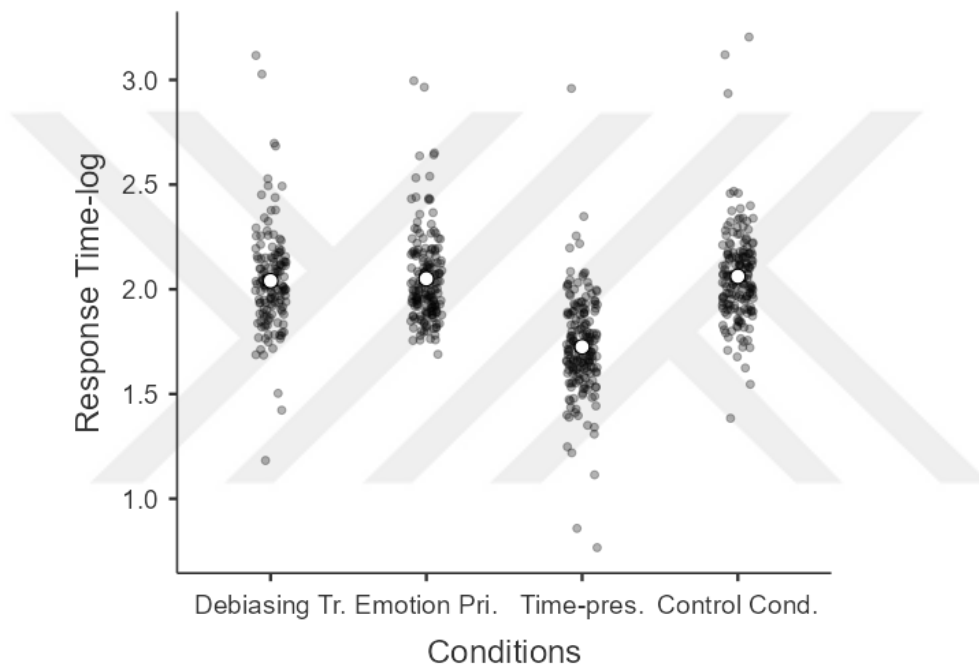
Figure 3. 2 Estimated marginal means plot of four conditions, debiasing (DE), emotion prime (EP), time-pressure (TP), and control condition, on reaction times to main dependent variable.

In addition to time spent on the dependent variable, we also analyze the total duration (seconds) of the study among 4 groups with an ANOVA (to analyze this relation, we applied Log transformation to account for skewness). A one-way ANOVA revealed there is a significant difference among between-subject groups on the total duration (in seconds) of the study, $F(3, 666) = 8.08$, $p < .001$, $\eta^2 = .035$. Tukey's posthoc test revealed that debiasing training condition ($M = 24660$, $SD = 92146$; %95 CI [9557, 39762]) has a significantly longer study duration compared to the control condition ($M = 20640$, $SD = 84850$; %95 CI [7809, 33471]), $t(666) = 3.27$, $p = .006$, $d = .372$. None of the other

between-subject conditions did significantly differ from the control condition (see Figure 3.3).
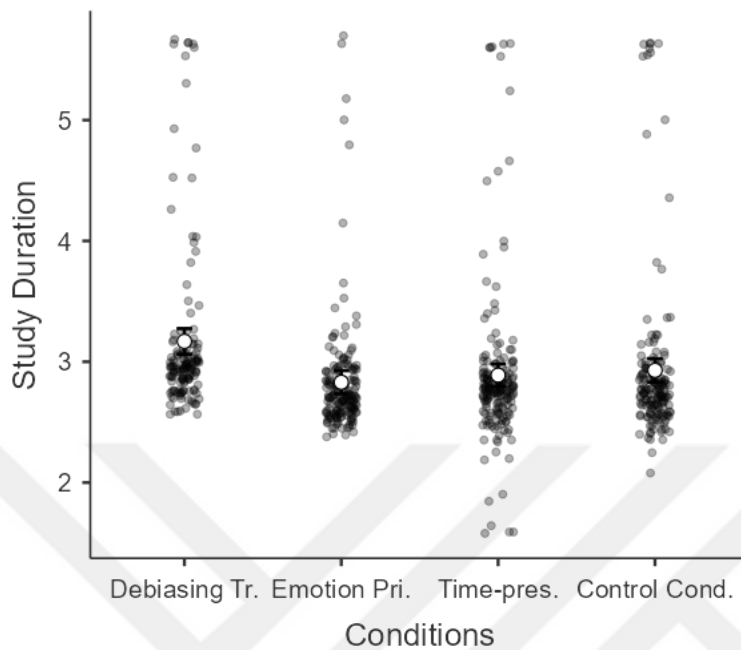
Figure 3. 3 Total study duration (transformed with log10) among between-subject comparisons according to confidence intervals.

Further, we analyzed the reaction time differences for the within-subject manipulation checks. We analyzed whether the participants complied with time limits of time pressure and no time pressure with a paired sample t-test. There was a significant difference between time-pressure ($M = 4.64$, $SD = 5.00$; %95 CI [3.96, 5.37]) and no time-pressure condition on mean reaction times (the time calculated according to the page submission time) ($M = 5.77$, $SD = 5.25$; %95 CI [5.00, 6.54])); $t(178) = -2.63$, $p = .005$, $d = -.196$. (see Figure 3.4).
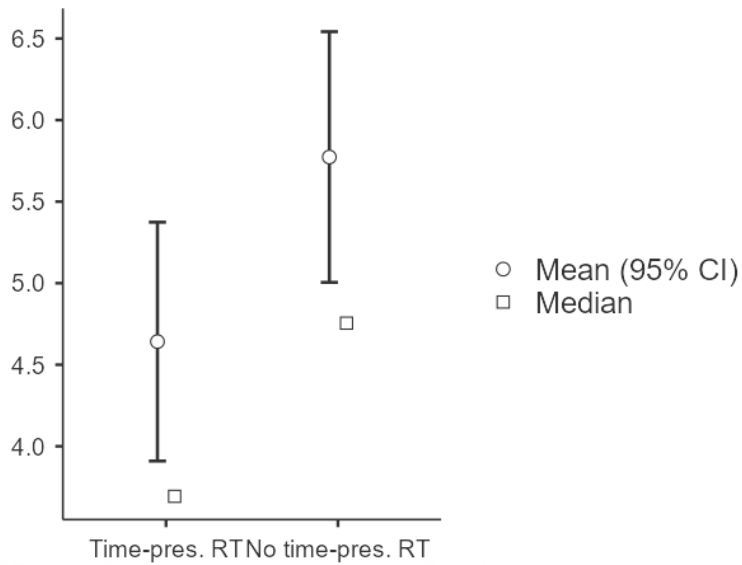
Figure 3. 4 Mean reaction time differences between time-pressure conditions and no time-pressure.

In addition, we analyzed the self-reported manipulation questions for time-pressured and without time pressure conditions with a paired sample t-test. There was a significant difference between time-pressure ($M = 5.96$, $SD = 1.48$; %95 CI [5.71, 6.14]) and no time-pressure ($M = 6.31$, $SD = 1.61$; %95 CI [6.07, 6.55]) conditions; $t(172) = -3.41$, $p < .001$, $d = -.260$ (see Figure 3. 5).
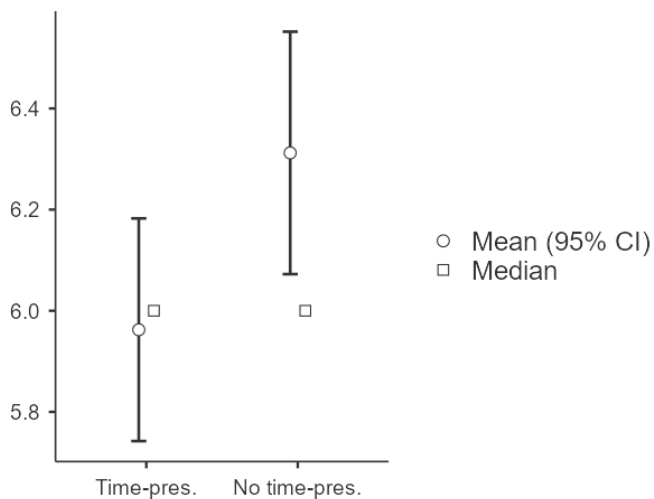
Figure 3. 5 Self-reported reflection mean differences between time-pressure condition and no time-pressure.

3.2 Confirmatory Tests

Two separate ANOVAs were conducted to see the impact of the four conditions: debiasing training, emotion prime, time-pressure, and control condition on free will and

scientific determinism subscales. Before this analysis was done, we searched for the outliers by using z score as preregistered, and above +3 and below -3 points were accepted as outliers in the data. We found three outliers in debiasing (2 of them were in determinism subscale), 3 outliers in emotion prime (2 of them in determinism scale), 1 in the control condition (in the determinism scale), and 2 in the time-pressure condition (2 of them were in free will subscale). We did not choose to remove the outliers because removing them did not change the results; in addition, it might cause to breach of the random assignment of the data.

