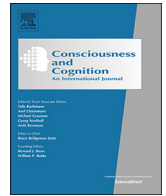




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A free will needs a free mind: Belief in substance dualism and reductive physicalism differentially predict belief in free will and determinism

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ABSTRACT

In this article, we show that lay people's beliefs about how minds relate to bodies are more complex than past research suggests, and that treating them as a multidimensional construct helps explain inconclusive findings from the literature regarding their relation to beliefs about whether humans possess a free will. In two studies, we found that items previously used to assess a unidimensional belief in how minds relate to bodies indeed capture two distinguishable constructs (belief in substance dualism and reductive physicalism) that differently predict belief in free will and two types of determinism (Studies 1 and 2). Additionally, we found that two fundamental personality traits pertaining to people's preference for experiential versus rational information processing predict those metaphysical beliefs that were theorized to be based on subjective phenomenological experience and rational deliberation, respectively (Study 2). In sum, beliefs about mind-body relations are a multidimensional construct with unique predictive abilities.

1. Introduction

Questions about the metaphysical properties of reality have long fascinated students and scholars of many disciplines—from philosophers to theologians to hobby mycologists. What constitutes true knowledge? Does everything that exists serve a purpose? Is there a life after death, and is it really true that people always get what they deserve?

Over the past few decades, more and more psychologists and experimental philosophers have become interested in how lay persons think about these “big questions,” facilitating empirical investigations into, for example, people's conception of whether good and evil are real agentic forces in the world (Bastian et al., 2015), their beliefs about intentionality and consciousness (Knobe & Prinz, 2008), or their theories about psychological phenomena such as the malleability of personality traits (e.g., Dweck & Leggett, 1988; Molden & Dweck, 2006) or the availability of self-control resources (Job, Dweck, & Walton, 2010). Based on the idea of people as lay scientists who test hypotheses through observation of the world, psychologists believe that people develop complex belief systems about how the world operates, which are then used to categorize and interpret novel information (Gopnik & Meltzoff, 1997).

These belief systems not only revolve around tangible issues with real-life implications. In fact, many of them include ontological claims—views on what constitutes reality or on how things really *are*. Studying such metaphysical beliefs can help researchers understand how people make sense of the world around them, rationalize their own phenomenological experience, or deal with the

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prospect of their inevitable death. It can further our understanding of the general processes behind belief formation and help identify certain common cognitive processes or biases that may be responsible for the formation of seemingly unrelated beliefs about metaphysical or philosophical issues. As a result, over the last years, there has been extensive research on people's beliefs in these domains (Zedelius, Müller, & Schooler, 2017).

As this research shows, lay beliefs are oftentimes more complex than they appear on the surface. To understand them, their antecedents, consequences, and relationships with other belief systems, scientists need to assess them accurately. It is especially crucial to capture the complexity of lay people's beliefs accordingly, in that people typically do not think about metaphysical questions like trained philosophers do, but rather apply their own common-sense thinking to these issues (Wegner & Petty, 1998).

In the present article, we are primarily interested in one specific metaphysical belief people hold, namely their belief about the relationship between mind and body. Although past research has often considered this belief a unidimensional construct (e.g., Forstmann, Burgmer, & Mussweiler, 2012; Hook & Farah, 2013), in the present research, we argue in favor of treating it as a multidimensional construct. We further contend that such a differentiation helps explain inconsistent findings from the literature on metaphysical beliefs, specifically regarding the relationship between belief in mind-body dualism and free will beliefs—another construct that is now widely regarded as being represented by multiple unique dimensions, and that has long been argued to be closely tied to belief about how minds relate to bodies. Lastly, in line with past theorizing, we argue that certain subdimensions of both metaphysical beliefs are intimately linked to individual preferences for intuitive versus rational thinking styles, but that these thinking styles do not entirely explain the association between these constructs in question.

In the following, we will discuss both the philosophical and empirical literature on belief in mind-body dualism and free will, followed by a section about how and why these constructs should be related.

1.1. Mind-body dualism

1.1.1. Philosophical positions on mind-body relations

One philosophical concept that both scholars and lay people have tried to wrap their heads around for centuries is the relationship between mind and body, also referred to as the mind-body problem. The mind-body problem is a complex topic in the philosophy of mind, and involves both ontological questions about what mental and physical states are (e.g., whether they are one and the same, whether they are fundamentally distinct, or whether one is a subclass of the other) and questions about causal effects between the two (e.g., whether the mental causally effects the physical, the physical causally effects the mental, or both/none) (Robinson, 2017). Specifically, the debate often revolves around how the human mind (i.e., the self, consciousness, or intentionality) relates to the human body, with philosophers arguing for different kinds of *monist* or *dualist* views on this issue.

One fundamental issue in this debate is the question whether the mind can be considered entirely independent of the physical realm. As the first “modern” philosopher to discuss the problem in more detail, Descartes (1641/1984) argued in his *Meditations on First Philosophy* that minds are separate from bodies and not part of the physical realm. For Descartes, the mental (the *res cogitans*) and the physical (the *res extensa*) are two distinct kinds of substances that make up the world, adhere to different rules, and have vastly different properties. While the mental substance can think and is spatially and temporally unrestricted, the opposite applies to the physical substance: it is spatially and temporally finite and cannot think.

Descartes thus argued in favor of a view often referred to as *substance dualism*, that is, the idea that mental states are not made from (or merely the result of) physical “stuff,” but exist as an entirely independent substance that is fundamentally non-physical in nature, and that can even exist in the absence of the physical. At the opposite end of the spectrum, one can find *reductive physicalism*, the view that mental states are nothing more than physical states (or descriptions of physical states) and entirely reducible to this one substance (see, for example, Churchland (1981) for an extreme reductive physicalism referred to as *eliminative materialism*).

However, some views fall between those two extremes. Although they acknowledge that only a single physical substance exists, supporters of *property dualism* argue that this substance has both physical and mental *properties*. Unlike in reductive physicalism, philosophical positions related to property dualism (such as *strong emergentism* or *non-reductive physicalism*; Chalmers, 1996) consider the mind to not merely be a different description of certain physical states, but consider it to be more than the sum of its parts—a fully emergent property that is irreducible to its physical origins. However, in contrast to Cartesian substance dualism, these positions consider the mental property unable to exist in the absence of the physical substance out of which it emerges. In other words, this view holds that while the mind cannot be entirely reduced to its physical counterparts, it is not understood as a non-physical source of thought.

Regardless of whether mind and matter are conceptualized as distinct substances or different properties of the same substance, philosophers who endorse a dualist view on this matter differ with regard to their belief in the causal relation between both constructs. Some positions argue that mental states are nothing but an epiphenomenon (*epiphenomenalism*; Jackson, 1982), and that only physical states can causally affect mental states. Others argue that there is a bi-directional influence between the two kinds of substances/properties (*interactionism*; Popper & Eccles, 1977), or that there is no causal relation between the two at all (e.g., *parallelism*, Broad, 1925/2014).

In sum, philosophers have a variety of different takes on the mind-body problem, primarily differing with regard to whether they postulate the existence of one or two substances, one or multiple properties of a substance, as well as the causal interplay between the respective concepts. Yet, and more important to the current research, how precisely do lay people construe the relationship between mind and body and what effects does it have?

1.1.2. Psychological research into lay people's views on mind-body relations

Without trying to make definite statements about the metaphysical reality pertaining to the issue, lay people's beliefs about how minds relate to bodies have recently become the focus of attention for psychologists and experimental philosophers. After all, although most people lack a formal education in the Philosophy of Mind, everybody knows what it feels like to have a mind and a body, and they are likely to have more or less elaborate lay theories about their relationship. How precisely people think about this complex topic, however, is not yet entirely understood.

