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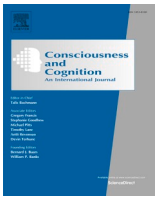

Full Length Article

The nature of mind scale (NOMS): Validation of an eight-dimensional scale assessing beliefs about the relationship between mind and matter

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ABSTRACT

We developed and validated the Nature of Mind Scale (NOMS), a 24-item measure assessing lay beliefs about eight distinct philosophical positions on the mind–body relationship. Given the limitations of existing measures and the theoretical diversity of mind–body positions, our goal was to develop a comprehensive yet practical scale that could capture the full range of philosophical stances without reducing them to overly simplified dimensions. Across four studies with 1074 participants, we established the NOMS's psychometric properties and nomological network. Through exploratory and confirmatory factor analyses, we identified an eight-factor structure representing belief in substance dualism, interactionism, panpsychism, idealism, reductive physicalism, non-reductive physicalism, mystical monism, and neutral monism. Participants most strongly endorsed interactionism, non-reductive physicalism, and mystical monism, while showing the least support for idealism. The scale demonstrated good model fit and strong evidence of measurement invariance across samples. Convergent validity was established through correlations with existing mind–body belief measures. Construct validity was supported by theoretically consistent relationships with religiosity, free will beliefs, cognitive style, personality traits, and afterlife beliefs. The NOMS represents an extension of previous measures of mind–body relations, capturing the multifaceted nature of these beliefs while maintaining sufficient brevity for practical research applications.

1. Introduction

The relationship between mind and body has long been a central question in both philosophy and psychology. The classic mind–body problem asks how mental processes relate to physical structures: whether the mind is a distinct, non-material entity (Descartes, 1993), entirely reducible to physical states (e.g., Kim, 2005), not entirely reducible to physical states (e.g., Sturm, 2012), a mere illusion (Korman, 2009) or a universal feature of everything in existence (e.g., Chalmers, 2015) (Table 1). Across centuries and cultures (Slingerland & Chudek, 2011; Barrett et al., 2021), views on this question have shaped scientific paradigms (Benton, 1974), clinical approaches (Mehta, 2011; Kendell, 2001), and lay intuitions about what happens after death (e.g., Hoogeveen et al., 2024).

While neuroscientific advances increasingly support physicalist frameworks, research consistently reveals that dualistic

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intuitions—the sense that mind and body are fundamentally separate (Demertzi et al., 2009; Stanovich, 1989) or at least not reducible to one another (Valtonen et al., 2021)—persist in ordinary people's everyday thinking, so much that some have referred to humans as "natural born dualists" (Bloom, 2004). These lay beliefs carry significant implications across domains. Dualistic beliefs have been associated with reduced physical health maintenance (Forstmann et al., 2012; Burgmer & Forstmann, 2018) and different conceptions of the self (Anglin, 2014). In clinical contexts, biological explanations of mental illness—reflecting physicalist thinking—create complex effects, simultaneously reducing blame while increasing perceptions of dangerousness and prognostic pessimism (Kvaale et al., 2013), and reducing clinician empathy through mechanistic dehumanization (Lebowitz & Ahn, 2014), though they may increase treatment-seeking (Angermeyer et al., 2017).

Some research suggests that these beliefs are a by-product of mentalizing capacities (Berent et al., 2022). Others have shown that dualistic beliefs serve as a psychological buffer against mortality anxiety, with stronger dualism predicting increased afterlife beliefs (Heflick et al., 2015). Consistently, Riekki et al. (2013) found that reflective dualism, afterlife beliefs, paranormal beliefs, and religiosity were strongly intercorrelated and that reflective dualism and afterlife beliefs mediated the relationship between ontological confusion and religious/paranormal beliefs.

Beliefs about the nature of the mind are also related to other fundamental beliefs. Wisniewski et al. (2019) showed that free will belief correlates more strongly with dualism than with anti-determinism (see Table 1). Forstmann and Burgmer (2018) found that dualistic beliefs correlate with intuitive thinking styles and endorsement of both free will and fatalistic determinism, while physicalist views correlate with analytical thinking and endorsement of scientific determinism. Highlighting the difference between these constructs as well as their downstream consequences, Genschow (2024) found dualism predicts helping behavior more so than belief in free will, suggesting that people may help others not primarily because of moral responsibility associated with free will, but because they believe altruistic actions benefit their immortal souls—reflecting how dualistic views of mind–body separation connect prosocial behavior to spiritual self-interest.

In the domain of personality research, Grankvist et al. (2016) found students with stronger dualistic beliefs attached less importance to power values (seeking social status, dominance), suggesting potential links between metaphysical beliefs and value systems. Work by Havlík et al. (2018) found self-transcendence scores were highest among dualists and lowest among reductive materialists, suggesting philosophical positions are influenced by stable personality traits rather than purely intellectual considerations.

These diverse findings, combined with the persistence of a wide range of mind–body beliefs in contemporary society, has motivated psychologists to develop instruments measuring these intuitions. Such measurements reveal not only how philosophical positions permeate everyday cognition and which form they take, but also how these beliefs correlate with other psychological constructs. Accurate assessment of mind–body (or mind-matter) beliefs is therefore crucial for understanding their implications across multiple domains of human experience and behavior.

Existing measures of mind–body associations. While philosophers have debated this topic for centuries, psychological research

Table 1
Philosophical Positions on the Mind-Body Relationship.

Position	Definition	Incl. in NOMS
Substance Dualism	Mind and body are distinct substances; the non-physical mind can exist independently of the body.	✓
Interactionism	A form of substance dualism: distinct mental and physical substances causally interact in both directions.	✓
Non-Reductive Physicalism	Mental states supervene on, yet are not reducible to, physical states.	✓
Reductive Physicalism	Every mental state type is identical with, and fully explained by, a physical (typically neural) state type, inheriting physical causal powers.	✓
Idealism	Reality is fundamentally mental; apparent physical objects are constructions of mind.	✓
Panpsychism	All fundamental physical entities possess some basic experiential quality; consciousness is ubiquitous.	✓
Mystical Monism	Mind and matter are expressions of a single transpersonal consciousness in which all apparent distinctions dissolve.	✓
Neutral Monism	Mind and body are two aspects of one neutral "stuff" that is neither inherently mental nor physical.	✓
Eliminativism	Folk-psychological categories (e.g., belief, desire) refer to non-existent entities and will be discarded by mature neuroscience.	
Epiphenomenalism	Conscious mental states are produced by brain activity but lack causal power over physical events.	
Property Dualism	One physical substance instantiates two irreducible kinds of property—physical and mental—with distinct causal roles.	
Type Identity Theory	Each mental state type is numerically identical to a specific brain state type.	
Anomalous Monism	Every particular mental event is identical with a physical event, yet no strict psychophysical laws link mental and physical predicates.	
Emergentism	Novel, non-identical mental properties emerge from complex physical systems and can exert downward causal influence on the physical.	
Functionalism	A mental state is whatever plays the right causal–functional role, regardless of its material realiser.	
Vitalism	Living organisms allegedly require a non-physical vital force not fully explainable by physico-chemical laws.	
Psychosomaticism	Mental and bodily phenomena form an integrated system; neither is fully intelligible without the other.	
Anti-Reductionism	Denies that mental phenomena can be completely reduced to physical processes; umbrella for diverse non-reductive views.	
Complementarity	Mental and physical descriptions are mutually necessary yet individually incomplete perspectives on one reality.	

Note. Positions marked with a checkmark (✓) are the eight dimensions measured by the Nature of Mind Scale (NOMS). Unmarked positions have been included in previous mind–body belief measures but are not part of the current scale.

has increasingly focused on measuring how people intuitively conceptualize the relationship between mind and matter. Early research in this area primarily treated mind–body beliefs as existing along a single dualism-physicalism dimension, with various instruments developed to quantify individuals' positions on this spectrum.

Unidimensional approaches. Among the first psychometric approaches, Stanovich (1989) developed a 27-item Dualism Scale that assessed agreement with statements reflecting varying degrees of dualistic thinking. Despite including both physicalist and dualist content, the scale was scored unidimensionally. Many items were philosophically complex, such as "Minds are inside brains but are not the same as brains," blending substance dualism, property dualism, and interactionism without distinguishing between them. Other items introduced epistemological claims about scientific understanding, eliminativist positions, and complex analogies (like comparing pain to "C-fibers firing"). This conceptual complexity made the scale challenging for non-expert participants.

In contrast, Demertzi et al. (2009) used four straightforward statements to assess mind-brain beliefs, including "The mind and the brain are two separate things" and "Some spiritual part of us survives after death.". Items were analyzed individually rather than forming a composite score. They revolve around general substance dualism (first item), specific claims about mind physicality (second item) and afterlife/soul beliefs (third and fourth items). Their surveys revealed majority endorsement of dualist views, with religious belief emerging as the strongest predictor of dualistic responses. Notably, the authors report stronger correlations between the two soul/afterlife items than amongst the other items, suggesting they might tap into different constructs.

Based on Stanovich's (1989) and Demertzi et al. (2009) items, Hook and Farah (2013) developed two brief 4–5 item scales for measuring dualistic beliefs. Their items mix mind-brain identity, afterlife beliefs, and causal interaction concepts, treating them as manifestations of a single construct. Similarly, Preston et al. (2013) created a 14-item Dualism Scale that treated all forms of non-physicalism (e.g., soul persistence beliefs and non-reductionism, but also free will beliefs) as expressions of a single "dualism" construct.

The Free Will Inventory (Nadelhoffer et al., 2014) also included a 5-item Dualism/Anti-Reductionism subscale alongside measures of free will and determinism. This subscale combined substance dualism and soul belief items (e.g., "The fact that we have souls that are distinct from our material bodies is what makes humans unique") with broader non-reductionist statements (e.g., "The human mind cannot simply be reduced to the brain"), without further distinguishing between positions. In addition, by embedding this measure within a broader inventory addressing agency, this approach may implicitly link mind–body beliefs with free will concepts.

Trying to implement a more intuitive (and less linguistically challenging) measure, Forstmann et al. (2012) introduced a pictorial approach using a single-item instrument with two circles labeled "mind" and "body" displaying varying degrees of overlap. While reducing linguistic complexity, this visual metaphor may have an inherent ambiguity about whether the overlapping circles represented causal interaction (mind and body affecting each other), ontological identity (mind and body being the same thing), or functional integration (mind and body working together as a system). The single-item format also precluded assessment of internal reliability.

Lastly, the simplest approach came from Bourget and Chalmers (2014) in a PhilPapers.org survey, using a single forced-choice question: "Mind: physicalism, non-physicalism, or other?" This compressed numerous distinct philosophical positions into a nominal choice, obscuring the diversity of specific views philosophers might hold. The high proportion of "other" responses (16.4 %) suggested many philosophers found the binary classification inadequate for capturing their positions.

Collectively, these unidimensional approaches constrained responses to a single dualism-physicalism dimension, treating complex philosophical positions as points on a spectrum rather than qualitatively distinct stances. Most measures contained items that mixed different philosophical positions without clear theoretical distinctions. Someone might reject both strong substance dualism and physicalist accounts, or endorse panpsychism—positions these traditional scales would struggle to capture.