A one-way ANOVA was conducted to see the differences in free will subscale among debiasing training, emotion prime, time-pressure, and control conditions. Results of the ANOVA with the dependent variable of free will subscale revealed significant differences among means of four different groups, $F(3,664) = 21.2$, $p < .001$, $\eta^2 = .090$ (see Figure 3.6).

Figure 3. 6 Estimated marginal means plot of four conditions according to confidence intervals, debiasing (DE), emotion prime (EP), time-pressure (TP), and control condition, on free will subscale.

We ran three planned contrast tests to see the difference among between-subject manipulations on free will subscale. The debiasing training condition ($M = 2.80$, $SD = .632$; %95 CI [2.70, 2.91]) had a significantly lower scores than the control group ($M =$

3.02, $SD = .709$; %95 CI [2.91, 3.13]), $t(309) = -2.84$, $p = .005$, $d = -.323$. Emotion prime condition ($M = 3.03$, $SD = .642$; %95 CI [2.94, 3.13]) did not significantly differ from the control condition ($M = 3.02$, $SD = .709$; %95 CI [2.91, 3.13]), $t(339) = .149$, $p = .882$, $d = .016$. As a third comparison, we examined the time-pressure condition, and found that time-pressure condition ($M = 3.35$, $SD = .530$; %95 CI [3.27, 3.43]) significantly increased the free will scores compared to the control condition ($M = 3.02$, $SD = .709$; %95 CI [2.91, 3.13]), $t(350) = 4.94$, $p < .001$, $d = .528$

As expected, time-pressure manipulation caused significantly higher free will scores than the control condition. In line with our hypothesis, intuition invoked by the time-pressure worked as intended increased the free will score. Furthermore, debiasing training decreased the free will scores, as we predicted in our hypothesis.

A one-way ANOVA was conducted to see the differences on the scientific determinism subscale among the debiasing training, the emotion prime, the time-pressure, and the control condition. The results of the ANOVA with the dependent variable of scientific determinism subscale revealed significant differences among means of four different groups, $F(3,666) = 3.61$, $p = .013$, $\eta^2 = .016$ (see Figure 3.7).
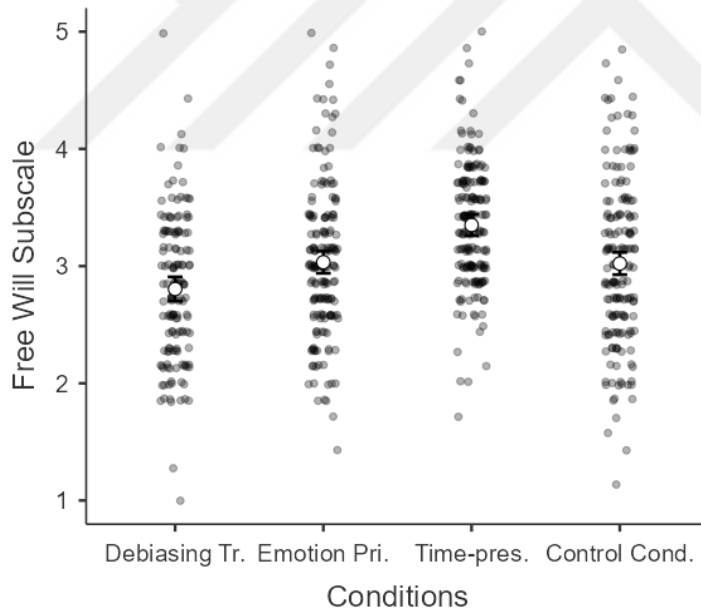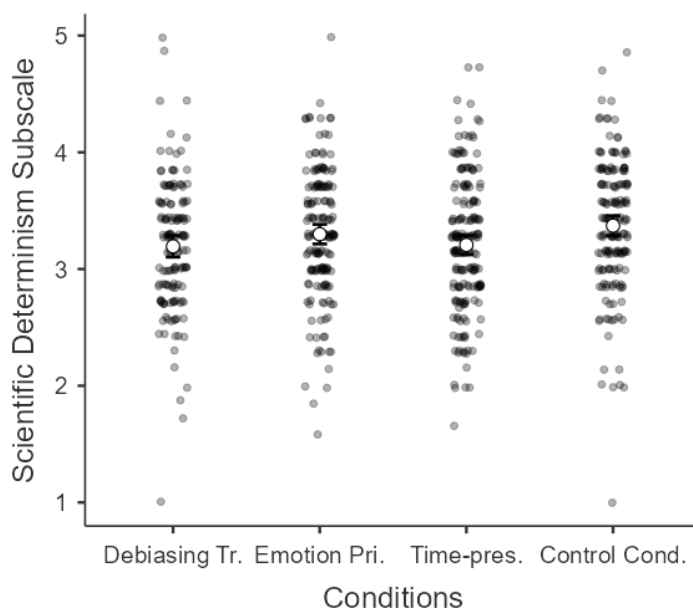

Figure 3. 7 Estimated marginal means plot of four conditions according to confidence intervals, debiasing (DE), emotion prime (EP), time-pressure (TP), and control condition, on scientific determinism subscale.

We ran three planned contrast tests to see the difference among between-subject manipulations on scientific determinism subscale. The debiasing training condition (M = 3.19, SD = .568; %95 CI [3.10, 3.29]) had a significantly lower scores than the control group (M = 3.37, SD = .564; %95 CI [3.29, 3.46]), $t(309)$ = -2.75, p = .006, d = -.312. Emotion prime condition (M = 3.30, SD = .548; %95 CI [3.22, 3.38]) did not significantly differ from the control condition (M = 3.37, SD = .564; %95 CI [3.29, 3.46]), $t(339)$ = -1.206, p = .228, d = -.130. As third comparison, we examined the time-pressure condition, and found that time-pressure condition (M = 3.21, SD = .570; %95 CI [3.12, 3.29]) significantly lowered the scientific determinism scores compared to the control condition (M = 3.37, SD = .564; %95 CI [3.29, 3.46]), t(352) = -2.73, p = .007, d = -.290. Hence, the results did not meet our initial hypothesis, except time-pressure manipulation, which reduced the determinism scores compared to the control group.

3.2.1 Impact of Within-subjects Time-limit Manipulations

Unlike other conditions, we embedded a within-sample design to the time-pressure condition. Participants who answered the questions both in free will and scientific determinism subscales under the time-pressure are given a chance to reevaluate their decision without a time limit. We analyzed whether time-pressure or no time pressure/absence of time-pressure changed their stances on free will and scientific determinism in a paired samples t-test. Two separate paired samples t-test were run to understand the mean differences between free will and scientific determinism subscales in time-pressure and no time-pressure. First, we examined the free will subscale, and we found that there were no significant differences between time-pressure (M = 3.34, SD = .510; %95 CI [3.27, 3.43]) and no time-pressure (M = 3.33, SD = .519; %95 CI [3.26, 3.41]) conditions on free will scores; $t(175)$ = .701, p = .242, d = 0.052. Secondly, we examined the scientific determinism subscale in time-pressure and no time-pressure, and we found that there were no significant differences between time-pressure (M = 3.22, SD = .554; %95 CI [3.12, 3.29]) and no time-pressure (M = 3.19, SD = .580; %95 CI [3.10, 3.27]) on scientific determinisms scores; t (178) = 1.48, p = .930, d = .111 (see Figure 3.8).
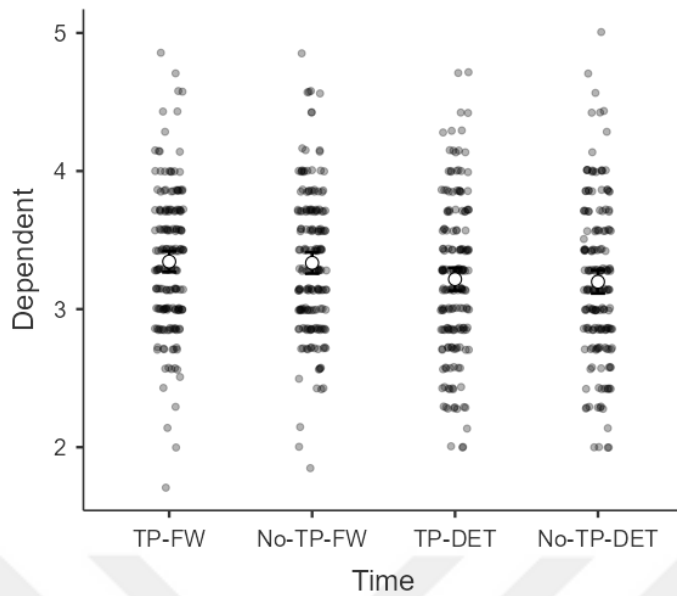
Figure 3. 8 Descriptive plots of two paired sample t-tests, time-pressure free will score (TP-FW), no time-pressure (No-TP-FW), time-pressure determinism (TP-DET), and no time-pressure determinism score (No-TP-DET) according to confidence intervals.