Recent theoretical considerations suggest that it makes sense to distinguish between people's *intuitive* and *explicit* beliefs in mind-body relations, which are informed by different underlying processes and potentially have unique cognitive and behavioral implications. While the former may be considered side-effects of more fundamental cognitive processes and experiences, the latter seem manifestations of culturally-shared worldviews that are themselves potentially informed by shared intuitions (a constructionist view), as well as by acquired scientific knowledge (Forstmann & Burgmer, 2017).

Specifically, according to theoretical and empirical contributions in this domain (e.g., Bloom, 2004; Bering, 2006; Forstmann & Burgmer, 2015) people seem to *intuitively* think of minds and bodies as two distinct entities, a fact that already becomes evident in early childhood (Bering & Bjorklund, 2004; Hood, Gjersoe, & Bloom, 2012). As a result, some scholars refer to human beings as natural-born dualists (Bloom, 2004), intuitive mind-body dualists (Forstmann & Burgmer, 2015), or implicit theists (Uhlmann, Poehlman, & Bargh, 2008). According to their theorizing [referring to Bloom and others], an intuitive belief in an unspecific mind-body dualism can be considered a belief that most humans are readily equipped to develop in some way or another. Specifically, all humans share certain fundamental cognitive processes that are believed to contribute to the formation of dualist beliefs. In order to be able to predict others' behaviors, it is necessary to make inferences about their mental states (i.e., their goals, intentions, desires), which are—in contrast to their physical appearance or their actual behavior—principally inaccessible to an observer. As a result, people learn from early on to distinguish between the observable-physical and the unobservable-mental world, leading to the development of two different modes of construal that lay the foundation for dualist beliefs (Bloom, 2004). In other words, some scholars suggest that dualist intuitions can be considered a by-product of more fundamental cognitive processes that most human beings share, such as our ability and inclination to mentalize with others (i.e., to make inferences about unobservable minds) (Bloom, 2004; Burgmer, Forstmann, & Todd, 2018), our tendency to dissociate ourselves from our bodies, or our ability to engage in introspection and rely on internal bodily states as a source for information (Forstmann & Burgmer, 2017).

Speaking to the universal nature of dualist belief, explicit belief in mind-body dualism can indeed be encountered across most cultures in human history (e.g., Roazzi, Nyhof, & Johnson, 2013; Slingerland & Chudek, 2011), while individuals' lay beliefs show considerable interpersonal variation (Lindeman, Riekkki, & Svedholm-Häkkinen, 2015). Dualist thinking was theorized to form the basis of various other, more complex belief systems, such as in a life after death, souls, or bodiless supernatural entities (Bloom, 2007; Boyer, 2001). All of these beliefs rely in some form on the assumption that mental states can exist in the absence (or outside of) a material body (Bering, 2006). An explicit belief in non-reductive physicalism on the other hand, may be the result of culturally acquired scientific knowledge overlying people's default dualist intuitions (Forstmann & Burgmer, 2015; Preston, Ritter, & Hepler, 2013).

As past research shows, whether or not people believe in mind-body dualism can have significant effects on their cognitions and behaviors. For example, belief in mind-body dualism was found to attenuate health behavior (Forstmann et al., 2012), that is, people who endorse this view believe to a lesser degree that bodily states affect mental well-being and therefore care less about their physical constitution (Burgmer & Forstmann, *in press*). This may be one of the reasons why a dualist view on mind and body may have detrimental consequences in clinical settings, both on the side of doctors and patients (Mehta, 2011). Especially in the field of mental health, dualism may make patients skeptical about non-biological explanations for their mental illnesses (Duncan, 2000).

Other empirical research found that dualist beliefs moderate the effect of mortality salience on afterlife beliefs (Heflick, Goldenberg, Hart, & Kamp, 2015), and positively predict teleological reasoning, belief in god, belief in the paranormal, as well as to self-reported purpose in life (Willard & Norenzayan, 2013). In other words, it seems as if people's metaphysical views can indeed have consequences for the development and maintenance of other, typically more tangible, belief systems, which may ultimately even affect their mental and physical well-being.

Directly assessing explicit belief in mind-body dualism can, however, be a challenging task. Only few questionnaires directly assess this metaphysical construct, either with pictorial or semantic items (e.g., Forstmann et al., 2012, Hook & Farah, 2013; Nadelhoffer, Shepard, Nahmias, Sripada, & Ross, 2014; Stanovich, 1989), and although some of these scales include items that seemingly assess different facets of belief about mind-body relations, they do not differentiate between these facets on an analytical level and only produce a single score for an unspecific belief in mind-body dualism. In other words, mind-body dualism has in the past been considered a single unidimensional construct, despite there being no empirical evidence supporting this reasoning. For example, in the Free Will Inventory (FWI) developed by Nadelhoffer et al. (2014), the authors include a single subscale labelled "dualism/non-reductionism," which "measures intuitions about both the existence of an immaterial soul and the irreducibility of the mind and the body" (Nadelhoffer & Tocchetto, 2013, p. 128). According to the philosophical literature discussed above, however, this definition fails to differentiate between belief in a substance dualism (i.e., a belief in immaterial minds or souls) and a mere property dualism (i.e., a belief in non-reducibility of mental states).

To summarize, we contend that lay people have more elaborate explicit views on mind-body relations than past unidimensional views account for, and that it would therefore be reasonable to differentiate lay people's views on mind-body relations more carefully. Such a differentiation may help explain some puzzling finds from the past literature, such as the interplay between belief in the mind-body relationship and the related philosophical concept of belief in free will and determinism.

1.2. Free will and determinism

1.2.1. Philosophical positions on free will and determinism

Another philosophical question that has occupied the minds of many philosophers and lay people alike is the question whether human beings possess a free will, and how this concept can be reconciled with our knowledge about the rules of cause-and-effect that govern the universe. The Stanford Encyclopedia of Philosophy defines *free will* broadly as “the unique ability of persons to exercise control over their conduct in the manner necessary for moral responsibility” (McKenna & Coates, 2016). In contrast, *determinism* is the view that every event in the universe is a causal consequence of an antecedent event, given that the laws of nature remain constant. Both concepts initially seem at odds with one another, and their relationship with moral responsibility seems obvious: how can a perpetrator be punished for an action ostensibly performed without coercion, if the entirety of his or her behavior is a necessary consequence of events that took place long before he or she was born, reaching all the way back to the beginning of time? How can blame and praise be assigned if a person could not have acted otherwise? Philosophical views on the free will question can be broadly divided into two categories: those that posit that free will and determinism are two mutually exclusive concepts (*incompatibilism*), and those that posit that both concepts are compatible with one another (*compatibilism*). For many psychologists endorsing strong incompatibilist views, free will beliefs are an illusion, or a way for people to rationalize their own behavior (e.g., Harris, 2012; Wegner, 2002). According to these so-called *hard incompatibilists*, people cannot really be held morally responsible for their behavior, as their thoughts, choices, and actions are not of their own making.

Compatibilists, on the other hand, understand free will as “the unencumbered ability to do as one wants,” that is, as the ability to act or not to act in accordance with one’s desires (Frankfurt, 1988)—to make unconstrained choices based on reason and deliberation. Without rejecting the deterministic nature of the universe, supporters of this theory do not view the “absolute ability to do otherwise” as fundamental to the concept of moral responsibility, but rather whether or not one’s will conflicts at a higher level with what one wishes it to be (Frankfurt, 1988).

1.2.2. Psychological research into lay people’s belief in free will and determinism

While these questions seem abstract and far-removed from reality at first glance, psychologists and experimentally-minded philosophers have in the last decade begun investigating how lay people understand the issue of free will, how these views line up with the philosophical literature, and how they may affect people’s cognition, emotion, and behavior (e.g., Nahmias, Morris, Nadelhoffer, & Turner, 2006; Nichols, 2004, 2006).