Multidimensional approaches. For these reasons, other work suggests mind–body beliefs may be better captured through multidimensional frameworks that acknowledge distinct philosophical positions beyond the simple dualism-physicalism dichotomy.

Early multidimensional approaches included Fahrenberg and Cheetham's (2000, 2007) work on mind–body beliefs. Their initial Mind-Body Preconceptions Questionnaire (2000) offered participants ten distinct philosophical positions from which to select their most and least preferred views, including substance dualism, interactionism, epiphenomenalism, identity theory, functionalism, idealism, and complementarity (Table 1). In their 2007 study, they refined this approach by presenting participants with five distinct ontological positions regarding brain and consciousness (ranging from monism to dualism with psychophysical causation to complementarity), and also examined responses to "trilemmatic" configurations of related propositions. Their findings revealed that dualism with psychophysical causation was the preferred position among psychology students. While this approach recognized greater metaphysical diversity than unidimensional scales, the forced-choice format limited insights into how strongly participants endorsed each position or whether they held mixed views.

Even earlier, Embree and Embree (1993) developed the Personal Beliefs Scale with six subscales representing distinct mind–body positions: reductionist materialism, non-reductionist materialism, first-order psychosomaticism, second-order psychosomaticism, vitalism, and reductionist immaterialism (idealism). With 60 Likert-type items (ten per subscale), this extensive (and rather overlooked) measure recognized multiple positions but, due to its length, seems unwieldy for most research applications.

More recently, based on a comparable methodology, Havlík et al. (2018) created the Mind-Body Questionnaire (MBQ), presenting ten unlabeled mind–body theories including substance dualism, type identity theory, property dualism, anomalous monism, emergentism, and eliminative materialism (Table 1). Participants indicate agreement or disagreement with each theory's core argument, with follow-up options presented when they disagreed. Despite assessing reactions to multiple philosophical positions, a key limitation was that the MBQ ultimately categorized each participant into just one of three positions (dualism, non-reductive materialism, or reductive materialism), forcing those with potentially nuanced or mixed views into a single category and failing to capture that individuals might simultaneously endorse aspects of multiple philosophical positions.

A significant advancement came with Riekki et al.'s (2013) Mind-Body Relationship Scale (MBRS), which assesses beliefs along three dimensions: Reflective Dualism (12 items, e.g., "The mind is immaterial and it works with the brain to generate our behavior"), Emergentism (6 items, e.g., "The mind is based on brain activity, but the mind as a whole is more than only the activity of the brain"), and Monism (7 items, e.g., "The mind is a physiological state of the brain"). This scale recognized that individuals might simultaneously endorse aspects of different philosophical positions rather than adhering exclusively to a single stance. However, the three-factor structure still compressed certain philosophical positions: Reflective Dualism combined elements of substance dualism with interactionism, while Emergentism blended different forms of non-reductive views. Additionally, positions like panpsychism, idealism, and neutral monism were not distinctly represented within this framework.

Forstmann and Burgmer (2018) developed a two-dimensional mind–body relations scale based on Hook and Farah's (2013) items. Factor analysis of these 12 items revealed two independent dimensions rather than a single dualism construct: Substance Dualism (e.g., "Each of us has a soul that is separate from the body") and Reductive Physicalism (e.g., "The mind is fundamentally physical"). Like in Riekki et al. (2013)'s scale, this approach showed that endorsement of dualistic beliefs did not necessarily entail rejection of physicalist claims—many participants showed mixed belief patterns, suggesting these dimensions tap distinct aspects of mind–body conceptualization. Despite this improvement, the scale still reduced the philosophical landscape to just two factors, potentially missing other important positions, especially when it comes to non-reductive stances.

Several broader metaphysical measures have included mind–body dimensions within more comprehensive worldview assessments. Timmermann et al. (2021) developed the 9-item Metaphysical Beliefs Questionnaire (MBQ), which included statements reflecting idealism, panpsychism, and substance dualism alongside physicalist views. Factor analysis indicated these loaded onto a single "non-physicalist belief" dimension, suggesting potential common psychological foundations. The larger Core Metaphysical Beliefs Scale (Jylkkä et al., 2024) assessed 14 conceptual domains related to metaphysical worldviews with 42 items, finding that responses clustered into two broad factors: Idealism and Materialism. Similarly, Holmes et al. (2021) developed a 35-item Worldview Scale categorizing metaphysical orientations into Spirituality, Naturalism, and Agnosticism dimensions. While these scales captured broader metaphysical beliefs, they often subordinated specific mind–body positions to more general worldview factors.

More targeted measures have examined specific aspects of non-physicalist thinking. Diebels and Leary's (2019) Belief in Oneness Scale, for example, used 6 items to assess mystical monism—the belief that all things are fundamentally interconnected and ultimately one. This scale specifically measured agreement with statements like "The separation among individual things is an illusion; in reality everything is one" without reference to specific religious frameworks, providing a concise measure of one particular metaphysical stance.

While these multidimensional approaches improved upon unidimensional measures by capturing greater philosophical diversity, most still compressed multiple distinct philosophical positions into broader categories or omitted important positions entirely. Many focused on specific subsets of mind–body beliefs without attempting a comprehensive mapping of the philosophical landscape. The field lacks a measure that systematically distinguishes between the full range of positions individuals might hold regarding the nature and relationship of mind and body.

Theoretical dimensions of mind–body beliefs. Drawing on philosophical literature and prior measurement approaches, we identified ten distinct theoretical positions that represent key perspectives in mind–body philosophy. These positions capture fundamental differences in how the nature of mind, body, and their relationship might be conceptualized:

Substance Dualism posits that mind and body are fundamentally different substances or entities, with the mind being non-physical and capable of existing independently of the physical body. Interactionism, as a type of substance dualism, acknowledges the distinctness of mental and physical domains while emphasizing their bidirectional causal influence—mental events can cause physical events and vice versa. Non-Reductive Physicalism maintains that while the mind depends on physical processes, mental states cannot be fully reduced to or explained in terms of physical states alone. Reductive Physicalism, in contrast, holds that mental states are identical to or fully explainable in terms of physical states, typically brain processes.

Idealism inverts the physicalist perspective by claiming that reality is fundamentally mental in nature, with physical objects being mental constructs or projections. Panpsychism attributes some form of consciousness or experiential quality to all physical entities, suggesting that mentality is a fundamental feature of the universe. Eliminativism goes beyond reductive physicalism to argue that our folk psychological concepts like "consciousness" or "mind" are illusions that will eventually be replaced by more accurate neuroscientific explanations.

Mystical Monism emphasizes the fundamental interconnectedness of all reality, viewing mind and body as expressions of a single unified consciousness or ultimate reality. Neutral Monism proposes that mind and body are different aspects or expressions of a neutral substance that is neither inherently mental nor physical. Lastly, Epiphenomenalism acknowledges mental states but denies their causal efficacy, viewing consciousness as a byproduct of brain activity that cannot influence physical events.

Given the limitations of existing measures and the theoretical diversity of mind–body positions, our goal was to develop a comprehensive yet practical scale that could capture the full range of philosophical stances without reducing them to overly simplified dimensions. We aimed to create a measure that would recognize the potential independence of these positions while maintaining sufficient brevity for use in empirical research.

2. The present research

Across four studies with 1074 participants (see Table 7 for demographics), we developed and validated the Nature of Mind Scale (NOMS), a comprehensive measure assessing eight distinct philosophical positions on the mind–body relationship. In Study 1 (N = 206), we conducted exploratory and confirmatory factor analyses on an initial item pool of 50 items, resulting in a 24-item scale with

three items per dimension. We established convergent validity by examining correlations with existing mind–body belief measures, including the Mind-Body Relationship Scale (Riekki et al., 2013) and a pictorial measure of mind–body dualism (Forstmann et al., 2012). In Study 2 ($N = 283$), we confirmed the factor structure with an independent sample and further assessed construct validity through correlations with Hook and Farah's (2013) two-dimensional mind–body dualism scale. Study 3 ($N = 246$) expanded the nomological network of the NOMS by examining relationships with theoretically relevant constructs, including free will beliefs, cognitive style, ontological confusion, personality traits, and afterlife beliefs. Study 4 ($N = 339$) provided additional validation of the scale structure. Combined sample analyses ($N = 1074$) demonstrated strict measurement invariance across all four samples, indicating that the NOMS functions equivalently in terms of factor structure, item meaning, baseline levels, and measurement precision. Analyses also revealed high consistency in inter-subscale correlations across studies, and found very high factor congruence.[1]

3. Study 1: Initial scale Construction

In Study 1, we sought to develop and analyze an initial item pool for the NOMS, a comprehensive measure intended to assess individuals' beliefs about the relationship between and the nature of mind and body. Rather than conceptualizing mind–body beliefs along a single dimension, we took a multidimensional approach that aims to capture philosophical positions individuals may hold in a more nuanced manner.

3.1. Method

3.1.1. Participants and design

A total of 269 participants from a UK university participated in exchange for partial course credit. Sixty-three were excluded for failing one or both of two procedural attention checks items, leaving a final sample of 206 (159 women, 38 men, 8 diverse, 1 prefers not to tell; $M_{Age} = 19.48$, $SD = 1.86$). All participants worked on a set of questionnaires including the NOMS.

3.1.2. Materials and procedure

Upon consent, participants first responded to our new scale. The initial item pool consisted of 50 items spanning ten philosophical positions: Substance Dualism (e.g., "I believe that the mind is a non-physical thing that communicates with the physical body"), Non-Reductive Physicalism (e.g., "I believe that mental states depend on physical states but cannot be reduced to them"), Reductive Physicalism (e.g., "I believe that the mind is identical to the brain"), Idealism (e.g., "I believe that the material world is an illusion and that everything is mental in nature"), Panpsychism (e.g., "I believe that all physical things have some degree of consciousness"), Eliminativism (e.g., "I believe that consciousness is an illusion and does not truly exist"), Mystical Monism (e.g., "I believe that everything in the universe is interconnected and part of one ultimate reality"), Neutral Monism (e.g., "I believe that mental and physical phenomena cannot be reduced to each other but are two sides of the same coin"), Epiphenomenalism (e.g., "I believe that consciousness is a byproduct of brain activity but does not have any causal influence on it"), and Interactionism (e.g., "I believe that the mind and body interact through a two-way causal relationship"). Participants were instructed to indicate their agreement with each statement on a 7-point Likert scale from *strongly disagree* to *strongly agree*.

Subsequently, participants completed a pictorial measure of mind–body beliefs (Forstmann et al., 2012). This measure presented seven images showing two circles labeled "body" and "mind" in progressively closer configurations, ranging from completely separate (strong dualism) to completely overlapping (strong monism). Participants selected which configuration best represented their conception of the mind–body relationship, with higher scores indicating stronger monistic beliefs.