3.3 Exploratory Analyses

After the primary analysis on the free will subscale and determinism subscale, we explored the moderating effects of CRT and AOT on our main analysis. Thus, we ran two ANCOVA to see whether debiasing, emotion prime, control condition, and time-pressure influenced free will and scientific determinism when controlled for the AOT and CRT. Moreover, we also want to check belief revision in within-subject embedded condition, time-pressure, and absence of time, moderated by the AOT and CRT using repeated-measures ANOVA. In addition, we explored whether our between-subjects manipulations have any impact on the compatibilism score.

3.3.1 Between-Subject Moderation of AOT and CRT

We implemented the AOT and CRT to control for the influence of between-subjects manipulation on both the free will and scientific determinism subscales. Two ANCOVA was conducted to determine statistically significant differences between debiasing training, emotion prime, time-pressure, and control condition on free will subscale and scientific determinism while controlling for AOT and CRT separately (1-intuitive and 3-analytical).

Firstly, we ran an ANCOVA to see the effect of between-subject manipulations on free will subscales while controlling for the CRT scores. A covariate effect between between-subjects conditions and CRT could not be observed, $F(3, 611) = .719, p = .541, \eta^2 = .003$. Secondly, we ran the same analysis while controlling for AOT scores but not controlled for CRT scores. Results indicated no significant interaction between-subject manipulations and AOT scores, $F(3, 641) = 2.05, p = .106, \eta^2 = .009$.

In the second part, we examined the effect of between-subject manipulations on scientific determinism scores while controlling the data for CRT and AOT separately. First, we controlled the data for CRT scores, and results indicated no significant covariate effect found between scientific determinism and CRT scores, $F(3, 611) = 1.32, p = .266, \eta^2 = .006$. Second, we ran the same analysis while controlling for AOT scores but not for CRT scores. Results showed no significant interaction found between scientific determinism and AOT scores, $F(3, 641) = .765, p = .514, \eta^2 = .003$.

Although we could not detect a significant interaction when controlling the data for CRT and AOT, we always find AOT scale significant relation on both of the subscales separately. Therefore, we wanted to investigate the AOT's relation more deeply by using the general linear model (GLM). To do that, we created dummy-coded variables for debiasing, emotion prime, and time-pressure conditions to let them be examined in the regression. Then, these dummy variables and AOT, and interaction of each dummy variable with AOT were entered as predictors, and the composite score of free will subscale and scientific determinism subscale was entered as the outcome measure (we made two GLM each for one outcome variable).

There was a predictive power of AOT ($\beta = .138, p < .001$). Debiasing training ($\beta = -.148, p < .001$) has a predictive power on free will subscale scores. Emotion prime did not have a significant effect ($\beta = -.004, p = .921$) on free will subscale. Time-pressure condition had a significant effect ($\beta = .215, p < .001$) on free will subscale scores. The interaction of debiasing training and AOT ($\beta = -.020, p\ .660$) and time-pressure and AOT ($\beta = -.060, p = .171$) was not significant. However, the interaction between emotion prime condition and AOT significantly predicted free will score ($\beta = -.105, p = .019$). Simple slope

analysis comparing participants in the emotion prime condition indicated that emotion prime has no significant effect on low-AOT participants (B = .148, p = 0.121), on moderates (B = -.006, p = .921) and high-AOT participants (B = -.161, p = .083). The overall model had an adjusted R2 of .114.

We ran the same analysis for the scientific determinism subscale to see whether AOT scores had any estimation over determinism. There was a predictive power of AOT (β = .168, $p < .001$), debiasing condition (β = -.141, p = .002), and time-pressure (β = -.128, p = .007). There was no significant relation for emotion prime. For interactions among AOT and debiasing, emotion prime, and time-pressure, no significant relationships were detected.

3.3.2 Within-subjects Moderation of CRT and AOT

To control the impact of CRT and AOT on belief revision in within-subject comparisons, we ran a repeated-measures ANOVA. Firstly, we run the analysis without the CRT and AOT to see whether there is a significant effect in the baseline. Results showed that there was no statistically significant interaction between time (this is the label name for time-pressure and no time-pressure) and subscales (subscales of free will and scientific determinism), $F(1, 175)$ = .216, p = .643, η^2 = 1.59. There was no significant impact between time-pressure and absence of time-pressure conditions in free will subscale and scientific determinism subscales. There was no need to control the data for the AOT and CRT to see whether they impacted the belief revision[2] (see Figure 3.9).

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[2] Although the results of main analysis revealed un significant, we still checked for the results while controlling for the AOT and CRT. The results remained unsignificant.
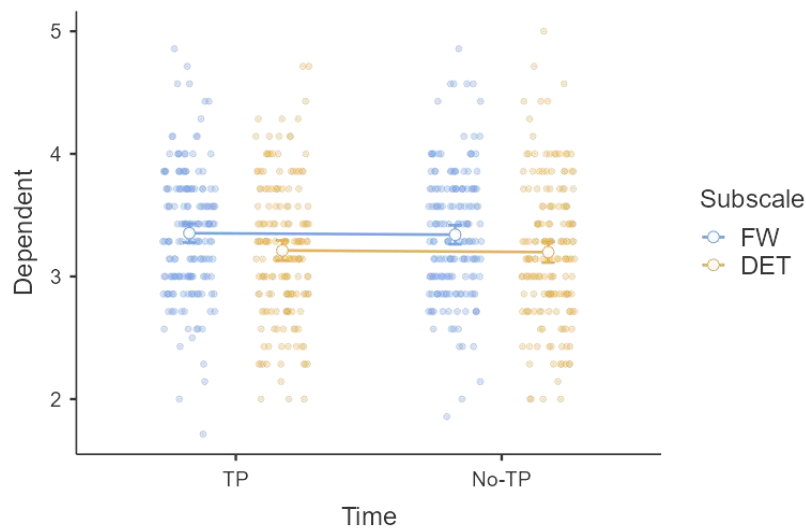
Figure 3. 9 The investigation of within-subjects embedded condition while controlling the data for the CRT and AOT in a repeated measure of ANOVA according to confidence intervals.

3.3.3 Between-subject Manipulation's Impact on Compatibility Score

For compatibility score, we asked participants, "To what extent do you believe that free will and determinism can go together?" on a 5-point Liker scale (1- absolutely disagree; 5- absolutely agree). A one-way ANOVA with Tukey's post-hoc test was conducted to see the differences in compatibility score between debiasing training, emotion prime, time-pressure, and control condition. Results of the ANOVA with the dependent variable of one-item compatibility score revealed no significant differences among means of four different groups, $F(3, 633) = 1.38$, $p = .248$, $\eta^2 = .006$ (to see the correlation among three compatibility questions, see Table 2). Furthermore, we had two additional questions to the first question, which was about the incompatibility of free will ("Assuming that free will and determinism incompatible, to what extent do you believe in the concept of free will?") and determinism ("Assuming that free will and determinism compatible, to what extent do you believe in determinism?"). We run an additional analysis regarding the relationship between the first question and these two follow-up questions. To analyze the compatibility scores in relation to the libertarianism and hard determinism scores (in Figure 3.10 raw interactions between compatibility, libertarianism, and hard determinism could be observed).
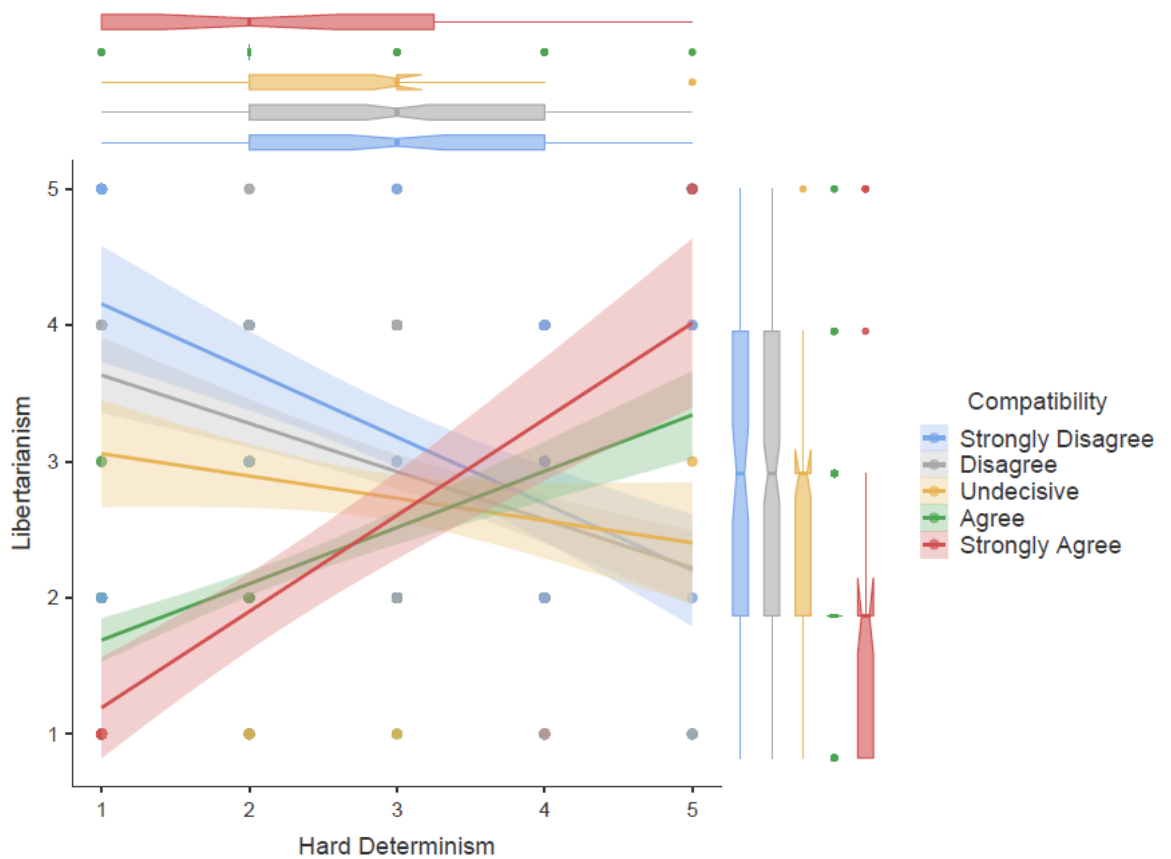
Figure 3. 10 The interactions between three compatibility questions. Compatibility scores are presented as separate lines, whereas the second and third questions, namely measuring the incompatibilist free will and determinism, are indicated.