Just as with intuitions about minds and bodies, all human beings seem to share an inclination to perceive themselves as agents capable of making free decisions (Sarkissian et al., 2010), and to be in control over their own destiny (Leotti, Iyengar, & Ochsner, 2010). They seem, however, to differ with regard to how strongly they believe in this notion (Baumeister, 2008; Nahmias, Morris, Nadelhoffer, & Turner, 2005; Paulhus & Carey, 2011). This seems especially important, given that questions on the issue of free will and determinism immediately also raise questions about moral responsibility—and hence praise, blame, and criminal accountability (see Greene & Cohen, 2004, for a review). In fact, psychological research on lay theories about free will and determinism found that these beliefs indeed crucially affect people’s cognitions and behaviors in various domains, and that they are important constructs that capture unique aspects of agency (Feldman, 2017).

For example, experimental research established that people’s view on the free will question can affect how they rationalize their own thoughts and actions: Vohs and Schooler (2008) found that activating a disbelief in free will via a vignette text increased participants’ likelihood to engage in cheating behavior. Similarly related to moral responsibility, Baumeister, Masicamo, and DeWall (2009) found that an attenuated belief in free will increased people’s hostility and reduced their pro-social inclinations, while Martin, Rigoni, and Vohs (2017) discovered that in cultures with low corruption levels free will belief predicts positive attitudes towards punishment and intolerance of unethical behavior. Some of these effects on attitudes and behavior can be attributed to free will belief affecting fundamental cognitive processes: as recent research shows, belief in a free will increases the likelihood of overattributing others’ behavior to internal states as opposed to external circumstances—the correspondence bias (Genschow, Rigoni, & Brass, 2017).

Other experimental findings revealed effects of free-will-related lay theories on conformity (Alquist, Ainsworth, & Baumeister, 2013), self-control (Rigoni, Kuhn, Gaudino, Sartori, & Brass, 2011), error detection (Rigoni, Pourtois, & Brass, 2015), gratitude (MacKenzie, Vohs, & Baumeister, 2014), counterfactual thinking (Alquist, Ainsworth, Baumeister, Daly, & Stillman, 2015), or how much people learn from negative experiences (Stillman & Baumeister, 2010), while some of the correlates of free will belief include academic and job performance (Feldman, Chandrashekar, & Wong, 2016; Stillman et al., 2010), self-efficacy (Baumeister & Brewer, 2012), and decisiveness (Feldman, Baumeister, & Wong, 2014).

One prevalent concern in these studies, however, is that the notions of free will and determinism are often treated as two poles of one single construct rather than two distinguishable constructs. This becomes evident both in experimental manipulations (e.g., by Vohs and Schooler, 2008) and individual-difference measures such as the ones developed by Viney, Waldman, and Barchilon (1982) (including unidimensional items such as “Where do you stand with respect to the free will/determinism issue?”), or Rakos, Laurene, Skala, and Slane (2008) (producing a single score ranging from “most deterministic” to “most libertarian”). These scales follow an incompatibilist view on free will and determinism, despite the fact that compatibilism is the view that most contemporary philosophers endorse (Bourget & Chalmers, 2014). This is insofar problematic in that more and more research points towards the notion that belief in compatibilism is not just an idea that educated philosophers endorse, but rather a concept that many lay people can agree with (Nahmias et al., 2006). According to Monroe and Malle (2010), lay people understand free will as “a choice that fulfills one’s desires, [...] free from internal or external constraints” (p. 211), and this understanding is neither associated with elaborate assumptions about (in-)determinism nor supernatural claims about the existence of souls. Consistently, recent empirical work indicates that lay

people indeed understand free will primarily as having unconstrained choice (Vonasch, Baumeister, & Mele, 2018).

Confirming Monroe and Malle's (2010) reasoning, in a more recently developed questionnaire (the FWI), Nadelhoffer et al. (2014) found that participants' responses were indeed best explained by two different and uncorrelated factors, representing belief in free will and determinism, respectively. A similar factor structure was found in a scale developed by Paulhus and Carey (2011), further differentiating between two kinds of deterministic belief (fatalistic vs. scientific).

In one of the first experimental investigations into this topic, Nahmias et al. (2005, 2006) investigated folk intuitions about determinism and moral responsibility. They found that people ascribed responsibility to a criminal offender even after they were told that the actions took place in a fully deterministic universe. Nichols and Knobe (2007) further added to these findings, showing that compatibilist intuitions only occur when people make affect-laden judgments about responsibility. When judgments were more abstract, people revealed incompatibilist views.

As such, research on people's belief in free will and determinism has already established that lay people's views are not as simplistic as earlier approaches seem to suggest, and that it is best advised to assess these beliefs as multifaceted constructs. As we argued above, we think that a similar approach should be followed for belief about mind-body relations, which, as we will outline in the following, are closely linked to belief in free will and determinism.

1.3. Mind-body dualism & free will

The relationship between the two kinds of metaphysical beliefs introduced above, seems intuitive: when holding a belief in fully unconstrained free will, that is, in an agent who possesses the absolute ability to do otherwise, the mind cannot be construed as strictly physical in nature when one accepts the legitimacy of the laws of nature. Only if the mind is construed as unaffected by the laws of cause and effect can an action be *fully* attributed to it (e.g., Montague, 2008; although this view is challenged by Mele, 2014). In other words, a belief in free will should require a belief in a second, non-physical substance that “does the thinking” and that can causally affect the physical world (an interactionist dualist view). Conversely, a belief in reductive physicalism fits a deterministic worldview, in which there is no room for an uncaused agentic force, or a “first mover.” How views in line with a property dualism affect belief in free will and determinism, respectively, is less self-evident and should depend on additional assumptions about causality.

Past research on the relation between the constructs involved was oftentimes theoretic in nature or utilized scales that do not make a sufficient distinction between them. In one of the rare cases of empirical investigations into this topic, Nadelhoffer et al. (2014) found that a unidimensional dualism/non-reductionism subscale of their FWI positively correlated with belief in free will, yet did not significantly correlate with belief in determinism. Notably, although belief in dualism and free will were correlated, they clearly loaded on two distinct factors, indicating that they are indeed two distinguishable constructs. Why no correlation with belief in determinism was found, however, remains an open question. The overall pattern was replicated (using the same scale) in another study by Nadelhoffer and Tocchetto (2013), albeit with a slightly weaker correlation, and was also recently found using two different scales (Fernandez-Duque & Schwartz, 2016). Monroe and Malle (2010), on the other hand, reported that when deliberating about free will, participants did not spontaneously evoke concepts of dualism or other related metaphysical concepts. This sentiment was supported by a small-scale survey by Mele (2014), in which participants still ascribed free will to a target even after a physicalist worldview was rendered salient, yet not when they were told the target was under the influence of a compliance drug. Likewise, Nahmias, Shepard, and Reuter (2014) found that participants considered an actor to possess free will and responsibility, even when they were told that his or her actions could be perfectly predicted from neural information.

Lastly, it is possible that both people's lay conception of mind-body relations and their idea about the existence of free will are related to a single more basic belief, mindset, or thinking style. As shown by Forstmann and Burgmer (2015) and theorized by Bloom (2004), people's intuitive belief in an unspecific mind-body dualism seems to be based on their intuitions—their phenomenological experience of the world. Likewise, as outlined above, some researchers assume that believing in free will is the result of an intuition that is grounded in our perception of our own thoughts and actions (Leotti et al., 2010; Sarkissian et al., 2010). In both cases, rational thought is needed to overcome one's intuitions and to arrive at an arguably more abstract and complex worldview. Thus, the degree to which people prefer to engage in deliberative or experiential information processing, that is, their need for cognition (Cacioppo & Petty, 1982) and their faith in intuition (Epstein, Pacini, Denes-Raj, & Heier, 1996) may be related to some of the more rational and intuition-based facets of both constructs, respectively.