Next, participants completed the Mind-Body Relationship Scale (MBRS; Riekki et al., 2013), a 26-item measure that assesses mind–body beliefs along three dimensions: Reflective Dualism (12 items, from which we removed the two weakest-loading items), which captures beliefs that the mind is independent from the body; Emergentism (6 items), which represents the view that the mind emerges from brain activity but possesses qualities beyond physical processes; and Monism (7 items), which measures beliefs that the mind is identical to brain activity. Participants indicate their agreement with statements such as "The mind is immaterial and it works with the brain to generate our behavior" (Reflective Dualism), "The mind is based on brain activity, but the mind as a whole is more than only the activity of the brain" (Emergentism), and "The mind is a physiological state of the brain" (Monism) on a 7-point Likert scale.

Next, participants completed the Basic Empathy Scale (Carré et al., 2013), a 20-item measure that assesses empathy along two dimensions: Affective Empathy, which captures emotional responsiveness to others' feelings (e.g., "I get caught up in other people's feelings easily"), and Cognitive Empathy, which measures the ability to understand others' emotional states (e.g., "I can often understand how people are feeling even before they tell me"). Participants indicated their agreement with each statement on a 7-point Likert scale from *strongly disagree* to *strongly agree*.

Lastly, participants responded to two unrelated scales assessing self-objectification and interoception for a different research project and provided demographics, including age, gender, and political orientation. Importantly, embedded within the demographics was a 5-item religiosity questionnaire (Strawbridge et al., 1998) assessing two dimensions: organizational religiosity (frequency of attending religious services and participating in other activities at places of worship) and private religiosity (frequency of prayer and

[1] Studies 1 and 2 were approved by the Faculty Research Ethics Committee at the University of Southampton. Studies 3 and 4 received ethical approval via the Ethics Self-Assessment Tool of the University of Zurich.

importance of religious/spiritual beliefs in daily life and as a source of meaning). Items were answered on 4-point Likert scales ranging from *never* to *every week or more* for frequency items and *not at all important* to *very important* for importance items.

All questionnaire items (including those of the NOMS) were presented in random order. Embedded in the questionnaires were two attention check items asking participants to select a specific response option. Participants who failed either of these checks were excluded from data analyses.

3.2. Results

EFA. An exploratory factor analysis (EFA) was conducted on the 50 items using maximum likelihood estimation with varimax rotation. Multiple criteria for factor extraction were assessed, including Kaiser's rule, parallel analysis, optimal coordinates, and scree plot examination. The nScree analysis (which applies multiple factor retention criteria simultaneously, including Kaiser's rule, parallel analysis, acceleration factor, and optimal coordinates; Raiche & Magis, 2022) suggested solutions ranging from 3 (acceleration factor) to 7 (optimal coordinates) to 12 (Kaiser criterion and parallel analysis) factors. Based on these analyses, we proceeded with a 12-factor solution that explained 53 % of the total variance.

The first eight factors demonstrated clear conceptual coherence and explained 46 % of the total variance. Factor 1 (Reductive Physicalism/Eliminativism) emerged as the strongest factor, explaining 11 % of the variance, with substantial loadings from both reductionist and eliminativist items. Factor 2 (Interactionism) explained 7 % of variance, with strong loadings from all interactionism scale items. Factor 3 (Substance Dualism) accounted for 6 % of variance with substantial loadings from substance dualism items. Factor 4 (Panpsychism) explained 5 % of variance and was defined by three panpsychism items. Factor 5 (Idealism) accounted for 5 % of

Table 2
Factor Loadings of the Nature of Mind Scale.

Factor	Item	Item Wording	Factor Loadings				
			Study 1	Study 2	Study 3	Study 4	Pooled
Substance Dualism	1	I believe that the mind is a non-physical thing that communicates with the physical body.	0.697	0.550	0.551	0.546	**0.576**
	2	I believe that the mind can survive the death of the physical body.	0.720	0.719	0.636	0.596	**0.665**
	3	I believe that the mind is not a product of the brain, but rather an independent entity.	0.669	0.784	0.786	0.726	**0.747**
Reductive P.	1	I believe that mental states can be fully reduced to physical states.	0.543	0.533	0.277	0.232	**0.360**
	2	I believe that the mind is identical to the brain.	0.625	0.764	0.781	0.673	**0.707**
	3	I believe that the mind is nothing but the brain and its functions.	0.855	0.765	0.798	0.649	**0.781**
Interactionism	1	I believe that the mind and body interact through a two-way causal relationship.	0.637	0.664	0.562	0.645	**0.635**
	2	I believe that the causal interaction between mind and body is a two-way street, with each affecting the other reciprocally.	0.815	0.677	0.623	0.724	**0.695**
	3	I believe that mental and physical events interact in a way more than just correlation or coincidence.	0.613	0.560	0.789	0.582	**0.627**
Panpsychism	1	I believe that all physical things have some degree of consciousness.	0.790	0.872	0.805	0.832	**0.827**
	2	I believe that everything in the universe is aware to some degree.	0.786	0.808	0.872	0.869	**0.840**
	3	I believe that consciousness is a fundamental property of every physical object.	0.723	0.779	0.842	0.781	**0.788**
Idealism	1	I believe that the physical world is a mental construct.	0.747	0.759	0.838	0.791	**0.788**
	2	I believe that reality is fundamentally mental and that physical objects only exist in the mind.	0.800	0.769	0.767	0.790	**0.777**
	3	I believe that the material world is an illusion and that everything is mental in nature.	0.723	0.861	0.849	0.839	**0.825**
Non-Reductive P.	1	I believe that mental states depend on physical states but cannot be reduced to them.	0.647	0.656	0.604	0.662	**0.645**
	2	I believe that mental states follow physical laws but cannot be reduced to them.	0.644	0.439	0.597	0.659	**0.592**
	3	I believe that mental states cannot be reduced to physical states, but are dependent on them.	0.605	0.759	0.743	0.589	**0.656**
Mystical Monism	1	I believe that everything in the universe is interconnected and part of one ultimate reality.	0.840	0.838	0.903	0.892	**0.876**
	2	I believe that all things are interconnected, and the universe is ultimately one.	0.457	0.426	0.540	0.442	**0.464**
	3	I believe that a single, ultimate reality is the source of both a person's mind and body.	0.800	0.950	0.878	0.901	**0.892**
Neutral Monism	1	I believe that there is a neutral substance that underlies the mind–body relationship, and it is not reducible to either one of them.	0.601	0.813	0.809	0.843	**0.790**
	2	I believe that the mind and body are not separate but interconnected through a neutral substance.	0.657	0.814	0.826	0.821	**0.798**
	3	I believe that there is a neutral substance that underlies both physical and mental phenomena.	0.739	0.578	0.693	0.643	**0.644**

Note. All loadings are standardized factor loadings from confirmatory factor analyses.

variance and included strong loadings from idealism items. Factor 6 (Mystical Monism) explained 4 % of variance and was defined primarily by Mystical Monism items. Factor 7 (Neutral Monism) accounted for 4 % of variance and was characterized by neutral monism items. Factor 8 (Non-Reductive Physicalism) explained 3 % of variance with loadings from non-Reductive Physicalism items (see Table S1).

The remaining four factors (9–12) each explained approximately 2 % of variance and lacked theoretical coherence or had fewer than three items with significant loadings. These factors appeared to capture residual variance from items that either cross-loaded or failed to load cleanly on the primary factors.

Based on the EFA results, we focused on the first eight factors and selected three items for each to create concise, psychometrically sound subscales. We selected the three highest loading items for Substance Dualism (items 2, 3, 5), Interactionism (items 2, 4, 5), Panpsychism (items 2, 3, 5), Neutral Monism (items 2, 4, 5), and Mystical Monism (items 1, 3, 5) (see Table S1, for full item wordings and numbers). For the Reductive Physicalism subscale, we selected the three highest-loading pure reductionist items (items 1, 2, and 4) rather than eliminativist items despite the latter's strong loadings, to maintain theoretical clarity. For the Idealism subscale, we included item 5 despite its cross-loading on Factor 1, due to its stronger loading on Factor 5. Fexcept for panpsych ("I believe that mental states depend on physical states but cannot be reduced to them") despite its relatively modest loading (0.39) and cross-loading with Factor 2, as it was the third-strongest item for this dimension and necessary to maintain a three-item scale.

We also examined an alternative EFA solution using oblimin rotation, which permits correlated factors. This solution explained less total variance (42 % versus 53 % for varimax) but yielded a similar 8-factor structure that largely validated our item selections. Minor differences were observed, particularly for the Interactionism factor where item 3 showed stronger loading than item 2 in the oblimin solution. Nevertheless, the oblimin rotation confirmed the robustness of our eight-factor structure and the overall appropriateness of our item selections.

CFA. To validate the eight-factor structure identified in the exploratory factor analysis, we conducted a confirmatory factor analysis (CFA) using maximum likelihood estimation. The model included the 24-item scale (3 items × 8 factors) with each item loading only on its respective factor and allowing correlations between factors.

The CFA showed adequate model fit. The chi-square test was significant ($\chi^2(224) = 354.62$, $p < 0.001$) and most common indices met conventional thresholds for acceptable fit: CFI = 0.92, TLI = 0.90, RMSEA = 0.053 (90 % CI [0.042, 0.063]), and SRMR = 0.062. The RMSEA confidence interval included values below 0.05, and the test of close fit (H_0: RMSEA ≤ 0.05) was non-significant ($p = 0.30$) (Tables 2 and 3).

All factor loadings were statistically significant ($ps < 0.001$) and substantial in magnitude, ranging from 0.46 to 0.84. The inter-factor correlations demonstrated good discriminant validity between the eight factors. No correlation exceeded $r = 0.63$, indicating that even related constructs maintained sufficient distinctness. Most correlations were below $r = 0.30$, further supporting the conceptual independence of these mind–body beliefs despite their philosophical relatedness. The strongest correlations were observed between Interactionism and Non-Reductive Physicalism ($r = 0.63$), Panpsychism and Idealism ($r = 0.58$), Non-Reductive Physicalism and Neutral Monism ($r = 0.57$), and Substance Dualism with both Panpsychism and Mystical Monism ($rs = 0.56$). A notable negative correlation was found between Substance Dualism and Reductive Physicalism ($r = -0.47$), aligning with the expected opposition between these positions. These correlation patterns confirm that the eight factors represent conceptually distinct constructs while maintaining expected relationships in terms of direction (see also measurement invariance testing below and Table 4).

The CFA results confirmed the eight-factor structure suggested by the EFA and provided evidence for the construct validity of the NOMS. Each factor demonstrated good internal consistency through strong factor loadings, and the pattern of inter-factor correlations showed expected relationships in terms of direction and magnitude.

Scale Reliability. We next assessed the internal consistency of our newly developed scale. Panpsychism (α = 0.81, $M = 3.52$, $SD = 1.44$) and Idealism (α = 0.80, $M = 2.71$, $SD = 1.29$) demonstrated the strongest internal consistency. The remaining subscales showed acceptable reliability values: Substance Dualism (α = 0.74, $M = 3.98$, $SD = 1.31$), Mystical Monism (α = 0.73, $M = 4.16$, $SD = 1.21$), Interactionism (α = 0.72, $M = 4.94$, $SD = 1.00$), Reductive Physicalism (α = 0.71, $M = 2.99$, $SD = 1.21$), and Neutral Monism (α = 0.70, $M = 4.00$, $SD = 1.11$). Only Non-Reductive Physicalism fell slightly below the conventional threshold of 0.70, with α = 0.66 ($M = 4.32$,

Table 3
Model Fit Indices for the Nature of Mind Scale.