3.3.4 Between-subject Manipulation's Impact on CRT and AOT Scores

We tested whether analytical thinking and intuitive thinking had any effect on the CRT and AOT. First, we compared the effects of our manipulations on AOT scales, especially the effect of debiasing training. However, we found no overall effect of manipulation on AOT; $F(645,3) = .593$, $p = .620$, $\eta^2 = .003$. Secondly, we tested whether the cognitive reflection test (CRT) scores differ among between-subjects conditions to see if any of the groups had a different reflection level than others. However, we found no significant differences among between-subjects conditions on CRT; $F(615,3) = .296$, $p = .828$, $\eta^2 = .001$.

4. DISCUSSION

Our aim was to search for the cognitive foundations of free will and scientific determinism beliefs. For that purpose, we designed an experiment that examines the

impact of three cognitive style manipulations that are empirically presented with robust findings, with the purpose of invoking either intuition or reflection and observing their effect on free will and scientific determinism beliefs. We used the FAD+ scale as a main dependent variable by using free will and scientific determinism subscales. We had four experimental groups: debiasing training (reflection), emotion manipulations (intuition), time-pressure (intuition), and control conditions. Also, we embedded a within-group manipulation to the time-pressure condition by giving participants an option to revise their initial answer provided under time pressure, to see whether people revise their initial attitudes when there is the absence of time pressure. In our first hypothesis, we expected that reflection would increase the endorsement of scientific determinism and decrease the endorsement of free will. In the second hypothesis, we expected that intuition would decrease the endorsement of scientific determinism but increase the belief in free will. As a third hypothesis, we expect that within-subjects time-pressure condition would increase the belief in free will but decrease the determinism scores compared to the control condition; we expected that this belief revision would be stronger for those higher in AOT and CRT.

The results showed that although between-subject manipulations have a significant effect on the free will and determinism subscales, we could not find full support for the first hypothesis because debiasing training only decreased the endorsement of free will but did not increase the endorsement of scientific determinism.

The results partially supported our second hypothesis: The time-pressure condition, which induces intuitive answers, increased the endorsement of free will and decreased the endorsement of scientific determinism. However, emotion prime, which was used to induce intuitive thinking, did not cause any significant effect on the endorsement of free will and scientific determinism.

For our third hypothesis, the within-subjects manipulation, we could not find any significant effect on belief revision. Answering free will and scientific determinism subscales under time-pressure and no time-pressure had a nonsignificant effect on the belief revision on the endorsement of scientific determinism and free will.

Moreover, for both covariate effect and predictiveness, we could not find a significant effect of AOT and CRT on the belief revision in within-subject, and between-subject differences in free will and determinism subscales. Furthermore, we examined the impact of between-subject manipulations on one item compatibility question, and we could not find any significant impact for it as well.

Additionally, we wanted to compare the effectiveness of our manipulations. Self-reported reflection in debiasing condition did not significantly differ from the control group. However, when we compare the total duration of the experiment, we found that participants in the debiasing condition spent significantly more time on the experiment, but the time duration during responding FAD+ scale did not significantly differ from other conditions. We expected a longer time spent on the experiment and higher self-reported reflection since debiasing training was intended to be used to activate reflection. For the emotion prime, we did not detect a significant difference on the self-reported reflection and time-duration compared to the control group. Lastly, the time pressure condition significantly differed from the control condition in terms of duration (FAD+ response duration) but not for self-reported reflection. For intuition manipulations, we expected that both the duration of the study and the self-reported reflection would be lower compared to the control condition because using intuition is assumed not to be deliberative and time-consuming. Furthermore, we compared the manipulation checks for within-subjects manipulation. When we check for the self-reported reflection change between the time-pressure and no time-pressure conditions, we found that there was a significant increase in the reported reflection after the participants were allowed to reflect on the questions. This indicates that time-pressure manipulation seems to work as intended. Besides, the time-duration differences between the time-pressure and no time-pressure were significant (see Results). Participants responded more quickly in the time-pressure compared to no time-pressure condition. Also, the total time duration spent on tasks was shorter in no time-pressure condition. Furthermore, as an exploratory measure, we compared the compatibility, CRT, and AOT scores among between-subjects conditions, and we could not find significant differences in both CRT and AOT (see Results).

Overall, the results of the study are mixed, and our confirmatory hypotheses are mainly unsupported. We only partially supported the second hypothesis that intuition would increase free will but reduce the endorsement of determinism. Additionally, the manipulation checks have mainly failed. Hence, we propose several explanations as to why our hypothesis and our manipulation checks might have failed.

One of these problems might be that debiasing training can lead participants to be more skeptical about the choices they made instead of the hypothesized effect. Thus, we compared the manipulation checks to be sure and found a ceiling effect caused by the debiasing condition (see Results). Also, we argued the FAD+ scale's inappropriateness for this experiment. Another point we suspect is the data quality. We investigated these topics more in-depth in the implications section.

4.1 Implications

Our results provided promising findings, especially for time-pressure and debiasing training conditions. Time-pressure condition increased the endorsement of free will scores but decreased the determinism scores. Therefore, we can infer that free will has an intuitive foundation. This finding does not align with previous research because they showed no effect of making a fast judgment (time-pressure/ intuition) on free will (e.g., Protzko et al., 2016). On the other hand, debiasing training aimed at inducing reflective thinking in participants, decreased the endorsement of free will and, unexpectedly, lowered the determinism scores. This effect was the opposite of what we expected. We come up with several explanations for such interaction.

We suspect there could be several possible issues when answering questions after debiasing training. When we control the findings for the self-reflection manipulation check, we could not find any significant difference between debiasing training and the control group for manipulation check scores. Moreover, when we controlled for the response time duration for the dependent variable, we could not detect a significant difference again. However, when we check the duration of the study, we found that the debiasing condition significantly lasted longer compared to the control condition and other between-subject conditions (see Results). Reflection is a time-consuming activity,

so longer duration of the study implies that participants took time to reflect on their thoughts. Therefore, it is hard to say whether debiasing training worked as intended or not. However, according to Evans and Wason (1976), an extended reflection does not necessarily lead to reflective thinking if it is merely an elaboration on the favored conclusion. Therefore, for reflection, considering the alternative choices or leaving room for rumination is also necessary. In this regard, the FAD+ questionnaire had straightforward questions that might lead participants not to think for alternatives, and in response times to FAD+ measurement, we observed this pattern. The time differences among between-subject groups differences were non-significant. So, participants were being asked simplistic questions leading to simplistic judgments and not seeking alternative possibilities. In this regard, skepticism invoked by the simplistic nature of the question could be one alternative explanation for our results.