2. The present research

We designed the present research with three goals in mind. First, our primary goal was to test, whether lay people conceptualize mind-body relations as a multidimensional construct. To that end, we used factor analysis to determine whether items typically used to calculate a unidimensional belief in mind-body dualism score (Hook & Farah, 2013) in fact load on two distinct factors (representing belief in substance dualism and reductive physicalism, respectively). Second, we tested, whether the two isolated dimensions can help explain the inconclusive findings regarding the association between dualist belief and belief in free will and determinism found in past research. To that end, we used regression-based and correlational approaches to test how the two factors uniquely predict the two dimensions of belief in free will and determinism identified by Nadelhoffer et al. (2014) (Study 1).

Third, we investigated whether—as theory suggest—certain facets of the two constructs are related to personality traits that pertain to a general preference for experiential versus rational information processing—that is, people's need for cognition and their faith in intuition. At the same time, we replicated and further differentiated our primary results by using a different scale for belief in

free will-related constructs that allows for a disentanglement of multiple kinds of deterministic beliefs (Paulhus & Carey, 2011) (Study 2).

2.1. Data reporting and analysis

For all studies reported below, we attest to reporting all variables assessed, all conditions realized, as well as all subject exclusions that took place prior to data analysis. In all studies, participants were only excluded if they responded positively to a question asking them whether they answered to one or multiple questions randomly or in purposefully wrong manner. We aimed for sample sizes beyond a minimum of 250 participants per study to be able to reliably detect small correlations, and to arrive at a precise estimate of the strength of correlation between the variables involved (Schönbrodt & Perugini, 2013).

2.2. Study 1

As outlined above, the goal of our first study was to investigate the basic relationship between belief about mind-body relations and free will/determinism. To that end, we planned on analyzing the factor structure of items previously used to assess a uni-dimensional belief in mind-body dualism. Based on an initial screening of the items, we expected them to load on two distinct factors (representing belief in substance dualism and reductive physicalism, respectively) that would each differentially correlate with the two free-will-related subscales identified by Nadelhoffer et al. (2014). In line with past studies and the theoretical considerations outlined above, we hypothesized that those facets of the questionnaire that exclusively assess belief in substance dualism would positively predict free will beliefs. We were agnostic with regard to any correlation between substance dualism and belief in determinism, as past studies painted a less clear picture with regard to these two constructs. Similar, we were agnostic about how reductive physicalism may relate to free will and determinism beliefs, but considered it a possibility that reductive physicalism may be associated with belief in determinism.

2.2.1. Method

2.2.1.1. Participants and design. We recruited 400 participants from Amazon's Mechanical Turk website (see Buhrmester, Kwang, & Gosling, 2011), who participated in exchange for a moderate monetary compensation. All participants worked on the same two questionnaires presented in random order.

Of the 400 participants, 36 were excluded based on the single item assessing random/misleading responding described above, leaving us with a final sample of 364 participants (178 female, 185 male, 1 other/none; $M_{Age} = 36.37$, $SD = 11.93$).

2.2.1.2. Materials and procedure. After giving their informed consent, participants worked on two questionnaires presented in random order. Depending on order of measurements, they either first worked on two of the subscales of the Free Will Inventory by Nadelhoffer et al. (2014) or a mind-body relations scale adapted from Hook and Farah (2013). At the end of the study, participants answered demographic questions as well as one question assessing whether participants gave intentionally misleading or random answers to some of the questions.

Free Will Inventory. To assess participants' belief in free will and determinism, participants were asked to work on two subscales of the Free Will Inventory (Part I) developed by Nadelhoffer et al. (2014), designed to assess both constructs on separate subscales. Specifically, participants were asked to indicate their agreement with 10 statements, presented in random order, using a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Five of the items comprise the free will subscale, and include statements such as "People always have the ability to do otherwise" or "How people's lives unfold is completely up to them." The remaining five items comprise the determinism subscale, including statements such as "Everything that has ever happened had to happen precisely as it did, given what happened before" or "A supercomputer that could know everything about the way the universe is now could know everything about the way the universe will be in the future."

Mind-Body Relations Scale. To assess participants common sense belief about mind body relations, we administered a scale that we created by combining all twelve items used in the various studies presented by Hook and Farah (2013; see Table 1 for the full scale). Although the FWI (Part I) included a dualism subscale, we opted for this specific questionnaire, as its items seemed to cover a wider array of beliefs. We also decided to include a larger number of items (at once) than the original authors, to increase internal consistency of the scale and help determine a more accurate factor structure.

Participants were told that the questionnaire was assessing how people think about mind, brain, and behavior, and that there were no right or wrong answers. Then, participants were asked to indicate on a Likert-type scale ranging from 1 (*disagree completely*) to 7 (*agree completely*) how strongly they agreed with each of twelve statements (likewise presented in random order) pertaining to the relationship between these entities. Example items from this questionnaire are "The mind is fundamentally physical" or "Each of us has a soul that is separate from the body."

Demographic questions. After working on the two questionnaires, participants responded to a selection of demographic questions, assessing age, gender (male; female; other/none), whether or not they were native speakers (yes/no), nationality, current location, highest level of education (6 levels from "school" to "PhD"), and political orientation (from 1 (*very liberal*) to 7 (*very conservative*)). Some of these demographics were intended to be used as control variables in the regression analyses, as it is conceivable that some of them share variance with belief in substance dualism and/or free will (e.g., age, political orientation), belief in reductive physicalism and/or determinism (e.g., education), or comprehension of the—rather complex—item wording (e.g., education, native speaker).

Table 1

Study 1: Rotated factor solution.

	Factor	
	1 (Substance Dualism)	2 (Reductive Physicalism)
Each of us has a soul that is separate from the body.	0.866 (0.843)	
Some spiritual part of us survives after death.	0.843 (0.824)	
Though our bodies die, our minds (consciousness, memory, will) can survive.	0.822 (0.758)	
Some nonmaterial part of me (my mind, soul, or spirit) determines my behavior.	0.810 (0.804)	
Minds are inside brains but not the same as brains.	0.631 (0.582)	
The mind is a nonmaterial substance that interacts with the brain to determine behavior.	0.610 (0.716)	
All mental processes are the result of activity in the nervous system.		0.829 (0.712)
All of my conscious experience is the result of activity in my nervous system.		0.776 (0.734)
The mind is fundamentally physical.		0.736 (0.675)
When I use the word “mind” it is just a shorthand term for the complicated things my brain does.		0.710 (0.795)
The mind and the brain are the same thing.	−0.431	0.701 (0.780)
My mind (consciousness, memory, will) is an emergent property of my brain and cannot be separated from it.		0.617 (0.695)

Notes. Rotated factor loadings for the twelve items comprising the mind-body relations scale from Studies 1 and 2. Factor loadings smaller than 0.4 are not displayed. Values in parentheses are for Study 2.

2.2.2. Results and discussion

Factor structure of the Mind-Body Relations Scale. To test whether, similar to the free will construct, belief about mind-body relations is a multidimensional construct, we conducted a principal component analysis with Varimax rotation and Kaiser normalization on the twelve items comprising the mind-body relations scale. Factor loadings for the rotated solution can be found in Table 1. The rotation converged in three iterations, and two factors were extracted with an Eigenvalue of greater than 1, which explained a combined 64.1% of the total variance. As expected, the first factor corresponds to a belief in substance dualism, and comprises items that refer to a belief in souls or other parts of the self that can survive physical death. Only two of the items do not share such a metaphysical connotation, and merely make general statements with regard to the non-reductive nature of the mind. These items, however, reveal the weakest factor loadings on this factor.