Fit Index	Study 1	Study 2	Study 3 (const.)	Study 4	Pooled
χ^2	354.615	515.823	481.485	536.976	1071.767
df	224	224	225	224	224
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
CFI	0.921	0.897	0.910	0.907	0.919
TLI	0.902	0.873	0.889	0.886	0.900
RMSEA	0.053	0.068	0.068	0.064	0.059
90 % CI RMSEA	[0.042, 0.063]	[0.060, 0.076]	[0.060, 0.076]	[0.057, 0.071]	[0.056, 0.063]
RMSEA close-fit test (p)	0.299	<0.001	<0.001	<0.001	<0.001
RMSEA not-close-fit test (p)	<0.001	0.004	0.009	<0.001	<0.001
SRMR	0.062	0.082	0.078	0.084	0.070
Sample size (N)	206	283	246	339	1074

Note. Study 3 model includes one parameter constraint to address a non-positive definite latent variable covariance matrix issue. For the RMSEA close-fit test, the null hypothesis is RMSEA ≤ 0.05, and for the not-close-fit test, the null hypothesis is RMSEA ≥ 0.08.

Table 4
Measurement Invariance Testing Results for the Nature of Mind Scale.

Invariance Level	χ^2	df	CFI	RMSEA [90 % CI]	SRMR	Model Comparison	$\Delta\chi^2$ (Δdf)	p	ΔCFI	ΔRMSEA
Configural	1886.719	896	0.907	0.064 [0.060, 0.068]	0.078	—	—	—	—	—
Metric (weak)	1985.904	944	0.903	0.064 [0.060, 0.068]	0.083	Metric vs. Configural	99.18 (48)	<0.001	0.0047	0.0001
Scalar (strong)	2073.546	992	0.899	0.064 [0.060, 0.068]	0.084	Scalar vs. Metric	87.64 (48)	<0.001	0.0037	−0.0004
Strict	2247.623	1064	0.889	0.064 [0.061, 0.068]	0.085	Strict vs. Scalar	174.08 (72)	<0.001	0.0095	0.0006

Note. Measurement invariance was tested across all four studies (N = 1074). While chi-square difference tests were significant ($p < 0.001$) for all model comparisons, changes in practical fit indices were minimal (ΔCFI ≤ 0.01; ΔRMSEA < 0.015), supporting measurement invariance at all levels. This indicates that the eight-factor structure, item loadings, intercepts, and residual variances of the NOMS function equivalently across all four samples.

SD = 1.05), suggesting potential refinement may be beneficial for this subscale in future research (Table 5). The most-endorsed philosophical positions were interactionism, non-reductive physicalism, and mystical monism (Table S2), with the lowest support for idealism.

Convergent/discriminant validity. To assess construct validity, we examined the correlations between our eight mind–body belief subscales and established measures, including the Mind-Body Relationship Scale (MBRS, Riekki et al., 2013), as well as the pictorial measure of mind–body dualism (Forstmann et al., 2012) that represents mind–body relations through overlapping circles (*M* = 4.60, *SD* = 1.26).

The subscales of the MBRS showed strong reliability, with Reflective Dualism ($\alpha = 0.90$, $M = 4.10$, $SD = 1.15$) and Emergentism ($\alpha = 0.86$, $M = 4.60$, $SD = 1.06$) demonstrating high internal consistency, while Monism showed acceptable reliability ($\alpha = 0.74$, $M = 3.84$, $SD = 0.89$). We therefore created mean scores for all subscales of the NOMS and MBRS. Correlation analyses revealed several noteworthy correlation patterns supporting the construct validity of our measure.

The correlations between the eight averaged NOMS subscales further supported the distinctiveness of these mind–body belief dimensions while also revealing theoretically consistent relationships (see Table S2). As expected, Substance Dualism showed moderate positive associations with conceptually related positions such as Panpsychism ($r = 0.44$, $p < 0.01$), Mystical Monism ($r = 0.42$, $p < 0.01$), and Interactionism ($r = 0.37$, $p < 0.01$). Conversely, Substance Dualism demonstrated a significant negative relationship with Reductive Physicalism ($r = -0.30$, $p < 0.01$), reflecting the theoretical opposition between these positions.

Interactionism showed significant positive correlations with Non-Reductive Physicalism ($r = 0.44$, $p < 0.01$), Neutral Monism ($r = 0.37$, $p < 0.01$), and Mystical Monism ($r = 0.33$, $p < 0.01$), consistent with its intermediate position acknowledging both mental and physical causation. Panpsychism and Idealism were moderately correlated ($r = 0.46$, $p < 0.01$), reflecting their shared emphasis on mental properties being fundamental. Non-Reductive Physicalism showed its strongest correlation with Interactionism ($r = 0.44$, $p < 0.01$), consistent with both positions acknowledging mental causation while maintaining the dependence of mental states on physical processes.

Interestingly, Idealism exhibited a moderate positive correlation with Reductive Physicalism ($r = 0.34$, $p < 0.01$), despite these positions representing seemingly opposite ontological commitments. This unexpected relationship might reflect their shared monistic tendencies, with both positions rejecting the distinctness of mental and physical substances, albeit in different ways. Most correlations between subscales of the NOMS were below $r = 0.40$, reinforcing the discriminant validity of these dimensions and supporting our multidimensional approach.

Further, the pattern of correlations with the Mind-Body Relationship Scale (MBRS; Riekki et al., 2013) strongly supported the construct validity of our measure. As theoretically expected, NOMS Substance Dualism showed the strongest positive correlation with MBRS Reflective Dualism ($r = 0.79$, $p < 0.01$), while NOMS Reductive Physicalism correlated strongly with MBRS Monism ($r = 0.61$, $p < 0.01$). Similarly, NOMS Interactionism showed moderate correlations with both MBRS Reflective Dualism ($r = 0.32$, $p < 0.01$) and

Table 5
Reliability and Descriptive Statistics for the Nature of Mind Scale.

Subscale	Study 1		Study 2		Study 3		Study 4		Pooled Sample	
	α	M (SD)	α	M (SD)	α	M (SD)	α	M (SD)	α	M (SD)
Substance Dualism	0.736	3.98 (1.31)	0.701	3.47 (1.42)	0.698	3.74 (1.48)	0.644	3.60 (1.39)	0.692	3.67 (1.42)
Reductive P.	0.708	2.99 (1.21)	0.729	3.62 (1.39)	0.638	3.39 (1.34)	0.503	3.61 (1.25)	0.645	3.45 (1.32)
Interactionism	0.724	4.94 (1.00)	0.642	5.02 (1.10)	0.716	5.10 (1.15)	0.672	4.93 (1.13)	0.681	5.00 (1.10)
Panpsychism	0.809	3.52 (1.44)	0.857	3.32 (1.66)	0.878	3.23 (1.74)	0.867	3.13 (1.70)	0.859	3.28 (1.66)
Idealism	0.801	2.71 (1.29)	0.834	2.50 (1.35)	0.854	2.53 (1.46)	0.847	2.56 (1.43)	0.838	2.56 (1.39)
Non-Reductive P.	0.664	4.32 (1.05)	0.644	4.35 (1.08)	0.684	4.26 (1.08)	0.669	4.37 (1.13)	0.665	4.33 (1.09)
Mystical Monism	0.730	4.16 (1.21)	0.768	4.22 (1.49)	0.800	4.56 (1.49)	0.769	4.31 (1.44)	0.772	4.31 (1.43)
Neutral Monism	0.702	4.00 (1.11)	0.772	3.88 (1.30)	0.814	3.83 (1.42)	0.806	4.02 (1.34)	0.785	3.94 (1.31)

Note. All subscales consist of three items each. α = Cronbach's alpha; M = Mean; SD = Standard Deviation.

Emergentism ($r = 0.39, p < 0.01$), consistent with its theoretical position acknowledging both mental and physical causation. Likewise, albeit modest in size, NOMS Non-Reductive Physicalism expectedly correlated most strongly with the Emergentism subscale of the MBRS ($r = 0.25$, $p < 0.01$).

A notable pattern emerged when comparing MBRS Reflective Dualism and Emergentism correlations across our NOMS subscales. Both MBRS dimensions showed remarkably similar correlation patterns with most NOMS subscales, except for Panpsychism, which correlated substantially with Reflective Dualism ($r = 0.42$, $p < 0.01$) but minimally with Emergentism ($r = 0.14$, $p < 0.05$). While panpsychism is typically considered a monistic rather than dualistic position, this correlation may reflect that both panpsychism and dualistic beliefs reject reductive physicalism and attribute mental properties beyond standard materialist accounts. This suggests that the MBRS Reflective Dualism factor may capture broader non-reductionist intuitions rather than specifically dualistic commitments.

Discriminant validity was evident in the negative correlations between conceptually opposed positions: NOMS Substance Dualism with MBRS Monism ($r = -0.22$, $p < 0.01$), and NOMS Reductive Physicalism with MBRS Reflective Dualism ($r = -0.42$, $p < 0.01$). The pictorial measure of mind–body dualism (overlapping circles, with larger values representing more monistic views) showed modest negative correlations with MBRS Reflective Dualism ($r = -0.23$, $p < 0.01$) and Emergentism ($r = -0.16$, $p < 0.05$), but surprisingly modest correlations with NOMS subscales. As such, it seems as if this measure is conceptually unclear in which philosophical position it actually assesses.

Construct validity. Notably, religiosity measures showed consistent positive correlations with Substance Dualism (Organizational: $r = 0.31$, $p < 0.01$; Private: $r = 0.38$, $p < 0.01$) and Mystical Monism (Private: $r = 0.30$, $p < 0.01$), aligning with previous research connecting dualistic beliefs with religious orientation. Empathy dimensions showed differential relationships with mind–body beliefs, with Affective Empathy positively related to Interactionism ($r = 0.20, p < 0.01$) but negatively to Idealism ($r = -0.19, p < 0.01$), while Cognitive Empathy showed negative associations with both Reductive Physicalism ($r = -0.20, p < 0.01$) and Idealism ($r = -0.27, p < 0.01$). Based on these findings it seems as if mentalizing, which has previously been linked to dualistic beliefs (Bloom, 2004; Berent et al., 2022; Forstmann & Burgmer, 2017) may be more related to low reductionist views rather than a belief in substance dualism.

3.3. Discussion

In Study 1, exploratory and confirmatory factor analyses of our initial item pool yielded an eight-factor structure representing distinct philosophical positions on mind–body relationships. Based on these analyses, we developed a 24-item Nature of Mind Scale (NOMS) with three items per dimension: Substance Dualism, Interactionism, Panpsychism, Idealism, Reductive Physicalism, Non-Reductive Physicalism, Mystical Monism, and Neutral Monism.