We suspect that debiasing might increase skepticism in general; as a result, participants would become more skeptical about the questions asked in both free will and determinism scales, and they would endorse less free will and determinism. According to Baron (1993), open-minded thinking (AOT) is one of the best features of critical thinking, described as a deep and unbiased search for alternatives, evidence, reasons, and goals. Since being open-minded about one's belief often requires being skeptical, AOT measurement can be considered as a variable closely related to skepticism. To see whether skepticism had an effect, we checked the results of between-subject differences on AOT (see Results). We found no significant differences among between-subject conditions, which means between-subject conditions did not differ in terms of skepticism. Furthermore, we run a multiple regression analyses to better understand that the AOT scores had any predictive ability on free will and scientific determinism. Results demonstrated that only emotion prime manipulation interaction with AOT had a significant effect on free will scores. However, this relationship was nonsignificant when we checked simple slope analysis for AOT scores (see Results). Hence, we could not be sure whether debiasing caused skepticism or not. Further investigations with an actual measurement of skepticism could be beneficial for future studies.

Nevertheless, we come up with another alternative explanation for the effect of debiasing on the scientific determinism scale. The FAD+ scientific determinism subscale is a straightforward scale, and these simple questions such as "Our genes determine the future" are not intellectually challenging. Thus, the evaluation of these questions could be endorsed less after debiasing training. In a sense, for the free will subscale, the same pattern could be expected too. Hence, the debiasing training worked, but the questions were not challenging enough for the participants to use reflective thinking. The simplistic nature of the questions confounds with simplistic thinking, and scientific determinism is the exact opposite of being simple when we consider its philosophical grounds. Hence, an analytic thinker would probably accept questions such as "the person's biological structures determine their abilities and personalities" in the scientific determinism subscale, but even if they want to endorse these questions, the simplistic nature of the questions makes it harder to endorse them. The reflection manipulation is expected to increase the reflection and analytical thinking in participants so that the participants ruminate more on the given subjects. However, given that the questions in both free will and scientific determinism were not intellectually challenging, participants did not endorse these questions in debiasing condition. The reason for this could be the lack of intellectual challenge in the questions of the FAD+ scale. Overall, we propose that the finding that reflection reduces the endorsement of scientific determinism might be caused by unsophisticated, simplistic thinking. To be more specific, in reflection manipulation, we encouraged the participants to encounter questions that require complex thinking, but they encountered simple questions on the FAD+ scale. Therefore, participants who prepared themselves for complex questions might tend to reject the endorsement of these beliefs in both free will and scientific determinism subscales as a response bias. Moreover, to see whether reflection had any effect, we used CRT as a secondary measure of analytical thinking. Overall, CRT scores among between-subjects conditions did not significantly differ from each other. In addition, multiple regression analysis also revealed that CRT had no effect on the endorsement of free will and scientific determinism subscale (see Results). However, the simplistic nature of the FAD+ questions might still be an issue that needs to be reconsidered in future studies despite the non-significant relationship between CRT and free will and determinism beliefs.

Another point that might imply a data quality problem is that most of our manipulation checks have failed. Since debiasing training was effective in a few preregistered, large-scale studies (Isler et al., 2020; Yilmaz & Saribay, 2017a, 2017b), it is one of the possibilities that it did not work as intended in the current experiment due to an artifact or a confound in our design, which might be the low quality of the data. We suspect that the length of the experiment and the online design as of March 2021 could be an issue in the wake of the COVID-19 pandemic. Although Isler et al. (2020) found an effect of debiasing manipulation in the online setting, they collected their data from Prolific, an online data collection service prior to the current pandemic. Although most of our sample was collected via an e-mail link sent to former participants of previous studies, some of them attended our study from links that we shared on social platforms such as "What'sApp." At least some of our participants (N = 173) has no previous experience in terms of taking experiment such as ours. Their naiveness might affect the quality of the data. The fact that some participants might take a break while continuing the experiment may have caused a problem because the dataset included participants (N = 25, 3%) who took exceptionally long (z score < +-3) to finish the experiment. Additionally, the mean duration of the experiment exceeds our expectations (M = 43.2 min); we expect the study duration to be around 20 min. In the current pandemic, most people have begun to work from home, and their daily lives activities may impact the experimental process adversely.

Furthermore, we checked the demographics of our data in terms of SES, age, education, religion, political orientation, and religious orientation. Our data predominantly consisted of female participants (73% of our participants were female). When we compared the endorsement of free will and scientific determinism between females and males, we found that males endorsed scientific determinism more than female. This outcome was in line with the findings of Paulhus and Carey (2011), where they found that males endorsed scientific determinism more than females. Since the sample size between males and females is unequal, the lower endorsement of scientific determinism by females might affect the outcome of our study[3].

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[3] We conducted a Welch's t-test, and we found female endorsed significantly less scientific determinism, $t(264) = -2.28$, $p = .023$, d = -.212; %95 CI [-.226, -.016] and for free will we find nonsignificant difference $t(254) = -1.89$, $p = .060$, d = -.177; %95 CI [-.246, -.003].

We rechecked the correlation matrix to seek to point other possible issues in our data (Table 3. 2). Several correlations from our results come as unexpected, such as the correlation between CRT and free will subscale and CRT and determinism subscale. Our data showed that there was a non-significant correlation between CRT and free will subscale scores (see Results). We expect a negative correlation between them because the intuitive endorsement of free will would have negatively correlated with the reflective thinking which CRT measures. However, a non-significant relation between CRT and free will leads us to question our initial hypothesis. We expect a positive correlation for the CRT and determinism correlation since we thought determinism was a reflective and highly analytical product of reasoning and science. Nonetheless, we could not find a significant correlation between CRT and scientific determinism (see Results).

In our experiment, we could not detect an impact for the emotion prime. The self-reflection manipulation check reveals that participants reported significantly less reflection; they did not differentiate in the response and total duration times. The impact of emotion prime as Levine et al. (2018) and Gärtner et al. (2020) used for their research on cooperation and showed significant results. Moreover, a meta-analysis by Kvarven et al. (2020) presents that emotion induction as a method for inducing intuition manipulation is better than time-time pressure. However, we failed to replicate the effect of emotion induction in our study. Emotion prime could not activate the intuition as time-pressure activated. These studies that find a significant effect for emotion induction are not preregistered, and they are conducted on Western samples. This could be a potential reason why we were not able to replicate the effect. Another potential reason for why emotion prime did not work could be the lack of a pair in the interaction (e.g., economic game). In the Levine et al. (2018) experiment, participants played a cooperation game involving pair of participants, where the emotion prime was directed to social decision-making, similar to real-life. Therefore, the interpersonal cooperation play led participants to use their emotions and intuitions rather than reasons. In our research, even though we can confirm that the effect of emotion prime induced the intuition on self-reflection manipulation check, the actual results of our dependent variables did not change. Thus, the problem could lay in the dependent variable itself, a philosophical attitudinal

measurement unlike the cooperation game of Levine et al. (2018). More research is needed to assess the effectiveness of emotion-inducing as a way of activating intuition.

Nichols and Knobe (2007) used high and low emotions to manipulate the belief in free will and determinism compatibility. Although Feltz and Cova (2014), in their meta-analysis, confirmed this effect, the emotion explained a small variance. In a sense, our experiment could help explain this relation. We expected that emotion would increase the effect of intuition on participants' decisions. In the literature, there are no studies including the intuitive effect of emotion induction. However, in our study, we tried to induce emotion in order to increase intuition. Therefore, Nichols and Knobe's (2007) findings can be explained by manipulating participants' emotional states, causing an increase in the reliance on intuition when they read a vignette about some other individual's decisions or actions. As a result, intuition might have moderated the link between emotion and free will belief in their study. Investigation of such links could be beneficial to contribute to the literature.

People's openness to revising their own ideas and openness to new experiences is essential when re-thinking an initial answer made in a hurry, and in our within-subject condition, it was done with a time-pressure. Between time-pressure and no time-pressure conditions, we could not find any significant belief revision and, AOT and CRT were found to be nonsignificant (see Results). Still, we found a significant effect of time-pressure and no-time pressure on both manipulation checks: self-reflection and time duration. No time pressure condition resulted in significantly higher reflection and longer response durations, both antecedent of reflection. If there were a manipulation for the reflection in no time-pressure condition, the results could be different. Isler et al. (2021) found that time pressure induced intuition and no time pressure act as a control condition. However, our results did not indicate a significant change between time-pressure and no time-pressure. Even if the manipulation checks revealed that participants in the time-pressure condition spend less time and depend more on their intuition, we could not find an effect.