The second factor we identified corresponds to a reductive physicalist view on mind and body, and revolves around statements that claim that mental processes are entirely reducible to activity in the brain. Only one item—again with the weakest factor loading—corresponds to a belief in emergentism, that is, that mental states emerge from brain states but are not reducible to brain states.

As such, both factors seem to indeed assess unique constructs, as a lack of belief in a soul or another part of the self that survives physical death (i.e., a lack of a belief in substance dualism) does not necessarily mean that a reductive physicalist view of the world must be endorsed. For example, a property dualist would score low values on both subscales. And indeed, we found that both factors were strongly, but not perfectly negatively correlated in our sample, $r(364) = -0.536$, $p < .001$, 95% CI = $[-0.613; -0.450]$.

We therefore created individual mean scores for the items loading on the substance dualism factor (Cronbach's $\alpha = 0.90$), and the items on the reductive physicalism factor ($\alpha = 0.87$), respectively. To be able to compare our results with previous findings, we also created a mean score for all items, with greater values indicating greater dualism/non-reductive-physicalism belief ($\alpha = 0.91$).

Correlational analyses (single score). Consistent with findings by Nadelhoffer et al. (2014), we found a negative correlation between the two subscales assessing belief in free will and determinism, $r(364) = -0.174$, $p = .001$, 95% CI = $[-0.308; -0.042]$. More importantly, however, the overall dualism/non-reductive-physicalism index significantly correlated with belief in free will in a positive direction, $r(364) = 0.196$, $p < .001$, 95% CI = $[0.075; 0.313]$. Participants who indicated a greater belief in dualism (or a lack of belief in reducibility of mental states to brain states) had a greater tendency to agree with statements that posit the idea that humans have a free will and can choose their destiny. Also consistent with their findings, the combined dualism/non-reductive-physicalism score did not significantly correlate with belief in determinism, $r(364) = 0.042$, $p = .419$, 95% CI = $[-0.073; 0.154]$.

This pattern replicates Nadelhoffer et al. (2014) findings—the authors also found their dualism scale to positively correlate with free will beliefs, yet found no significant association between beliefs in dualism and determinism. However, the lack of a relationship between the latter two constructs seems surprising at first. While it makes intuitive sense that a belief in a mind that is an uncaused causal agent is a requirement for belief in true free will, it seems counterintuitive that one's views on the reducibility of the mind to the brain do not have anything to do with one's view on whether the world is physically pre-determined, in a way that the laws of nature guarantee that everything *has* to happen the way it does.

Correlational analyses (two factors). This issue becomes clearer, however, when instead of using a single dualism/non-reductive-physicalism score, one includes the two subscales of the mind-body-relations scale we identified earlier in the analysis. Specifically, we were able to differentiate the unique roles that the *substance dualism* and *reductive physicalism* factors play in the relationship between belief in free will/determinism and belief about mind-body relations. That is, we were able to analyze how belief in substance dualism and belief in reductive physicalism individually correlate with both belief in free will and determinism.

Results of our analysis revealed that belief in substance dualism indeed correlates with belief in free will, that is, people's ability to choose and affect their own destiny, $r(364) = 0.247$, $p < .001$, 95% CI = $[0.132; 0.355]$. In other words, a belief in a mind that exists outside the physical realm and that “does the thinking” seems to be strongly associated with (and maybe a prerequisite for) a strong belief in a free will and humans' ability to causally affect their future. Whether or not people believed in reductive physicalism,

however, did not correlate with their free will belief, $r(364) = -0.075, p = .151, 95\% \text{ CI} = [-0.189; 0.039]$.

When it comes to the previously reported null finding regarding the association between mind-body beliefs and belief in determinism, differentiating the two mind-body beliefs revealed the reason for this absence of correlation. On its own, a belief in reductive physicalism positively correlates with belief in determinism, $r(364) = 0.107, p = .041, 95\% \text{ CI} = [-0.008; 0.221]$. That is, as common sense would suggest, the belief that minds are nothing above and beyond brain states fits the idea of a cause-and-effect universe in which no metaphysical elements are at play. Unexpectedly, however, belief in substance dualism similarly correlates with belief in a deterministic world, and likewise in a positive direction, $r(364) = 0.148, p = .005, 95\% \text{ CI} = [0.029; 0.267]$. Specifically, these results indicate that a greater belief in a metaphysical substance dualism positively predicts responses on a scale assessing people's belief in the predetermined nature of the universe. The fact that both types of mind-body beliefs positively predict determinism explains the lack of correlation that we—and other authors—found between a unidimensional dualism score and belief in determinism.

Regression analyses. We also analyzed the data using two regression analyses predicting free will and determinism beliefs, respectively. In both cases, we predicted the outcome variable with the second, not predicted subscale (e.g., the free will subscale when predicting determinism) of the FWI (to account for intercorrelation between the two subscales), the two mind-body subscales we identified (as our prime subject of interest), as well as the control variables age, gender (dummy-coded), being a native English speaker or not, education (dummy-coded), and political orientation. Results show, that both substance dualism ($\beta = 0.396, SE = 0.065, p < .001, 95\% \text{ CI} = [0.269; 0.524]$), and reductive physicalism ($\beta = 0.270, SE = 0.058, p < .001, 95\% \text{ CI} = [0.156; 0.384]$) uniquely, and positively, predict a belief in determinism. In fact, both dimensions did not significantly differ in their predictive power, $Z = 1.446, p = .148$. Conversely, as hypothesized, free will beliefs were also significantly predicted by belief in substance dualism, $\beta = 0.341, SE = 0.067, p < .001, 95\% \text{ CI} = [0.208; 0.473]$. Unlike in the correlations reported above, however, in a second regression analysis, belief in reductive physicalism did also positively predict free will beliefs ($\beta = 0.136, SE = 0.0061, p = .026, 95\% \text{ CI} = [0.016; 0.254]$), albeit to a significantly lesser degree than belief in substance dualism, $Z = 2.279, p = .023$ (Table 2). That is, even when controlling for various demographic covariates and the intercorrelation between free will and determinism beliefs (as well as substance dualism and reductive physicalism beliefs), both substance dualism and reductive physicalism predict belief in determinism to a similar degree, whereas it is primarily belief in substance dualism that predicts belief in a free will.

To follow up on these findings, we designed a second study to investigate the relationship between the constructs involved in more detail. Specifically, having shown a differential relation between beliefs in substance dualism, reductive physicalism, and free will, we designed the next study to investigate why both beliefs in substance dualism and reductive physicalism similarly predicted belief in determinism.

2.3. Study 2

In the second study, our goal was to investigate the relationship between the relevant constructs in more detail by including a more fine-grained questionnaire assessing various dimensions of free-will-related beliefs. We thereby set out to replicate the results of Study 1 and to extend them by trying to isolate the relationship between the two newly-identified subdimensions of belief about mind-body relations and different subcomponents of free will belief.

In addition, we also included a single-item measure for belief about mind-body relations that has been used in past research (e.g., Burgmer & Forstmann, *in press*; Forstmann et al., 2012; Marshall, Lilienfeld, Mayberg, & Clark, 2017). So far, it is not known whether this pictorial measure rather assesses people's belief in substance dualism or in reductive physicalism, how it compares to other semantic scales assessing the same constructs, and how predictive it is of free will-related beliefs.