The pattern of correlations between NOMS subscales and with existing measures (MBRS) aligned with theoretical expectations, and most NOMS subscale showed meaningful unique correlations with theoretically related constructs (e.g., related to religious belief or empathy). These differential correlation patterns further suggest that our eight dimensions capture distinct aspects of mind–body beliefs, which are not comprehensively addressed by existing measures. In Study 2, we aim to confirm the factor structure of the NOMS with an independent sample and provide further evidence of construct validity.

4. Study 2

We next conducted a validation study with an independent sample to confirm the factor structure of the 24-item NOMS and to provide further convergent validity.

4.1. Method

4.1.1. Participants and design

A total of 300 UK-based participants were recruited from the crowdsourcing platform Prolific.com. Of those participants, 17 were excluded from data analysis for failing one or both of two instructional attention check items, leaving a final sample of 283 (142 female, 140 male, 1 non-binary, M_{Age} 41.34, $SD = 22.32$). As in Study 1, all participants worked on a set of questionnaires, including the NOMS.

4.1.2. Materials and procedure

Upon consent, participants responded to the NOMS and two additional measures of mind–body beliefs. One was a 2-dimensional mind–body relations scale (Forstmann & Burgmer, 2018) based on Hook and Farah (2013), which assessed belief in Substance Dualism (e.g., "Some spiritual part of us survives after death") and Reductive Physicalism (e.g., "All mental processes are the result of activity in the nervous system") with 6 items each. Participants also completed the pictorial measure of mind–body beliefs (Forstmann et al., 2012) as used in Study 1. The three mind–body belief measures were presented in random order.

Subsequently, participants completed several items related to self-objectification and introspection (similar to Study 1, unrelated to the present research) and provided demographic information including religious beliefs. For the latter, we again used the 5-item religiosity questionnaire (Strawbridge et al., 1998) assessing organizational and private religiosity as in Study 1. Embedded within the questionnaires were two attention check items asking participants to select a specific response option. Participants who failed either of these checks were excluded from data analyses.

4.2. Results

A confirmatory factor analysis was conducted to validate the 8-factor structure of the NOMS identified in Study 1. The model demonstrated adequate fit: $\chi^2(224) = 515.82$, $p < 0.001$, CFI = 0.90, RMSEA = 0.068 [90 % CI: 0.060, 0.076], SRMR = 0.082 (see Table 3 for complete fit indices). All items loaded significantly on their respective factors, with standardized loadings ranging from 0.43 to 0.95 (Table 2).

Internal consistency for the eight subscales was comparable to Study 1, with Cronbach's α values ranging from 0.64 (Non-Reductive Physicalism) to 0.86 (Panpsychism). All subscales showed acceptable reliability considering their brief three-item format (Table 5).

Convergent/discriminant validity. To assess convergent and discriminant validity, we examined correlations between NOMS subscales and established measures. As shown in Table S3, our NOMS Substance Dualism subscale correlated strongly with the Hook and Farah (2013) two-dimensional scale's Substance Dualism subscale ($r = 0.78$, $p < 0.01$) and negatively with their Reductive Physicalism subscale ($r = -0.57$, $p < 0.01$). Similarly, our NOMS Reductive Physicalism subscale showed strong positive correlation with Hook and Farah's Reductive Physicalism subscale ($r = 0.66$, $p < 0.01$) and negative correlation with their Substance Dualism subscale ($r = -0.44$, $p < 0.01$). The pictorial measure of mind–body dualism (overlapping circles, with larger values representing more monistic views) showed a modest positive correlation with NOMS Reductive Physicalism ($r = 0.19$, $p < 0.01$) and with Interactionism ($r = 0.23$, $p < 0.01$), but no significant correlations with other NOMS dimensions.

The overall pattern of inter-subscale correlations within the NOMS was broadly consistent with those observed in Study 1, as demonstrated by both the direct comparison of correlation matrices and measurement invariance testing across all studies (see Combined Sample Analysis). Based on non-overlapping confidence intervals, two notable differences emerged: (1) Substance Dualism and Idealism showed a much stronger association in Study 2 ($r = 0.49$, 95 % CI [.39, 0.57]) compared to Study 1 ($r = 0.17$, 95 % CI [.03, 0.30]); and (2) Reductive Physicalism and Non-Reductive Physicalism changed from a positive relationship in Study 1 ($r = 0.20$, 95 % CI [.07, 0.33]) to a negative one in Study 2 ($r = -0.11$, 95 % CI [−0.22, 0.01]). These differences suggest some sample-specific variation in how certain philosophical positions are understood. As in Study 1, religiosity measures showed consistent positive correlations with NOMS Substance Dualism (Organizational: $r = 0.27$, $p < 0.01$; Private: $r = 0.41$, $p < 0.01$) (Table S3).

4.3. Discussion

Study 2 successfully replicated the eight-factor structure of the NOMS with an independent sample, providing further evidence for the scale's factorial validity. The patterns of correlations with established measures of mind–body beliefs supported the construct validity of our scale. Particularly noteworthy was the strong convergence between the NOMS Substance Dualism subscale and Hook and Farah's (2013; cf. Forstmann & Burgmer, 2018) Substance Dualism subscale, as well as between our NOMS Reductive Physicalism subscale and their Reductive Physicalism subscale. The consistent associations between religiosity and dualistic beliefs aligned with findings from Study 1.

While the overall pattern of inter-subscale correlations remained stable across studies, the observed differences in specific relationships (particularly involving Substance Dualism and Idealism) suggest potential demographic variations in how these philosophical positions are understood. In Study 3, we examine the relationships between NOMS dimensions and a broader range of theoretically relevant constructs to establish the scale's nomological network.

5. Study 3

Having established the factor structure and internal reliability of the NOMS across two samples, in Study 3 we sought to investigate its construct validity by examining relationships with theoretically relevant constructs. We expected that the eight mind–body belief dimensions would show theoretically coherent patterns of association with established measures of free will beliefs, cognitive style, ontological confusion, personality traits, and afterlife beliefs.

5.1. Method

5.1.1. Participants and design

We recruited 251 participants, located in the UK or Ireland, from Prolific. Out of those, five failed an instructional attention check item, leaving a final sample of 246 (144 female, 97 male, 5 diverse, $M_{Age} = 38.72$, $SD = 13.26$). All participants completed a set of questionnaires including the NOMS.

This study was preregistered: https://aspredicted.org/mtc5-6zh8.pdf.

5.1.2. Materials and procedure

Upon consent, participants first completed the 24-item NOMS. To assess construct validity, participants then completed several additional measures in randomized order. The Free Will and Determinism Plus Scale (FAD +) measured beliefs about free will, determinism, and related constructs across four subscales: Fatalism (e.g., "I believe that the future has already been determined by fate"), Free Will (e.g., "People have complete control over the decisions they make"), Scientific Determinism (e.g., "Your genes determine your future"), and Unpredictability (e.g., "Life seems unpredictable—just like throwing dice or flipping a coin"). Items were rated on a 7-point scale from *completely disagree* to *completely agree*.

Participants then completed the Core Knowledge Confusion scale (Lindeman et al., 2015), presented as a language task where

participants rated statements from *fully metaphorical* (1) to *fully literal* (7). This measure assessed ontological confusion—the tendency to blur conceptual boundaries between different categories of existence by attributing mental or intentional properties to inanimate objects or processes (Lindeman et al., 2015). Items included statements like "A rock lives long," "Earth wants water," and "Plants know the seasons," alongside filler items expressing conventional metaphors (e.g., "A good memory is a mine").

The Rational-Experiential Inventory (REI-10; Pacini & Epstein, 1999) measured thinking styles with two subscales: Need for Cognition, assessing analytical thinking (e.g., "I prefer complex to simple problems"), and Faith in Intuition, measuring intuitive thinking (e.g., "I trust my initial feelings about people"). Items were rated on a 7-point scale from *strongly disagree* to *strongly agree*.

The Ten-Item Personality Inventory (TIPI; Gosling et al., 2003) assessed the Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience) with two items per trait rated on a 7-point scale from *disagree strongly* to *agree strongly*.

The Connection of Soul Scale (Ai et al., 2021) measured afterlife beliefs with three subscales: No Afterlife (e.g., "Regarding my life, after death everything is over"), God-centered Afterlife (e.g., "After death I come to paradise"), and Universe-centered Afterlife (e.g., "After death my soul connects with the world spirit or the infinite force"). Items were rated on a 7-point scale from *strongly disagree* to *strongly agree*.

Participants provided demographic information including age, gender, education level, and political orientation on a 7-point scale from *very liberal* to *very conservative*. The survey included an instructional attention check item embedded within the FAD + scale asking participants to select *completely agree* as their response.

5.2. Results

Model Specification. In Study 3, initial estimation of the eight-factor model resulted in a non-positive definite latent variable covariance matrix, due to one minor negative eigenvalue (−0.016), with the correlation between Substance Dualism and Reductive Physicalism factors being the primary contributor to this issue. To address this technical estimation problem, we constrained this correlation to −0.66, which successfully resolved the non-positive definite issue. The correlation between Substance Dualism and Reductive Physicalism in Study 3 (−0.75) was notably stronger than in Study 1 (−0.47), Study 2 (−0.62), and Study 4 (−0.55, see below). Hence, our constraint to −0.66 brought this parameter more in line with values observed in our other samples.

Importantly, this constraint did not significantly impact model fit, as demonstrated by a chi-squared difference test comparing the constrained and unconstrained models (χ^2diff(1) = 2.18, $p = 0.14$). AIC values were identical between models, and the BIC was slightly better for the constrained model. The constraint approach preserved the strong negative relationship between these conceptually opposed positions while ensuring stability of the model. We note that this estimation issue did not appear in the other studies, or the pooled sample analysis, suggesting it was a sample-specific technical anomaly rather than a problem with the underlying measurement model. The successful measurement invariance testing across all four samples (see below) further supports this interpretation.

CFA. Confirmatory factor analysis of the constrained model demonstrated adequate fit to the data: $\chi^2(225) = 481.49$, $p < 0.001$, CFI = 0.91, TLI = 0.89, RMSEA = 0.068 [90 % CI: 0.060, 0.076], SRMR = 0.078 (Table 3). All factor loadings were statistically significant ($ps < 0.001$), with most standardized coefficients showing moderate to strong relationships with their respective factors (all greater than 0.54), with one notable exception. Item 1 ("I believe that mental states can be fully reduced to physical states") displayed a notably weaker loading (0.28) compared to the other Reductive Physicalism items 2 ("I believe that the mind is identical to the brain") and 3 ("I believe that consciousness can be fully explained by physical processes in the brain"), which had much stronger loadings of 0.78 and 0.80, respectively (Table 2). This discrepancy may reflect the more abstract conceptual framing of item 1, which focuses on reduction at the state level rather than the more concrete mind-brain identity statements in the other items. This suggests that future refinements of the NOMS might benefit from rephrasing this item to better align with the conceptual accessibility of the other Reductive Physicalism items.