Moreover, we found there were no differences in compatibilism score among conditions, which contradicts with the results of Hannikainen et al. (2019). Hannikainen et al. (2019) found that participants who exhibit greater reflection are more prone to see free will as incompatible with determinism. However, in our research, we found no such effect; the reflection and intuition manipulations did not affect the compatibility scores (see Results). Because the measurement of the compatibility was not the actual dependent variable of our study, and was fully exploratory, it did not come right after the manipulation presented, so the effect of the manipulation might dissipate until the compatibility questions. Therefore, future studies should directly test the causal role of cognitive styles on compatibility and incompatibility judgments.

Furthermore, our results contributed to the debate whether between-subjects or within-subject comparisons are more effective (Clifford et al., 2020; Lambdin, 2009). We found between-subject groups to be more effective than within-subjects. Our results revealed that between-subjects manipulation significantly affected the free will and determinism scores compared to the within-subject embedded condition (see Results). The time-pressure condition increased the free will and decreased the determinism scores in between-subject comparison. On the other hand, we could not find an effect for the within-subject comparison (see Results). However, the manipulation checks revealed that between-subjects conditions such as time-pressure, debiasing, and control groups did not significantly differ in self-reported reflection. So, even if we supported the effect of the between-subject comparison, results are mixed when we control the manipulation checks. As a result, our experiment has mixed results. We tried to seek some answers for our mixed results, as explained above.

4.2 Limitations and Future Directions

Using the FAD+ scale could be one of the main limitations of our study. Even though the FAD+ scale is highly used in the literature, it has a limitation. FAD+ was created based on the premise that free will and determinism are incompatible (Carey & Paulhus, 2013). Thus, the questions could mislead participants in terms of measuring their actual beliefs on free will and determinism. The questions on free will and determinism seem like they measure libertarianism and hard determinism. Although we considered these limitations,

there is no measurement in the literature that measures free will and determinism considering compatibility and incompatibility. Therefore, we still used the FAD+ scale, but we also added a short scale measuring participants' attitudes on compatibilism and incompatibilism, which is developed for the current study.

Another limitation could be measuring stable opinions but not contextual ones. As we stated in the introduction, the measurement style is an issue, and it has downs and ups. Unlike contextual measurements, stable opinions reflect the person's stable opinion without any interruption of contextual knowledge. Still, contextual measurements have their merits, especially given the fact that free will debate is not a major concern for everyday people; giving a vignette to simplify the issue could be promising. However, understanding these vignettes requires base rate philosophy knowledge, which is a hard requirement to expect from a lay person (Nadelhoffer et al., 2020b). Another reason that we developed and added a compatibility scale is to provide a contextual measurement as well. It is a partially contextual measurement due to the fact an apriori information about the philosophical understanding of compatibility and incompatibility of belief in free will and determinism is given to the participant. In the compatibility scale, we tried to overcome the limitations of the FAD+ scale, which was that the questions reflected the assumption that free will and determinism are incompatible. In our analysis, we did not find any significant differences among between-subjects conditions impact on compatibility. Hence, a better device to measure compatibility without heavy interruptions of vignettes and a more comprehensive and accurate measurement of stable opinions could be beneficial for further studies to investigate both free will and compatibility. The free will that we mentioned here is an individual difference, as Paulhus and Carey (2011) and Carey and Paulhus (2013) discussed. This understanding of belief in free will as an individual difference represents a lay understanding of free will. On the contrary, from a philosophical point of view, people's perceptions about free will can be inferred from other indicators such as compatibilism and incompatibilism. Compatibilism is a thought which claims the coexistence of free will and determinism at the same time, and it is an indicator of a person's free will beliefs. Based on the findings of our experiment, it is very difficult to infer anything about the cognitive foundations of compatibility and incompatibility for free will and determinism. Although we did not ask

for the entire inventory of FAD+ and even if we asked for the full inventory, the agency part of the compatibility issue, dualistic understanding of participants and related concepts would be untouched. Future research could aim to develop better measurements for compatibility and incompatibility and study free will and determinism from a philosophical point of view.

Another point, as we mentioned in the implication section, is the questions of the FAD+, which are too simplistic. The interaction between free will and scientific determinism debate is highly philosophical and requires analytical reasoning to some degree. However, the questions of the FAD+ did not leave a place to ruminate on them. Hence, the questionnaire used in our experiment is also one of the limitations. Hence in future research, we must eliminate the confounding effect of simplistic thinking in this regard and ask more challenging questions in scales (such as Nadelhoffer et al., 2014).

Another limitation is that the low-reliability scores of our study. The low reliability in the subscales is a big concern regarding the quality of the measurement. Especially in the time-pressure condition, free will and determinism subscales and scientific determinism subscale of emotion prime condition had a low level of reliability. We checked the inter-item correlation of determinism and free will scales for each condition. When we excluded the questions that lowered the reliability of the scale from the free will subscale (time-pressure) and scientific determinism (emotion prime), we had three questions left to analyze, and removing four questions from a seven-question scale is more than half. Hence, we choose not to exclude any items.

We thought about the possibility of reflection leading to compatibilist attitudes because accepting the compatibility of free will and determinism could be explained by the moral consequences of believing solely in determinism. This means that endorsement of determinism is an attitude that requires reflection, but considering the lack of moral responsibility in a deterministic environment could lead people to obtain a midway approach which is endorsing free will while endorsing determinism to keep moral responsibility at hand. However, our data did not support this claim because compatibility scores did not reveal a significant difference between conditions (see Results). However,

each view could be supported on both analytical and intuitive levels. Since we open the discussion with the effect of reflection on moral consequences, living in a deterministic universe can lead people to endorse free will because of moral causalities. Belief in free will could be supported with analytical reasoning, too. Also, belief in determinism could be explained with an intuitive level because some of the facts of scientific determinism are undoubtedly prevalent in our lives; for instance, we already know our environment had an impact on us or our genes affecting the way we behave. Our perspective in accord with the results of our study and the philosophical perspectives on free will and determinism led us to obtain a view that both ideas could be supported in both analytical and intuitive levels. Maybe there is no certain way of assessing the cognitive foundations of free will and determinism because both ideas could have different underlying concepts. As a future direction, it could be beneficial to look at the impact of reflections on having a compatibilist view in a separate experiment.

Since Turkey is a non-WEIRD country (Henrich et al., 2010; Muthukrishna et al., 2020), understanding of free will and determinism is different from the WEIRD countries such as the USA and England. Yilmaz et al. (2018) showed in Turkey using the FAD+ scale that free will is not related to any type of religiosity but highly related to fatalism and determinism. This result contradicts with other findings from Western cultures, which indicates a positive association between free will and religiosity (Carey & Paulhus, 2013). In our study, we found a small positive correlation between religiosity and free will (see Results), which is different from the findings of Yilmaz et al. (2018). From previous studies conducted in Turkey, we know that the beliefs about free will are not the same with other cultures (Yilmaz et al., 2018; Alper & Sümer, 2017). For instance, Alper and Sümer (2017) could not find any significant differences between males and females in terms of belief in free will and scientific determinism. However, we found a significant difference that aligns with the findings of Paulhus and Carey (2011). Therefore, our data could be biased compared to studies previously conducted in Turkey but still does not reflect the WEIRD cultures.

The impact of religion and culture could be one of the things that could have an impact on our experiment. Turkey is a predominantly Muslim country, but only 54.9% of our participants were Muslim, which does not represent the Turkish demographics. In this regard, we can say we have slightly biased data. As Yilmaz et al. (2018) explain the Islamic movement debates on free will vs. determinism, the Ash'arite view supported God's absolute power, and fatalistic determinism (originally predestination: qada and qadar) became the dominant view. Thus, today Muslim world embraces fate and predestination more than western cultures. In our experiment, we did not search for the cognitive roots for fatalistic determinism. Nevertheless, searching for the fatalistic determinisms' cognitive roots could be beneficial for the progress of this literature. Although we compare the western culture's understanding of free will with other cultures, recent findings of Berniūnas et al. (2021) examines the lexical equivalent of English "free will" in Lithuanian, Hindi, Chinese and Mongolian languages and founds that the lexical equivalent of free will do not refer to the same concept as the English free will. Therefore, future studies on lexical and cultural differentiation of free will in Turkey compared to other countries could be beneficial.

4.3 Conclusion

In our experiment, we tried to investigate the cognitive foundations of free will and scientific determinism. We used three different cognitive style manipulations to activate either reflection (debiasing training) or intuition (emotion prime & time-pressure). We hypothesized that analytical thinking/reflection would decrease the endorsement of free will and increase the endorsement of scientific determinism, and for intuition, we expect the opposite relation. We have mixed findings in terms of intuition. We supported our hypothesis with the time-pressure condition, yet none of the other groups revealed an interaction that we predicted. In the time-pressure condition, we embedded a within-group condition to see belief revision when participants are given a second chance to revise their ideas, and we could not detect a significant difference between time-pressure vs. no time-pressure. We investigated free will and scientific determinism as an individual difference that has ties with evolutionary constructs. In addition, we asked about the philosophical concepts of compatibility and incompatibility of free will and determinism with the compatibility scale. We found that between-subject groups did not significantly differ from each other. We thought of compatibility and incompatibility as philosophical

stances and need to be examined with a priori knowledge so people can understand the current debate. However, free will and determinism are individual differences, and in line with the endorsement of these values separately, we can reach a conclusion about compatibility and incompatibility. Further, cross-cultural examinations of free will and scientific determinism are important to address for future studies in this regard. In line with the studies indicating that free will has intuitive roots, our research is one of the pioneers to search this topic empirically. Therefore, more research should be done to investigate the relation and interaction between free will and cognitive roots.