Lastly, as outlined in the Introduction, another goal of this study was to investigate how the different facets of the two metaphysical beliefs we observed in Study 1 relate to basic thinking styles. Specifically, individual differences in preference for experiential information processing (or “faith in intuition”) should be related to both belief in free will and substance dualism, as these beliefs are argued to be a function of our intuitive phenomenological experience (e.g., Bloom, 2004). Conversely, we expected the more abstract and “rational” constructs of determinism and reductive physicalism to be associated with a greater need for cognition, that is, a preference for rational information processing (Epstein et al., 1996).

Table 2
Regression results Study 1.

	Free Will	Determinism
Substance Dualism	0.341 ^{***}	0.396 ^{***}
Reductive Physicalism	0.136 [*]	0.270 ^{***}
Free Will	–	–0.254 ^{***}
Determinism	–0.266 ^{***}	–

Notes. Results of two regression analyses of Study 1, predicting the two dimensions of the Free Will Inventory included. Not included in this table are results for the control variables: age, gender, native speaker, education, and political orientation. Values represent standardized beta coefficients. ^{***} = $p < .001$; ^{**} = $p < .01$; ^{*} = $p < .05$.

2.3.1. Method

2.3.1.1. Participants and design. Based on the effect sizes observed in the first study, we recruited 301 participants from Amazon's Mechanical Turk website, who participated in exchange for a moderate monetary compensation. Participants worked on four questionnaires, the first two of which were again presented in random order. Of the 301 participants, four were excluded on the basis of self-admitted random/misleading responding, leaving us with a final sample of 297 participants (156 female, 140 male, 1 other/none; $M_{Age} = 33.17$, $SD = 10.64$).

2.3.1.2. Materials and procedure. First, after indicating agreement with the consent form, participants worked on two questionnaires assessing belief about mind-body relations. First, they worked on the modified Hook and Farah (2013) mind-body relations scale introduced in Study 1, followed by an established single item pictorial measure for general mind-body relations used in previous studies on mind-body dualism (e.g., Forstmann et al., 2012). Loosely based on the Inclusion of Others in the Self Scale (Aron, Aron, & Smollan, 1992), this item presents participants with seven diagrams, each depicting two circles on a horizontal line with continually increasing degrees of overlap, ranging from full separation to full overlap. Participants are then asked to indicate which of the constellations best represents their idea of how minds relate to bodies. Selecting a constellation with greater overlap between the circles thus indicated either a greater belief in some form of monism or a lesser belief in some form of dualism. Whether this item rather assesses belief in substance dualism or reductive physicalism (i.e., which factor of the mind-body relations scale used in Study 1), however, is so far unclear. Still, in order to gain insight into this matter, we decided to include this pictorial item in the present study.

Subsequently, participants worked on the Free Will and Determinism Scale (FAD-Plus) by Paulhus and Carey (2011). Unlike the FWI (Nadelhoffer et al., 2014) we used in Study 1, the FAD-Plus assesses four distinct dimensions of free will/determinism belief, by asking participants to indicate their agreement with each of 27 statements, using a 7-point Likert-type scale ranging from 1 (*disagree completely*) to 7 (*agree completely*). Specifically, the FAD-Plus comprises the dimensions *free will*, *scientific determinism*, *fatalistic determinism*, and *unpredictability*. The *free will* subscale captures a belief comparable to what is assessed by Nadelhoffer et al. (2014) free will subscale, that is, a belief in people's ability to causally affect their own destiny. It includes items such as "People have complete control over the decisions they make," or "People can overcome any obstacles if they truly want to."

Further, unlike the Free Will Inventory, the FAD-Plus assesses two unique kinds of belief in determinism: *scientific determinism* captures people's belief in that everything is determined by its past (or its biological makeup), and that everything is governed by the physical laws of cause and effect. This subscale includes items such as "As with other animals, human behavior always follows the laws of nature" or "Your genes determine your future." *Fatalistic determinism*, on the other hand, similarly constitutes a belief in that everything that happens is pre-determined, yet invokes a metaphysical explanation (e.g., fate, destiny) for this rationale. Items on this subscale include "Fate already has a plan for everyone" or "No matter how hard you try, you can't change your destiny." The last subscale of the FAD-Plus, *unpredictability*, assesses a belief in the unpredictability of the future, and the belief that most things that happen in the world are a result of chance events or randomness. It includes items such as "What happens to people is a matter of chance" or "People are unpredictable."

Lastly, all participants responded to the Rational-Experiential Inventory (REI), a questionnaire assessing trait preferences for rational versus experiential information processing (Epstein et al., 1996) that is comprised of two subscales labeled *need for cognition* and *faith in intuition*. Need for cognition (Cacioppo & Petty, 1982) refers to people's tendency to willfully engage in effortful cognitive activities such as intellectual deliberation, and assesses people's agreement with five statements using a 7-point Likert-type scale ranging from 1 (*disagree completely*) to 7 (*agree completely*). Items include statements such as "I prefer to do something that challenges my thinking abilities rather than something that requires little thought" or "I don't like to have to do a lot of thinking" (reverse-coded). Conversely, faith in intuition assesses trait reliance on heuristics and affect-based decision-making, and is similarly assessed through agreement with five statements, including statements such as "I trust my initial feelings about people" or "I believe in trusting my hunches."

As intuitive dualism potentially arises from intuitions based on phenomenological experience (Bloom, 2004; Forstmann & Burgmer, 2015, 2017), and free will beliefs similarly seem to derive from phenomenological states pertaining to intentions and actions, they may both be related to the same underlying personality trait (that is, faith in intuition). Likewise, both reductive physicalism and determinism are evidently linked to counterintuitive, abstract reasoning—either regarding the cause-and-effect nature of the universe or the reducibility of mental states to brain states. Thus, we decided to include both need for cognition and faith in intuition in our regression analyses for Study 2, in addition to the same control variables included in Study 1.

At the end of the study, we again assessed demographic variables as well as whether participants self-admittedly gave misleading or random responses to some of the questions.

2.3.2. Results and discussion

The factor structure of the mind-body relations questionnaire was similar to the structure we established in Study 1. Two factors with Eigenvalues greater than 1 emerged, cumulatively accounting for 62.5% of variance. The six items loading the strongest on each factor were the same items as in Study 1, with only slightly different factor loadings (see Table 1).

As in Study 1, we created indices for the subscales of the various questionnaires included in this study. Again, both the substance dualism ($\alpha = 0.88$) and the reductive physicalism ($\alpha = 0.87$) scales were reliable. Similarly, the four subscales of the FAD-Plus, free will ($\alpha = 0.83$), scientific determinism ($\alpha = 0.70$), fatalistic determinism ($\alpha = 0.88$), and unpredictability ($\alpha = 0.74$), revealed good internal consistency. The same was true for the two scales comprising the REI, that is, need for cognition ($\alpha = 0.87$) and faith in intuition ($\alpha = 0.91$).

Correlational analyses (two factors). Analyzing the raw correlations between the subscales of the mind-body relations questionnaire and the FAD-Plus, we replicated the key finding from Study 1. Belief in free will belief once more correlated positively with belief in substance dualism, $r(297) = 0.169, p = .004, 95\% \text{ CI} = [0.043; 0.285]$, but not with belief in reductive physicalism, $r(297) = 0.022, p = .709, 95\% \text{ CI} = [-0.099; 0.153]$. Further, the FAD-Plus sheds more light on the pattern observed for belief in determinism in Study 1: there, both substance dualism and reductive physicalism surprisingly correlated positively with determinism, explaining the null-correlation found between determinism and the single aggregate dualism/non-reductive-physicalism score initially calculated. In the present study, the relationship between the concepts involved becomes clearer. We found belief in substance dualism to substantially correlate with fatalistic determinism, that is, the metaphysical belief in destiny or fate, $r(297) = 0.482, p < .001, 95\% \text{ CI} = [0.373; 0.581]$, while revealing a weaker (and negative) correlation with belief in scientific determinism, $r(297) = -0.131, p = .024, 95\% \text{ CI} = [-0.261; -0.003]$. In contrast, belief in reductive physicalism revealed an almost reverse pattern: while it correlated strongly with belief in scientific determinism, $r(297) = 0.462, p < .001, 95\% \text{ CI} = [0.354; 0.558]$, it only revealed a weak (and negative) correlation with belief in fatalistic determinism, $r(297) = -0.117, p = .044, 95\% \text{ CI} = [-0.239; 0.012]$. In addition, only reductive physicalism correlated significantly with the unpredictability subscale of the FAD-Plus, $r(297) = 0.229, p < .001, 95\% \text{ CI} = [0.110; 0.338]$, while belief in substance dualism revealed no significant correlation with unpredictability, $r(297) = -0.018, p = .758, 95\% \text{ CI} = [-0.141; 0.113]$.