The pattern of inter-subscale correlations was remarkably consistent with Study 2, with an extremely high correlation between the correlation matrices ($r = 0.97$). Only one statistically significant difference emerged: the correlation between Mystical Monism and Neutral Monism was stronger in Study 3 ($r = 0.57$) than in Study 2 ($r = 0.36$), with non-overlapping confidence intervals. Internal consistency for the eight subscales was comparable to previous studies (Table 5).

Construct validity. To assess the construct validity of the NOMS, we examined correlations between the eight mind–body belief dimensions and theoretically relevant constructs. Several meaningful patterns emerged, supporting the scale's validity (see Table 6).

Afterlife beliefs showed theoretically consistent relationships with mind–body dimensions. Substance Dualism correlated strongly with both God-centered ($r = 0.49$, $p < 0.01$) and Universe-centered ($r = 0.61$, $p < 0.01$) afterlife beliefs, and negatively with No Afterlife belief ($r = -0.59$, $p < 0.01$). Panpsychism emerged as the strongest predictor of Universe-centered afterlife beliefs ($r = 0.64$, $p < 0.01$), consistent with its view that consciousness is fundamental throughout the universe. Mystical Monism also related positively to both God-centered ($r = 0.36$, $p < 0.01$) and Universe-centered ($r = 0.54$, $p < 0.01$) afterlife beliefs. Conversely, Reductive Physicalism correlated positively with No Afterlife belief ($r = 0.49$, $p < 0.01$).

Free will and determinism beliefs showed patterns consistent with previous research by Forstmann and Burgmer (2018). Free Will belief related to Substance Dualism ($r = 0.24$, $p < 0.01$) and Idealism ($r = 0.24$, $p < 0.01$). Fatalistic Determinism correlated strongly with Idealism ($r = 0.57$, $p < 0.01$), Substance Dualism ($r = 0.43$, $p < 0.01$), Panpsychism ($r = 0.48$, $p < 0.01$), and Mystical Monism ($r = 0.48$, $p < 0.01$). Scientific Determinism showed a moderate correlation uniquely with Reductive Physicalism ($r = 0.29$, $p < 0.01$), replicating Forstmann and Burgmer's (2018) findings that scientific determinism relates specifically to physicalist views.

Cognitive style measures revealed that Ontological Confusion correlated with non-physicalist positions: Substance Dualism ($r = 0.42$, $p < 0.01$), Panpsychism ($r = 0.50$, $p < 0.01$), Idealism ($r = 0.42$, $p < 0.01$), and Mystical Monism ($r = 0.40$, $p < 0.01$). Faith in

Table 6
Correlations Between Nature of Mind Subscales and Other Measures (Study 3).

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Substance Dualism	3.74	1.48																						
2. Reductive P.	3.39	1.34	-.46** [-.55, -.35]																					
3. Interactionism	5.10	1.15	.39** [.28, .49]	-.15* [-.27, -.02]																				
4. Panpsychism	3.23	1.74	.59** [.50, .67]	-.07 [-.19, .06]	.30** [.19, .41]																			
5. Idealism	2.53	1.46	.49** [.39, .58]	.06 [-.06, .19]	.28** [.16, .39]	.63** [.54, .70]																		
6. Non-Reductive P.	4.26	1.08	.35** [.23, .45]	-.16* [-.27, -.03]	.39** [.28, .49]	.23** [.10, .34]	.15* [.03, .27]																	
7. Mystical Monism	4.56	1.49	.55** [.46, .63]	-.11 [-.23, .02]	.56** [.47, .64]	.52** [.42, .60]	.48** [.38, .57]	.36** [.25, .47]																
8. Neutral Monism	3.83	1.42	.57** [.48, .65]	-.16* [-.28, -.04]	.48** [.37, .57]	.56** [.47, .64]	.52** [.42, .60]	.42** [.31, .52]	.57** [.48, .65]															
9. Ontological Confusion	3.51	0.99	.42** [.31, .52]	-.03 [-.16, .09]	.31** [.20, .42]	.50** [.40, .59]	.42** [.31, .51]	.29** [.18, .40]	.40** [.28, .50]	.42** [.32, .52]														
10. Afterlife (None)	4.22	2.02	-.59** [-.67, -.50]	.49** [.39, .58]	-.22** [-.33, -.09]	-.38** [-.48, -.27]	-.29** [-.40, -.17]	-.13* [-.25, -.00]	-.42** [-.52, -.31]	-.35** [-.46, -.24]	-.26** [-.37, -.14]													
11. Afterlife (God)	2.73	1.71	.49** [.39, .58]	-.18** [-.29, -.05]	.16* [.03, .28]	.41** [.30, .51]	.41** [.30, .51]	.10 [-.03, .22]	.36** [.25, .47]	.39** [.28, .49]	.37** [.26, .47]	-.66** [-.72, -.58]												
12. Afterlife (Universe)	3.46	1.64	.61** [.53, .69]	-.26** [-.37, -.14]	.39** [.28, .49]	.64** [.56, .71]	.52** [.42, .60]	.26** [.14, .37]	.54** [.45, .63]	.51** [.41, .60]	.46** [.36, .56]	-.56** [-.64, -.47]	.50** [.40, .59]											
13. Fatalistic Determ.	3.32	1.30	.43** [.32, .52]	-.07 [-.20, .05]	.31** [.19, .42]	.48** [.38, .57]	.57** [.48, .65]	.12 [-.01, .24]	.48** [.37, .57]	.51** [.41, .60]	.38** [.26, .48]	-.39** [-.49, -.28]	.49** [.39, .58]	.48** [.38, .57]										
14. Free Will	4.70	1.07	.24** [.12, .35]	.11 [-.01, .23]	.06 [-.06, .19]	.17** [.05, .29]	.24** [.12, .35]	.01 [-.11, .14]	.18** [.06, .30]	.12 [-.00, .24]	.14* [.02, .26]	-.09 [-.21, .03]	.21** [.08, .32]	.11 [-.02, .23]	.22** [.10, .34]									
15. Scientific Determ.	4.15	0.78	-.03 [-.16, .09]	.29** [.17, .40]	.12 [-.01, .24]	.03 [-.09, .16]	.09 [-.03, .22]	.08 [-.05, .20]	.14* [.02, .26]	.11 [-.02, .23]	.15* [.02, .27]	.19** [.07, .31]	.04 [-.08, .17]	.05 [-.08, .17]	.21** [.09, .33]	.18** [.05, .30]								
16. Unpredictability	4.63	0.89	.09 [-.04, .21]	.11 [-.01, .23]	.05 [-.08, .17]	.16* [.04, .28]	.16* [.03, .28]	.06 [-.06, .18]	.12 [-.01, .24]	.18** [.06, .30]	.22** [.09, .33]	.07 [-.05, .19]	.08 [-.05, .20]	.13* [.01, .25]	.31** [.19, .42]	.22** [.10, .34]	.21** [.09, .32]							
17. Need for Cognition	4.79	1.18	-.07 [-.20, .05]	.00 [-.12, .13]	-.01 [-.13, .12]	-.08 [-.21, .04]	-.07 [-.19, .06]	-.00 [-.13, .12]	-.00 [-.13, .12]	-.13* [-.25, -.01]	-.15* [-.27, -.03]	.00 [-.12, .13]	-.16* [-.28, -.03]	-.04 [-.16, .09]	-.17** [-.29, -.05]	.08 [-.05, .20]	-.02 [-.14, .11]	-.15* [-.27, -.02]						
18. Faith in Intuition	5.13	1.07	.29** [.17, .40]	-.01 [-.14, .11]	.09 [-.04, .21]	.24** [.12, .36]	.27** [.15, .38]	.15* [.03, .27]	.30** [.18, .41]	.24** [.12, .35]	.23** [.11, .35]	-.18** [-.30, -.05]	.18** [.05, .30]	.21** [.08, .32]	.24** [.12, .36]	.35** [.24, .46]	.10 [-.03, .22]	.21** [.08, .32]	.08 [-.05, .20]					
19. Openness	4.95	1.08	.16** [.04, .28]	-.07 [-.19, .06]	.16* [.03, .28]	.18** [.05, .30]	.12 [-.00, .24]	.08 [-.05, .20]	.24** [.12, .35]	.13* [.00, .25]	.07 [-.05, .20]	-.10 [-.22, .02]	.03 [-.10, .15]	.24** [.12, .36]	.03 [-.09, .16]	.04 [-.08, .17]	-.00 [-.13, .12]	.01 [-.12, .13]	.28** [.16, .39]	.21** [.09, .33]				
20. Conscientiousness	4.89	1.25	.14* [.01, .26]	.12 [-.00, .24]	.02 [-.11, .14]	.19** [.07, .31]	.22** [.10, .34]	.00 [-.12, .13]	.06 [-.06, .19]	.06 [-.06, .18]	.16* [.03, .28]	-.06 [-.18, .07]	.18** [.05, .29]	.10 [-.03, .22]	.06 [-.07, .18]	.33** [.22, .44]	.06 [-.07, .18]	-.03 [-.15, .10]	.23** [.11, .34]	.18** [.05, .29]	.04 [-.08, .17]			
21. Extraversion	3.51	1.46	.14* [.01, .26]	-.08 [-.20, .05]	.04 [-.08, .17]	.11 [-.01, .24]	.08 [-.05, .20]	.10 [-.02, .23]	.12 [-.01, .24]	.11 [-.02, .23]	.09 [-.03, .22]	-.21** [-.33, -.09]	.16* [.03, .28]	.15* [.03, .27]	-.02 [-.15, .10]	.10 [-.02, .22]	-.03 [-.15, .10]	-.05 [-.18, .07]	.03 [-.10, .15]	.19** [.07, .31]	.20** [.08, .32]	.06 [-.06, .19]		
22. Agreeableness	4.85	1.12	.15* [.02, .27]	-.05 [-.17, .08]	.22** [.10, .34]	.12 [-.01, .24]	.06 [-.07, .18]	.08 [-.04, .21]	.13* [.00, .25]	.10 [-.03, .22]	.06 [-.06, .19]	-.20** [-.32, -.08]	.14* [.01, .26]	.17** [.05, .29]	.08 [-.05, .20]	.02 [-.10, .15]	.01 [-.11, .14]	-.06 [-.18, .07]	.16** [.04, .28]	.09 [-.04, .21]	.22** [.09, .33]	.14* [.02, .26]	.01 [-.12, .13]	
23. Emotional Stability	4.13	1.38	-.03 [-.16, .09]	.18** [.06, .30]	.00 [-.12, .13]	.01 [-.12, .13]	.04 [-.08, .17]	-.12 [-.24, .01]	-.03 [-.16, .09]	-.07 [-.19, .06]	.00 [-.12, .13]	.04 [-.09, .16]	-.02 [-.15, .10]	.00 [-.12, .13]	-.09 [-.21, .03]	.16* [.03, .28]	.07 [-.05, .20]	-.19** [-.31, -.07]	.38** [.27, .48]	.07 [-.06, .19]	.15* [.02, .27]	.36** [.25, .46]	.13* [.01, .26]	.17** [.05, .29]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95 % confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation. * indicates $p < 0.05$. ** indicates $p < 0.01$.

Table 7
Demographics.