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Turkish Version of the FAD-Plus Scale

Bu bölümde ise sizden aşağıdaki ifadeleri değerlendirmeniz istenmektedir. İfadelerin doğru veya yanlış cevabı yoktur, size uygun cevabı veriniz.

1… Kesinlikle Katılmıyorum   2… Katılmıyorum   3… Kararsızım

4… Katılıyorum   5… Kesinlikle Katılıyorum

1. İnsanların biyolojik yapıları onların yeteneklerini ve kişiliklerini belirler.	1	2	3	4	5
2. İnsanlar verdikleri kararlar üzerinde tam kontrole sahiptir.	1	2	3	4	5
3. Psikologlar ve nörobilimciler er geç insan davranışının tüm yönlerini çözeceklerdir.	1	2	3	4	5
4. İnsanlar yaptıkları kötü seçimler için tüm sorumluluğu üzerlerine almalıdırlar.	1	2	3	4	5
5. Genleriniz geleceğinizi belirler.	1	2	3	4	5
6. İnsanlar eğer gerçekten isterlerse her engeli aşabilirler.	1	2	3	4	5
7. Bilim geçmişteki çevrenin şu anki zekanızı ve kişiliğinizi nasıl belirlediğini göstermiştir.	1	2	3	4	5
8. Suçlular yaptıkları kötü şeyler için tam anlamıyla sorumludurlar.	1	2	3	4	5
9. Diğer hayvanlarda olduğu gibi, insan davranışı da her zaman doğanın kanunlarına göre işlemektedir.	1	2	3	4	5
10. İnsanlar tam anlamıyla özgür iradeye sahiptir.	1	2	3	4	5
11. Anne-babaların karakterleri çocuklarının karakterlerini belirler.	1	2	3	4	5
12. İnsanlar kötü davranışlardan her zaman sorumlu tutulabilirler.	1	2	3	4	5
13. Çocukluğunun geçtiği ortam bir yetişkin olarak senin başarını belirler.	1	2	3	4	5
14. Sağlam bir irade her zaman bedenin arzularının üstesinden gelebilir.	1	2	3	4	5

Subscales

Free Will: 2, 4, 6, 8, 10, 12, 14.

Scientific Determinism: 1, 3, 5, 7, 9, 11, 13.

Reflection manipulation

1. Musa gemisine her hayvandan kaç tane aldı?

Cevap: Bazı insanlar "içgüdüsel tepkilerini" kullanarak sezgisel düşünme eğilimindedir. Bu kişiler bu soruya "2" veya "bir çift" cevabını vermeye yatkındır. Bununla birlikte, daha dikkatli bir okuma, bunun neden aldatıcı bir soru olduğunu anlamamızı sağlar çünkü burada Nuh'un değil Musa'nın gemisi yazmaktadır. Doğru cevap, "Musa'nın gemisi yok" olmalıdır. Bu soru sezgisel düşünme eğilimini ölçmek için kullanılır ve anında verilen yanıtlara direnip soru üzerinde düşünenler genellikle doğru yanıt verirler.

2. Bir çalışmaya 1000 kişi katılmıştır. Katılımcılar arasında 5 mühendis ve 995 tane avukat vardır. Mehmet bu araştırmanın katılımcıları arasından rastgele seçilmiştir. Mehmet 36 yaşındadır. Evli değildir ve biraz içe dönüktür. Boş zamanlarını bilim kurgu okuyarak ve bilgisayar programları yazarak geçirmekten hoşlanır.

Hangisi daha olasıdır?

Mehmet bir avukattır veya Mehmet bir mühendistir.

Cevap: Çoğu insan, özellikle sezgisel yanıtlarına güvenme eğiliminde olanlar, bu soruya "Mehmet bir mühendistir" cevabını verir. Bunun nedeni, soruda anlatılan kişinin zihnimizde kalıplaşmış bir mühendis imajını harekete geçirmesidir. Bununla birlikte, sorunun dikkatli bir şekilde yeniden okunması, Mehmet'in kişisel özelliklerine göre değil, bin kişi arasından rastgele bir şekilde seçildiğini açıkça ortaya koymaktadır. Bu nedenle seçilen kişinin avukat olma şansı %99,5 (1000'de 995) iken mühendis olma şansı yalnızca %0,5 (1000'de 5)'tir. Soru, okuyucuyu Mehmet hakkında alakasız ayrıntılar vererek kandırmak ve böylece onları sezgisel yanıta yönlendirmek için tasarlanmıştır. Yansıtıcı düşünme yoluna gidip, "içgüdüleriyle" cevap vermek yerine iki kez düşünme eğiliminde olanlar, bu soruyu doğru yanıtlama eğilimindedir (yani, "Mehmet bir avukattır" en olası senaryodur).

3. Köpekbalıkları mı yoksa atlara mı daha çok insan ölümüne neden olur?

Cevap: Çoğu insan "köpekbalıklarının" "atlardan" daha fazla insan ölümüne neden olduğu yanıtını verir ki bu yanlıştır. Örneğin, ulusal bir veri tabanına göre 2000 ile 2010 yılları arasında Avustralya'da sadece 16 köpekbalığına bağlı ölüm varken, atlar, midilliler veya eşeklere bağlı 77 ölüm vardır. Buna rağmen neden çoğu insan köpekbalıklarının atlardan daha ölümcül olduğunu düşünür? Bir olayın gerçekleşme

olasılığı sorulduğunda, genellikle sezgisel olarak bu olayın gerçek sıklığından ziyade bu tür olaylarla ilgili kolay hatırlanabilen anılara güveniriz. Köpekbalığı saldırılarından kaynaklanan ölümler, atlardan kaynaklanan ölümlere kıyasla medyada daha fazla yer aldığından, bir yargıya varırken bu olayları hatırlama olasılığımız daha yüksektir. Bu olguya bulunabilirlik kısayolu denir.

Sonuç: Yargılarımız çeşitli önyargılara açıktır. Bu nedenle, bir karar vermeden önce kendiliğinden tepkilerimizi duraklatmak ve yeniden gözden geçirmek çok önemlidir.

APPENDIX C

Emotion Prime

Bazen insanlar hislerini kullanarak ve duygularına dayanarak karar verirler. Bazı zamanlardaysa insanlar karar verirken mantıklarına ve sebep - sonuç ilişkilerine dayanırlar.

Birçok insan duygulara dayanarak karar vermenin iyiye götürdüğüne inanır. Mantıktansa hislerimizi kullanarak karar verdiğimizde duygusal açıdan daha tatmin edici kararlar veririz.

Lütfen cevaplayacağınız sorulara mantığınızdansa duygularınızı kullanarak cevap veriniz.

Cognitive Reflection Test

1. Çorba ve salata toplamda 5.50 TL etmektedir. Çorba salatadan 1 TL daha fazla tutmaktadır. Bu durumda salata kaç TL eder?

   Analytic Answer: 2.25 kuruş kuruş

2. 2 hemşirenin 2 hastanın kan basıncını ölçmesi 2 dakika alıyorsa, 200 hemşirenin 200 hastanın kan basıncını ölçmesi kaç dakika alır?

   Intuitive Answer: 200 dakika - Analytic Answer: 2 dakika

3. Selin güneşte çay demlemekte ve her saat çay iki katı yoğunlaşmaktadır (demlenmektedir). Çayın tamamen yoğunlaşması 6 saati buluyorsa, çayın yarısı kaç saatte yoğunlaşır?

   Intuitive Answer: 3 saat – Analytic Answer: 5 saat

Actively Open-Minded Scale

Aşağıdaki ifadelere ne ölçüde katılıp katılmadığınızı lütfen belirtiniz.

1…Kesinlikle katılmıyorum…   2…Pek katılmıyorum...