The single pictorial mind-body relations item (with higher values representing higher dualism/non-reductive-physicalism scores) revealed only one significant correlation, namely a positive correlation with belief in scientific determinism, $r(297) = 0.149, p = .010, 95\% \text{ CI} = [0.030; 0.267]$. The remaining correlations with the subscales of the FAD-Plus turned out non-significant (all $ps > .180$). This pattern seems to resemble the results for the reductive physicalism subscale of the questionnaire adapted from Hook and Farah (2013). It thus seems as if this pictorial item measures people’s belief in the complete reducibility of mental states to brain states rather than a belief in a mind that is a substance outside of the physical realm. This hypothesis is supported by the results of a regression analysis, predicting scores on this pictorial item with the two subscales of the mind-body relations questionnaire. Controlling for their intercorrelation, only reductive physicalism predicted scores on the pictorial item, $\beta = 0.345, SE = 0.067, p < .001, 95\% \text{ CI} = [0.016; 0.254]$, while substance dualism did not predict scores on this item, $\beta = -0.020, SE = 0.067, p = .767, 95\% \text{ CI} = [-0.151; 0.111]$. For these reasons, we decided to focus our further analyses on the two-factorial mind-body relations scale.

Regression analyses. To account for intercorrelations between the subscales, as well as to control for demographic variables and the two personality dimensions assessed with the REI, we conducted individual regression analyses—similar to the ones performed in Study 1—in addition to the correlations reported above, predicting all four subscales of the FAD-Plus (see Table 3).

Importantly, while controlling for the various demographics and personality variables, we found the same (if not more pronounced) pattern of results as in the correlational analyses reported above. Belief in substance dualism still predicted belief in free will, $\beta = 0.275, SE = 0.075, p < .001, 95\% \text{ CI} = [0.128; 0.422]$, and belief in fatalistic determinism, $\beta = 0.557, SE = 0.061, p < .001, 95\% \text{ CI} = [0.437; 0.678]$, whereas it did not predict belief in scientific determinism, $\beta = 0.012, SE = 0.074, p = .867, 95\% \text{ CI} = [-0.133; 0.158]$, or unpredictability, $\beta = 0.042, SE = 0.083, p = .610, 95\% \text{ CI} = [-0.121; 0.206]$.

Conversely, belief in reductive physicalism predicted belief in scientific determinism, $\beta = 0.486, SE = 0.064, p < .001, 95\% \text{ CI} = [0.361; 0.611]$, and uncontrollability, $\beta = 0.230, SE = 0.078, p = 0.003, 95\% \text{ CI} = [0.078; 0.382]$, while it did not predict belief in free will, $\beta = 0.092, SE = 0.072, p = .203, 95\% \text{ CI} = [-0.050; 0.234]$, or fatalistic determinism, $\beta = 0.072, SE = 0.066, p = .277, 95\% \text{ CI} = [-0.058; 0.202]$.

Analyzing the predictive power of the two personality variables assessed by the REI, the regression analyses revealed that—in line with the theoretical arguments found in the literature—faith in intuition primarily predicted belief in free will, $\beta = 0.275, SE = 0.054, p < .001, 95\% \text{ CI} = [0.168; 0.383]$, and to a lesser extent the two determinism subscales (fatalistic: $\beta = 0.091, SE = 0.052, p = .079, 95\% \text{ CI} = [-0.011; 0.194]$; scientific: $\beta = 0.111, SE = 0.055, p = .044, 95\% \text{ CI} = [0.003; 0.219]$). Thus, it seems indeed to be the case that a belief in free will is a product of intuitions we have about intentionality, causality, and behavior.

Need for cognition, that is, one’s preference for engaging in effortful cognitive elaboration, on the other hand, negatively predicted belief in fatalistic determinism—the belief in fate and destiny, $\beta = -0.128, SE = 0.048, p = .009, 95\% \text{ CI} = [-0.223;$

Table 3
Regression results Study 2.

	Free Will	Sci. Determ.	Fatal. Determ.	Unpredictability
Subs. Dualism	0.275^{***}	0.012	0.557^{***}	0.042
Red. Physicalism	0.092	0.486^{***}	0.072	0.230^{**}
Free Will	–	0.130 [*]	–0.288 ^{***}	0.212 ^{**}
Sci. Determ.	0.139 [°]	–	0.279 ^{***}	–0.009
Fatal. Determ.	–0.346 ^{***}	0.312 ^{***}	–	0.184 ^{**}
Unpredictability	0.179 [°]	–0.007	0.130	–
Need for cognition	0.062	0.007	–0.128 ^{**}	–0.144 [*]
Faith in intuition	0.275 ^{***}	0.111 [*]	0.091 [†]	0.066

Notes. Results of four regression analyses of Study 2, predicting the four dimension of the FAD-Plus scale. Bold values represent significant associations between the critical lay belief dimensions. Not included in this table are results for the control variables: age, gender, native speaker, education, and political orientation. Values represent standardized beta coefficients. ^{***} = $p < .001$; ^{**} = $p < .01$; ^{*} = $p < .05$; [†] = $p < .10$.

–0.033], as well as in unpredictability, $\beta = -0.144$, $SE = 0.057$, $p = .013$, 95% CI = [–0.257; –0.030]. These relationships make intuitive sense, as both belief in chance/randomness and in fate can be considered simple answers to the complex problems of free will, determinism, and its related constructs, that may not be easily adopted by people high in need for cognition.

Lastly, we investigated how predictive need for cognition and faith in intuition are of belief in substance dualism and reductive physicalism, respectively. Similarly supporting claims found in the literature, in two regression analyses, we found that only faith in intuition, $\beta = 0.225$, $SE = 0.057$, $p < .001$, 95% CI = [0.113; 0.337], but not need for cognition, $\beta = -0.029$, $SE = 0.057$, $p = .614$, 95% CI = [–0.141; 0.083], predicted belief in substance dualism. Neither need for cognition nor faith in intuition significantly predicted belief in reductive physicalism ($ps > .200$). Thus, similar to belief in free will, belief in substance dualism seems to be related to our preference for intuitive thinking, a notion that supports the hypothesis that this specific belief is rooted in our subjective phenomenological experience of the world. Yet, preferences for the two thinking styles did not fully explain the relationship found between belief in free will and in substance dualism. In other words, even though both seem to be related to intuitive thinking, it still seems as if the concept of free will is intimately linked (and maybe logically dependent) on a belief in a mental substance that is not affected by the law of cause and effects that governs the physical universe.

In sum, results of the second study show that while a belief in souls or minds that exist outside of the physical realm positively predicts a belief in free will, both belief in substance dualism and reductive physicalism have a more nuanced relationship with belief in determinism. While a belief in substance dualism seems to predict a belief in the world being pre-determined by destiny or fate, a belief in reductive physicalism predicts belief in the world being pre-determined by the laws of physics. However, a belief in reductive physicalism must not necessarily lead to a belief in a determined universe: as some sort of counterpart to belief in free will, reductive physicalism still allows to attribute future events to chance or randomness (i.e., unpredictability), thereby giving the option to reject the notion of any sort of pre-determination.