	Study 1 (N = 206)	Study 2 (N = 283)	Study 3 (N = 246)	Study 4 (N = 339)
Age				
M (SD)	19.54 (1.68)	40.29 (13.62)	38.72 (13.26)	44.70 (14.12)
Range	18–31	18–75	18–75	19–82
Gender n (%)				
Male	38 (18.4)	140 (49.5)	97 (39.4)	172 (50.7)
Female	159 (77.2)	142 (50.2)	144 (58.5)	163 (48.1)
Non-binary/Other	8 (3.9)	1 (0.4)	5 (2.0)	4 (1.2)
Prefer not to say	1 (0.5)	–	–	–
Nationality				
British	175 (85.0)	255 (90.1)	206 (83.7)	306 (90.3)
Irish	–	–	14 (5.7)	2 (0.6)
Other	31 (15.0)	28 (9.9)	26 (10.6)	31 (9.1)
Language				
English	181 (87.9)	259 (91.5)	223 (90.7)	317 (93.5)
Other	25 (12.1)	24 (8.5)	23 (9.3)	22 (6.5)
Ethnicity n (%)				
White	155 (75.2)	242 (85.8)	208 (85.6)	289 (86.0)
Asian	31 (15.0)	19 (6.7)	14 (5.8)	20 (6.0)
Black	6 (2.9)	11 (3.9)	9 (3.7)	14 (4.2)
Mixed Race	14 (6.8)	10 (3.5)	8 (3.3)	11 (3.3)
Other	–	–	4 (1.6)	2 (0.6)
Missing	–	1	3	3
Education n (%)				
High school or less	–	–	29 (11.8)	62 (18.3)
Some college/vocational	206 (100.0)	–	62 (25.2)	80 (23.6)
Bachelor's degree	–	–	107 (43.5)	138 (40.7)
Master's degree	–	–	39 (15.9)	50 (14.7)
Advanced degree (Ph.D. M.D. J.D.)	–	–	9 (3.7)	9 (2.7)
Religiosity				
M (SD)	1.57 (0.79)	1.57 (0.80)	Not assessed	Not assessed
Political Orientation				
M (SD)	2.90 (1.05)	3.21 (1.46)	3.22 (1.45)	3.49 (1.39)
Recruitment				
Source	University course credit	Prolific.com	Prolific.com	Prolific.com

Note. Study 1 participants were all current undergraduate students recruited via university course credit; Studies 2–4 recruited participants via Prolific.com. Ethnicity categories were simplified to White (combining White-British, White-European, and White-Other), Asian (combining Indian, Pakistani, Bangladeshi, Chinese, and Asian-Other), Black (combining Black-Caribbean, Black-African, and Black-Other), Mixed Race, and Other. Due to missing data, ethnicity percentages are calculated based on valid responses only (Study 2: valid n = 282; Study 3: valid n = 243; Study 4: valid n = 336). Political orientation was measured on a 7-point scale (1 = very liberal, 7 = very conservative). Religiosity was assessed using a composite measure of organizational and private religiosity on a 4-point scale (1 = never/not at all important, 4 = every week or more/very important). Education was not assessed in Study 2. Dashes (—) indicate that a category was not applicable or no participants belonged to that category.

Intuition related positively to Substance Dualism ($r = 0.29$, $p < 0.01$), Panpsychism ($r = 0.24$, $p < 0.01$), Idealism ($r = 0.27$, $p < 0.01$), and Mystical Monism ($r = 0.30$, $p < 0.01$), replicating previous findings by Forstmann and Burgmer (2018) that intuitive thinking styles associate with dualistic beliefs. Need for Cognition showed only weak negative correlations with Neutral Monism ($r = -0.13$, $p < 0.05$).

Personality traits demonstrated more modest but theoretically coherent relationships with mind–body beliefs. Openness to Experience correlated with Substance Dualism ($r = 0.16$, $p < 0.01$), Panpsychism ($r = 0.18$, $p < 0.01$), and Mystical Monism ($r = 0.24$, $p < 0.01$). Conscientiousness showed positive relationships with Substance Dualism ($r = 0.14$, $p < 0.05$), Panpsychism ($r = 0.19$, $p < 0.01$), and Idealism ($r = 0.22$, $p < 0.01$). Notably, Agreeableness correlated most strongly with Interactionism ($r = 0.22$, $p < 0.01$), which aligns with the conceptualization of this position as a "middle ground" belief that acknowledges both mental and physical causation. Emotional Stability correlated uniquely with Reductive Physicalism ($r = 0.18$, $p < 0.01$), consistent with our Study 1 findings that Reductive Physicalism related negatively to Cognitive Empathy ($r = -0.20$, $p < 0.01$). This suggests that physicalist views may be associated with cognitive styles that emphasize objective, mechanistic explanations, and aligns with the position that individuals with more reductive physicalist views might focus on physical causation rather than mentalistic explanations when understanding behavior (Berent et al., 2022).

Overall, these correlation patterns support the construct validity of the NOMS dimensions by demonstrating theoretically coherent relationships with established psychological constructs. The findings suggest that different mind–body positions reflect broader cognitive styles, personality dispositions, and existential beliefs, with non-physicalist views relating to afterlife beliefs, fatalistic determinism, and ontological confusion, while physicalist views associate with scientific determinism and rejection of afterlife beliefs.

5.3. Discussion

Study 3 further validated the NOMS with an independent sample. While we needed to constrain one parameter to address a model specification issue, this adjustment did not significantly impact model fit, suggesting the eight-factor structure remains robust.

Beyond confirming the psychometric properties, Study 3 further established the construct validity of the NOMS by examining its relationships with theoretically relevant constructs. The pattern of correlations revealed that different mind–body philosophical positions are embedded within broader existential belief systems, cognitive styles, and personality structures. Specifically, our findings replicated and extended previous research on the relationships between mind–body beliefs and free will concepts (Forstmann & Burgmer, 2018). The observed relationships between mind–body positions and cognitive styles likewise align with prior theorizing (Bloom, 2004; Forstmann & Burgmer, 2017) and empirical findings (Forstmann & Burgmer, 2018). Further, the personality correlations, while modest, suggest that certain philosophical positions may reflect broader dispositional tendencies.

6. Study 4

To examine whether the estimation issues encountered in Study 3 were sample-specific, we analyzed the NOMS once more using data from a different sample from the same population.

6.1. Method

6.1.1. Participants and design

As part of an unrelated research project, 363 participants from the UK and Ireland were recruited via Prolific.com, out of which 23 failed an instructional attention check item and one admitted random responding, leaving a final sample of 339 participants (163 female, 162 male, 4 other/none; $M_{Age} = 44.7$, $SD = 14.12$).

6.1.2. Materials and procedure

Following an unrelated thought experiment task, participants completed the 24-item NOMS and provided demographic information.

6.2. Results

Confirmatory factor analysis of the eight-factor model demonstrated acceptable fit: $\chi^2(224) = 536.98$, $p < 0.001$, CFI = 0.91, TLI = 0.89, RMSEA = 0.064 [90 % CI: 0.057, 0.071], SRMR = 0.084 (Table 3). Unlike in Study 3, no estimation issues were encountered, with a correlation between Substance Dualism and Reductive Physicalism ($r = -0.55$) that is similar to values observed in Studies 1 and 2. This suggests the non-positive definite matrix in Study 3 was indeed a sample-specific technical anomaly rather than a structural issue with the scale (see Table 2).

The pattern of inter-subscale correlations remained remarkably consistent between Studies 3 and 4 (see Table S4), with an extremely high correlation between matrices ($r = 0.975$). Despite some numerical differences, no statistically significant differences (based on non-overlapping confidence intervals) were found between any pair of correlations across studies. The largest differences involved the Reductive Physicalism subscale: its correlation with Substance Dualism was weaker in Study 4 ($r = -0.27$) than in Study 3 ($r = -0.46$). Internal consistency was comparable for most subscales. The largest reliability difference was observed for Reductive Physicalism ($\alpha = 0.638$ in Study 3 vs. 0.503 in Study 4), once more suggesting that this subscale may benefit from refinement in future iterations (Table 5).

7. Combined sample analysis

Combined Sample Analysis. To comprehensively assess the measurement properties of the NOMS across all four studies, we conducted analyses with the pooled data from all samples ($N = 1074$). First, a single-group CFA model was fit to the combined data, ignoring group membership. This pooled model demonstrated good fit to the data ($\chi^2 = 1071.77$, $df = 224$, CFI = 0.92, RMSEA = 0.059 [90 % CI: 0.056, 0.063], SRMR = 0.070), supporting the 8-factor structure of the NOMS (see Tables 2 and 3, and Fig. 1). Reliability analysis for the pooled sample further supported the internal consistency of the NOMS subscales. Cronbach's α values ranged from 0.65 (Reductive Physicalism) to 0.86 (Panpsychism), with four of the eight subscales exceeding the conventional 0.70 threshold despite their brief three-item format (Table 5). As in the other studies, the most-endorsed positions were interactionism, non-reductive physicalism, and mystical monism, with the lowest support for idealism (Table S5). Overall, the combined sample analyses demonstrate that the 8-factor structure of the NOMS is robust, reliable, and functions consistently across diverse samples, providing strong support for the scale's validity and utility in measuring mind–body beliefs.

Measurement Invariance Testing. To formally assess measurement invariance across the four samples, we conducted a multi-group analysis. A configural model allowing all parameters to vary freely between groups showed acceptable fit ($\chi^2 = 1886.72$, $df = 896$, CFI = 0.91, RMSEA = 0.064 [90 % CI: 0.060, 0.068], SRMR = 0.078), establishing that the factor structure was consistent across samples. The observation that the more parsimonious pooled model yielded slightly better CFI and RMSEA values than the configural model suggests that the magnitude of true differences in measurement parameters across the three samples is likely small.