3…Ne katılıyorum ne katılmıyorum… 4…Biraz katılıyorum…

5…Kesinlikle katılıyorum

1. Karşıt kanıtlar sunulsa bile kendi görüşlerine sadık kalmak önemlidir.	1	2	3	4	5
2. Bir şeyin doğru olup olmadığını hissetmek kanıttan daha önemlidir.	1	2	3	4	5
3. Sırf kanıtlar sahip olduğum görüşlerle çelişiyor diye, bu görüşlerimin yanlış olduğu anlamına gelmez.	1	2	3	4	5
4. Görüşlerinizle çelişen kanıtlar söz konusu olabilir, fakat bu görüşlerinizi değiştirmeniz gerektiği anlamına gelmez.	1	2	3	4	5
5. Doğru olduğuna inandığınız bir şeye karşı somut kanıtlar olsa bile, değer verdiğiniz görüşleri sürdürmeniz gayet normaldir.	1	2	3	4	5
6. Konu ne olursa olsun, doğru olduğuna inandığınız görüşleriniz, onlarla çelişen kanıtlardan daha önemlidir.	1	2	3	4	5

APPENDIX F

Free Will and Determinism Compatibility Scale

Özgür irade inancı, insanların yaptığı seçimlerde herhangi bir önceki sebepten veya ilahi bir müdahaleden etkilenmediğini öne sürer ve insanların yaptıkları seçimlerde tamamen özgür olduğunu vurgular. Yani özgür irade, farklı olası eylem biçimleri arasında engelsiz seçim yapma yeteneğidir. Öte yandan belirlenimcilik, diğer bir adıyla determinizm, insanların yaptıkları seçimlerin doğa yasaları ve geçmişteki davranışları tarafından belirlenebileceğini öngörür. Bu görüşe göre gelecekteki kararlar bilimin ve doğa yasalarının ışığında bilinebilir. Bu sebepten dolayı bu görüşe göre özgür irade yoktur.

Yukarıda verilen bilgiler ışığında aşağıdaki soruları cevaplayınız.

1... Kesinlikle Katılmıyorum

3... Ne Katılıyorum Ne Katılmıyorum

5... Kesinlikle Katılıyorum

	1	2	3	4	5
1. Ne ölçüde özgür iradenin ve belirlenimciliğin bir arada olabileceğine inanırsınız?	1	2	3	4	5
2. Özgür irade ve belirlenimciliğin bir arada var olamayacağını varsayarsak, özgür irade anlayışına ne ölçüde inanıyorsunuz?	1	2	3	4	5
3. Özgür irade ve belirlenimciliğin bir arada var olamayacağını varsayarsak, belirlenimciliğe ne ölçüde inanırsınız?	1	2	3	4	5

Cinsiyetiniz:

- Erkek

- Kadın

- Diğer (açıklayınız)

Yaşınız (belirtiniz):

Eğitim durumunuz:

- İlkokul

- Ortaokul

- Lise

- Üniversite

- Lisansüstü

- Doktora

Sosyo ekonomik seviye:

Aşağıdaki merdivenin Türkiye'deki insanların ekonomik açıdan bulunduğu seviyeyi temsil ettiğini düşünün. Merdivenin tepesindekiler (10) her şeyin en iyisine (örneğin; en çok paraya, en iyi eğitime ve en saygın mesleklere) sahip insanlardır. Merdivenin en altındakiler (1) ise en kötü koşullara (örneğin; en az paraya, en az eğitime ve en az saygın mesleklere) sahip insanlardır. Merdivende daha Yüksek bir konuma sahip olmanız en tepedeki insanlara daha yakın olduğunuz, daha aşağıda olmanız ise en alttaki insanlara daha yakın olduğunuz anlamına gelmektedir.

Kendi koşullarınızı düşünecek olursanız;

Bu merdivende kendinizi hangi konuma yerleştirirsiniz?

Politik yöneliminiz:

	1	2	3	4	5	6	7	
Sol	○	○	○	○	○	○	○	Sağ

Kendinizi ne ölçüde dindar olarak tanımlıyorsunuz:

	1	2	3	4	5	6	7	
Hiç dindar değil	○	○	○	○	○	○	○	Çok dindar

Dini İnancınız:

- Müslüman
- Hristiyan
- Musevi

- Deist
- Ateist
- Diğer (belirtiniz)

Teşekkür ve çekiliş:

Araştırmaya katıldığınız için teşekkür ederiz.

Katılımınız karşılığında size hediye çekinizi iletebilmemiz için lütfen aşağıdaki forma e-posta adresinizi giriniz. 50 TL ve 100 TL değerindeki Migros Hediye Çeki e-posta adresinize iletilecektir. Hediye çekini tüm Migros, 5M Migros, Macrocenter, MigrosJet ve internet üzerinden yapacağınız Sanal Market alışverişlerinizde kullanabilirsiniz.

*50 TL değerindeki hediye çekine ek olarak 5 katılımcıya çekilişle ekstra olarak 100 TL değerinde hediye çeki verilecektir.

*E-posta adresiniz hiçbir şekilde kayıt altına alınmayacak yalnızca tek seferlik hediye çeki gönderimi için kullanılacaktır. Eğer hediye çeki almak istemiyorsanız bu bölümü boş bırakarak bir sonraki sayfaya geçebilirsiniz.

Bilgilendirme:

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Research Experience

Research Assistant, Kadir Has University, İstanbul, Turkey, July 2020 – January 2021

Responsibilities: I worked as a research assistant in a project, led by Dr. Yilmaz and funded by the Scientific and Technological Research Council of Turkey, called "How Can We Increase Compliance with Preventive Measures? The Effect of Personal and Social Benefit Messages" that investigate the effect of health messages on compliance with the preventive measures regarding COVID-19. In the project, we ran three experiments, one of which was longitudinal, to examine the effect of personal and social messages on COVID-19. We looked at the effect of certain messages (protecting one's family, protecting one's nation and protecting one's self) when coming from certain sources (governmental authority; scientific authority). In this project, I helped with the data collection, regulated budget planning and expenses, preregistered the studies, and I cleaned data, and conducted the initial analysis.

Lab Manager, *Department of Psychology,* Kadir Has University. Moral Intuitions Laboratory – Istanbul**,** July 2019 – Present

Responsibilities: As a lab. manager of the Moral Intuitions Laboratory (MINT Lab), I worked under the supervision of Dr. Onurcan Yilmaz, focusing on meta-ethics, free will, and moral psychology. Generally, I coordinated process of

experiments and studies in the laboratory. I actively participated and regulated the weekly laboratory meetings; we discussed relevant literature and prepared individual peer reviews on the published papers as a practice. Lastly, we ran several projects such as psychological correlates of anti-climate change beliefs and meta-ethical beliefs.

Research Assistant, *Department of Psychology***,** Portsmouth University - England, July 2018 – September 2018, Erasmus+ Internship

Responsibilities: During the internship, I studied under the supervision of Dr. Marina Davila Ross. I mainly observed chimpanzees (also orangutans), assessing their behaviors in a semi-experimental field on videos and coding their behaviors systematically for evolutionary inferences in the ongoing research. In addition, I regularly attended to lab meeting and involved in research discussions in the time I spent there. I helped the reliability of the data video coding analysis of the thesis of Helene Chotard (nowadays Dr. Chotard)

Research Assistant, *Department of Psychology,* Boğazici University, Psychobiology lab**.** – Istanbul, October 2017 – May 2018

Responsibilities: As a part of the research group, I attended weekly lab meetings in the psychobiology lab and actively followed the relevant literature regarding circadian rhythms and ketamine's effect on depression. I took part in studies that were conducted on circadian rhythms and ketamine consumption in "Wistar" rats and as part of the lab. Also, I learned how to handle rats and behavioral research methods on them in the Psychobiology lab.

Teaching Experience

Teaching Assistant, Kadir Has University – İstanbul (Fall 2020), PSY 533 – Advanced Topics in Social Psychology

Responsibilities: I helped the instructor with class exams and assignments, assisting students in the class. In addition, I help the active process of the final

assignment by helping students pre-registration a study on open science framework (OSF) as a part of their replication project.

Teaching Assistant, Kadir Has University – Istanbul, PSY 301 – Measurement and Assessment, September 2020 – 2021

Responsibilities: Assisting in exams and assignments, also helping students improve in understanding and using SPSS and JAMOVI. I help them to understand data analyses and how to collect data online.

Work Experience

Summer Research Assistant/Internship, Child Psychiatry Service**,** Umraniye Public Hospital – Istanbul**,** July 2017 – August 2017

Responsibilities: Mainly observing the patients and working on an ongoing project run by the supervisor psychiatrists in the hospital. The project focused on autistic children's development and progress of the disorder and patient's families. As a part of the experience, I collect data from patients' parents and attended activities with autistic children.

Grants, Honors, & Scholarships

- 2020-2021   TÜBİTAK (The Scientific and Technological Research Council of Turkey) – Graduate Research Scholarship
- 2019   Kadir Has University Full scholarship for master's degree
- 2018   Scholarship for Erasmus+ internship
- 2016   Dogus University High achievement scholarship
- 2015   Dogus University High achievement scholarship

Examinations

TOEFL IBT (Test Date: October 10, 2020)

Total: 91

Reading: 22

Listening: 25

Writing: 22

Speaking: 22