3. General discussion

The current research explored people's views on mind-body relations and their relationship with belief in free will and determinism. Inspired by past research suggesting that belief in free will and determinism are two distinct dimensions (in a sense that lay people are intuitive compatibilists) rather than the two poles of a single dimension, we analyzed the factor structure of a commonly used set of items assessing belief about mind-body relations and discovered a similar pattern. While negatively correlated, beliefs in substance dualism and reductive physicalism turned out to be individual dimensions that each uniquely predicted different facets of belief in free will and determinism. Specifically, in two studies, we found that only substance dualism, but not reductive physicalism predicted belief in free will, that is, people's ability to choose their own destiny. In addition, while past research reports no correlations between single dualism/non-reductive-physicalism measures and belief in determinism (e.g., Nadelhoffer et al., 2014), we provide initial evidence for why this may be the case: in our studies, we found that *both* belief in substance dualism and reductive physicalism are positively related to belief in determinism (Study 1). Specifically, while substance dualism is related to a belief in fatalistic determinism, reductive physicalism predicts scientific determinism (Study 2). These results were not explained by demographic variables such as age, gender, political orientation or education. Moreover, we found support for the hypothesis that belief in free will and in substance dualism are linked to people's tendency to rely on their intuitions to form their metaphysical beliefs (Study 2). The relationship between both constructs is however not entirely explained by intuitive thinking, suggesting that there might indeed be a causal connection between the two. Lastly, we found that a one-item pictorial measure of belief about mind-body relations used in past research primarily captures people's tendencies to believe in reductive physicalism (or the lack thereof), rather than in minds that can exist in the absence of a physical counterpart.

3.1. Theoretical contributions and future research

The present findings suggest that people have a more complex view on the relationship between mind and body than past unidimensional approaches would suggest. However, most existing scales assessing people's conception of mind-body relations fail to adequately capture these nuanced beliefs. A factor analysis performed on the items taken from past research on mind-body beliefs revealed that lay people do in fact differentiate between belief in substance dualism and belief in reductive physicalism, and that both dimensions uniquely predict various subdimensions of belief in free will and determinism. In addition, both types of belief seem to be differentially related to people's tendency to rely on intuitive or rational thinking, further supporting the notion that they are distinct constructs. Notably, though, in the development of the FDI, Nadelhoffer et al. (2014) did not find their dualism-related items to load on two distinct factors. As they did not intend to test for such a factor structure (and therefore did not report an individual factor analysis for the dualism subscale), it is only possible for us to speculate on why this may be the case. Plausible reasons could be the formulation of the item wordings, the lower total number of items, or the (comparably large) correlation between both dimensions. Still, it may very well be the case that, upon further investigation, one would find that responses to their dualism items can similarly be explained by an underlying two-factor structure.

However, even a two-factorial conceptualization is most likely insufficient to fully capture people's beliefs about the relationship between mind and body. For example, it fails to properly assess beliefs related to property dualism, that is, beliefs that assume that mental states are something above and beyond physical states, yet cannot exist in the absence of the corresponding physical matter. Likewise, the present scale does not allow to assess people's belief in the causal relationship between the mental and the physical, regardless of whether they are conceptualized as different properties or substances. In other words, the present items cannot differentiate whether a person believes the mental can affect the physical and/or vice versa. In addition, the current scales are unable to

assess belief in certain forms of non-materialistic monism (such as idealism) or in panpsychism, the idea that every combination of physical matter has mental properties, including non-living entities.

As such, future research efforts should focus on developing and validating more complex scales assessing various subdimensions of belief in mind-body relations in order to accurately assess how they may differentially predict various metaphysical and non-metaphysical beliefs (such as in free will and determinism), as well as which cognitive processes may be responsible for their development. For example, a belief in idealism, while technically a non-dualist view on the world, may be compatible with a belief in free will, yet not necessarily. Idealism is the belief that something mental constitutes the sole foundation of reality (*ontological idealism*), or that although something non-mental may theoretically exist, one cannot acquire any knowledge about it—similar to Descartes' *cogito ergo sum* argument (epistemological idealism; Guyer & Horstmann, 2016). Because it does not make any explicit claims about the nature of the physical universe, for example whether it adheres to the laws of cause and effect, idealism allows for belief in free will, in scientific determinism (if the physical world is merely construed as epistemologically inaccessible), and/or in fatalistic determinism.

In addition, as outlined earlier, the causal direction between the concepts identified is not yet clear. While it seems to be that both a belief in substance dualism and in free will are related to an intuitive thinking style, future research may investigate these relationships in more detail to see if, for example, an experimental manipulation of thinking style affects responses to items assessing free will belief. Likewise, although past research has established a causal relation between intuitive thinking and unspecific belief in mind-body dualism (Forstmann & Burgmer, 2015), it would be interesting to assess which of the current sub-dimensions of belief about mind-body relations (or those discovered by future research) are primarily affected by this thinking style.

Similarly, after establishing a more thorough assessment of people's belief about mind-body relations, it is possible to investigate the causal relation between these beliefs and beliefs in free will and determinism in more detail. In fact, both belief systems are ontological propositions about reality, presumably based on our subjective, phenomenological experience of the world. In addition, as outlined in the Introduction, they seem to logically depend on one another, yet were shown to be distinct constructs (Nadelhoffer et al., 2014). While mind-body beliefs seem to be informed by what it feels like to *perceive* (as in p-consciousness or qualia), free will beliefs seem to be informed by what it feels like to *act*, both closely-related phenomenological states. As a belief about the relation between mind and body seems more abstract than about free will, we would propose a causal direction in which mind-body beliefs would causally affect free will beliefs. In fact, in a recent set of studies by Vonasch et al. (2018), the authors found that, on average, lay people believe that humans would have more free will if souls existed than if souls did not exist (corresponding to a belief in substance dualism). Notably, they asked participants about souls without any reference to religion or faith. Rather, participants considered souls to be something that is partly (yet not fully) responsible for making unconstrained conscious decisions, a notion that in turn informed their judgments about free will and responsibility. These results lend further support to our hypothesis that a belief in the existence of a non-material mental substance (such as a soul) and belief in free will are closely interlinked, and possibly causally related, concepts. Yet, to fully capture hypothesized causal effects with regard to the different facets of dualist beliefs, new manipulations for the two subdimensions identified would be needed.

A second aspect that could potentially be addressed in future work is whether and how people who subscribe to certain positions regarding the mind-body problem conceptualize free will: do people who endorse substance dualism or reductive physicalism have the same understanding of what it means to have “free will”? As detailed in the Introduction, people may have different conceptions about what it means to be free, that is, whether it entails having the ability to do otherwise, or whether it means to be able to act in accordance with how one wishes to act. In a similar vein, people with different views on how minds relate to bodies may also differ with regard to how much they equate free will with moral responsibility and therefore criminal accountability.

In sum, the present research adds to the growing literature on how lay people think about metaphysical questions and which factors contribute to their beliefs. Yet, as outlined above, more research will be necessary to fully understand the intricacies of people's lay beliefs about minds and bodies, their views on whether people possess free will and/or whether the world is pre-determined by the laws of nature, how these different constructs may relate to one another, and what consequences this may have in people's minds for ascriptions of guilt, praise, reward, and punishment. The present research thus adds to our understanding of how people explain their own phenomenological consciousness, and may help to further investigate how these views affect our cognition, emotion and behavior.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.concog.2018.07.003>.

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