We then tested progressively stricter invariance models (see Table 4). While chi-square difference tests were significant ($p < 0.001$)

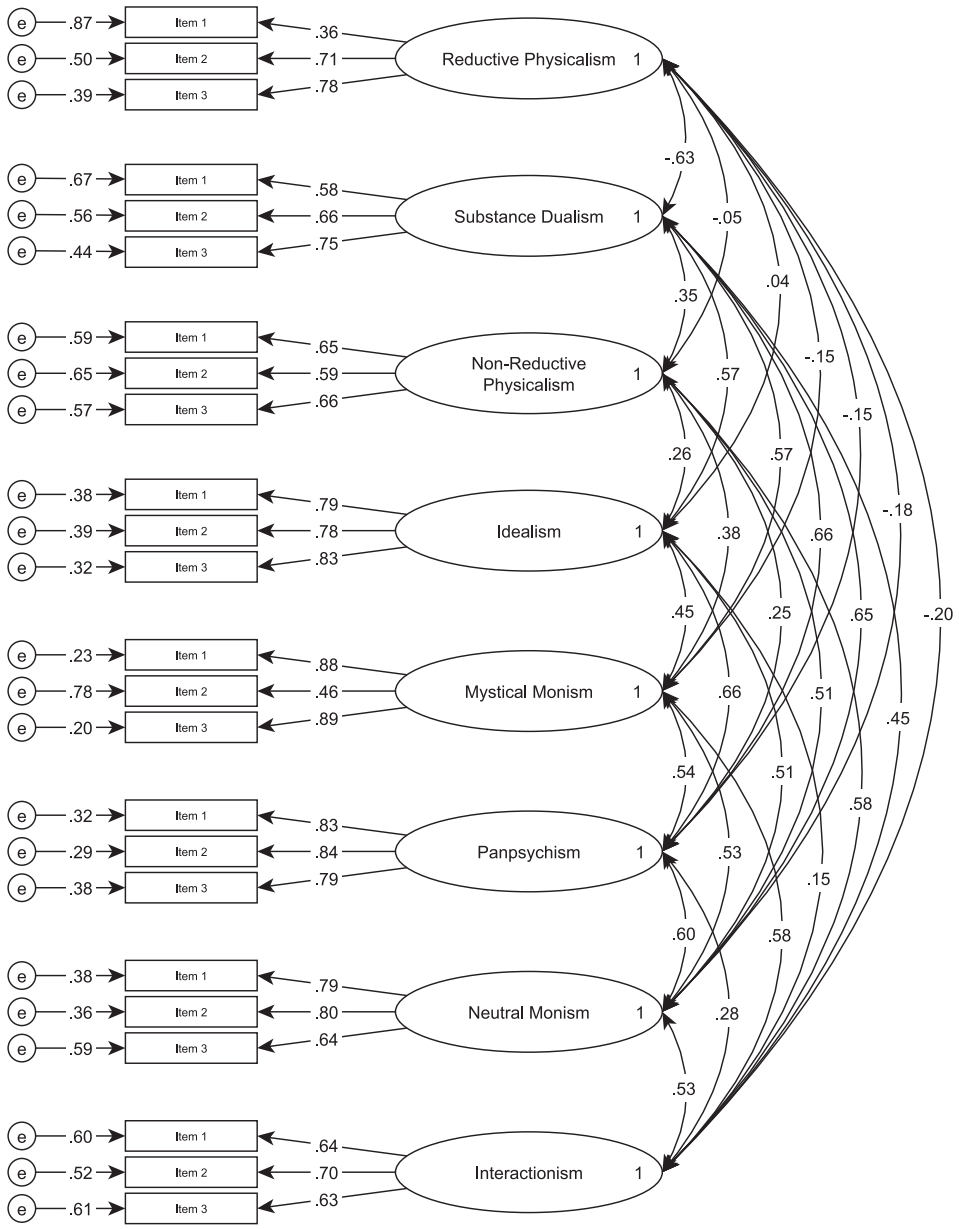

Fig. 1. Measurement Model (CFA) of the Nature of Mind Scale. *Note.* Standardized coefficients for the Confirmatory Factor Analysis (CFA) on the pooled samples from Studies 1–4.

for all model comparisons, changes in practical fit indices were minimal. For the metric invariance model, constraining factor loadings produced minimal change in model fit (ΔCFI = 0.0047, ΔRMSEA = 0.0001). For scalar invariance, constraining item intercepts also resulted in minimal fit changes (ΔCFI = 0.0037, ΔRMSEA = −0.0004). Finally, for strict invariance, constraining residual variances still maintained acceptable changes in fit indices (ΔCFI = 0.0095, ΔRMSEA = 0.0006).

Following established criteria (ΔCFI ≤ 0.01; ΔRMSEA < 0.015; Cheung & Rensvold, 2002; Chen, 2007), these results provide strong support for measurement invariance of the NOMS across the four samples, indicating that the scale functions equivalently in terms of factor structure, item meaning, baseline levels, and measurement precision.

Tucker's Phi Coefficients. To provide further evidence regarding the similarity of factor structures across the samples, we calculated Tucker's Phi congruence coefficients for each NOMS factor using the standardized factor loadings from the configural model. These congruence coefficients were consistently high across all pairwise sample comparisons, ranging from 0.96 to 1.00 (mean Phi = 0.992). Values exceeding 0.95 are typically considered to indicate excellent factor congruence (Lorenzo-Seva & ten Berge, 2006).

Stability of Factor Correlations Across Samples. To assess the similarity of correlation structures across the four samples, we compared the correlation matrices of the eight NOMS dimensions (i.e., their mean scores) by calculating the correlation between their lower

triangular elements. The pairwise correlations between matrices ranged from 0.79 to 0.97, with particularly high similarity observed between Studies 2–3 ($r = 0.97$), 2–4 ($r = 0.96$), and 3–4 ($r = 0.97$). The correlation between Study 1 and the other samples was somewhat lower but still substantial ($r = 0.82$, 0.79, and 0.85 for Studies 2, 3, and 4, respectively). Using Fisher's z-transformation to properly average these values, the mean correlation across all matrix comparisons was 0.93, indicating exceptional stability in the pattern of inter-factor relationships across diverse samples.

8. General Discussion

Across four studies with a combined sample of 1074 participants, we developed and validated the Nature of Mind Scale (NOMS), a multidimensional measure that captures eight distinct philosophical positions regarding the nature and relationship of mind and body. The NOMS demonstrates robust psychometric properties, with confirmatory factor analyses supporting the hypothesized eight-factor structure corresponding to Substance Dualism, Interactionism, Panpsychism, Idealism, Reductive Physicalism, Non-Reductive Physicalism, Mystical Monism, and Neutral Monism. Measurement invariance testing revealed that the scale functions equivalently across diverse samples in terms of factor structure, item meaning, baseline levels, and measurement precision. The high factor congruence coefficients (mean $\varphi = 0.992$) and remarkably consistent inter-subscale correlation patterns further attest to the structural stability of the NOMS.

The convergent and discriminant validity of the scale was established through theoretically consistent correlations with existing measures of mind–body beliefs, including the Mind-Body Relationship Scale (Riekki et al., 2013) and the two-dimensional mind–body relations scale (Forstmann & Burgmer, 2018; cf. Hook & Farah, 2013). Beyond these correlations, the NOMS demonstrated meaningful relationships with theoretically relevant constructs such as religiosity, free will beliefs, cognitive style, ontological confusions, personality traits, and afterlife beliefs. The differential relationships between empathy dimensions and mind–body beliefs are theoretically meaningful. Cognitive empathy—which assesses the ability to understand others' mental states and is closely related to mentalizing processes—showed stronger negative associations with reductive physicalism than with substance dualism. This pattern aligns with research by Berent et al. (2022), who found that individuals with autism spectrum disorder (characterized by deficits in understanding others' emotions and mental states) showed less dualistic and more physicalist thinking. While our explicit belief measures differ methodologically from tacit dualistic processes, these findings provide tentative support for theoretical connections between social-cognitive abilities and mind–body conceptualization.

These patterns of associations help establish the nomological network within which different mind–body beliefs are embedded. In line with past research, participants showed highest level of endorsement of non-reductive positions (incl. interactionism) and—somewhat surprisingly—mystical monism.

Theoretical Implications. The development of the NOMS represents a significant advancement over previous measurement approaches that conceptualized mind–body beliefs along a single dualism-monism dimension or reduced the philosophical landscape to a few broad categories. By capturing eight distinct positions, the NOMS acknowledges the multifaceted nature of people's beliefs about the mind and its relationship to physical processes. This multidimensional approach reveals important distinctions that would be obscured by simpler frameworks. For instance, while Substance Dualism and Reductive Physicalism showed expected negative correlations, other theoretically opposed positions (e.g., Idealism and Reductive Physicalism) demonstrated more complex relationships than a simple bipolar model would predict.

The pattern of correlations between mind–body beliefs and other psychological constructs further reinforces the value of a multidimensional approach. Different mind–body positions showed unique associations with constructs such as afterlife beliefs, free will concepts, cognitive styles, and personality traits. For example, while several non-physicalist positions related positively to fatalistic determinism, only Reductive Physicalism showed consistent positive correlations with scientific determinism. Similarly, the strong relationship between Panpsychism and universe-centered afterlife beliefs suggests that this philosophical position captures unique aspects of existential thinking not represented in simpler dualism-monism frameworks.

These differential correlation patterns suggest that mind–body beliefs are embedded within broader cognitive frameworks and worldviews. The associations with religious beliefs, empathy, cognitive style, and personality traits provide empirical support for theoretical claims about the psychological foundations of different lay beliefs about the relationship between mind and matter (Bloom, 2004; Forstmann & Burgmer, 2015, 2017). The NOMS thus offers a valuable tool for exploring how people's intuitions about consciousness relate to their broader understanding of reality, causality, and human nature.

Philosophical Implications. The correlation patterns observed across the eight NOMS dimensions suggest these beliefs may be organized around broader metaphysical orientations. Several dimensions—particularly Substance Dualism, Panpsychism, Idealism, and Mystical Monism—exhibited similar correlations with religiosity, ontological confusion, and faith in intuition, potentially reflecting shared psychological foundations underlying spiritualistic worldviews. Conversely, Reductive Physicalism showed consistent associations with scientific determinism and negative correlations with religious beliefs, suggesting a materialistic orientation.

These patterns are consistent with theoretical frameworks positing that metaphysical beliefs form the unverifiable core of individuals' worldviews (Koltko-Rivera, 2004), potentially serving as fundamental lenses through which people interpret reality and experience. The clustering also corresponds with findings from Jylkkä et al. (2024) identifying a materialism-idealism dimension in metaphysical belief systems. However, when we empirically tested whether a higher-order factor structure with broader materialistic versus spiritualistic latent variables would better capture the data, model fit did not improve compared to the eight-factor solution. This suggests that while dimensions show theoretically meaningful clustering in their external correlations, they maintain sufficient distinctiveness to warrant separate measurement.

Rather than maintaining rigid adherence to specific philosophical doctrines, people appear to hold flexible belief systems organized

around core commitments about the fundamental nature of reality, simultaneously endorsing aspects of different philosophical positions while preserving overall worldview coherence.

Limitations and Future Directions. Despite the strong psychometric properties of the NOMS, several limitations and avenues for improvement should be acknowledged. First, certain subscales demonstrated suboptimal reliability, particularly Reductive Physicalism and Non-Reductive Physicalism, which fell below the conventional threshold of $\alpha = 0.70$ in some studies. This suggests potential refinement is needed for these dimensions. Specifically, the Reductive Physicalism subscale showed notable concerns with one item ("I believe that mental states can be fully reduced to physical states") demonstrating a weak factor loading (0.28) in Study 3 compared to the other items that referred more concretely to mind-brain identity. This suggests that participants may find it harder to respond to abstract, state-level reduction concepts compared to more concrete mind-brain assertions. Future iterations of the NOMS might benefit from rephrasing this item to better align with the conceptual accessibility of other items.

A straightforward approach to addressing reliability concerns would be to increase the number of items per subscale. While the current three-item format enhances practicality (which was one of the goals of the present research), expanding to four items per dimension could improve internal consistency while maintaining reasonable overall scale length (32 items). Additionally, some items may conflate related philosophical concepts—for example, references to mind–body "communication" in substance dualism items potentially overlap with interactionism. Future refinements of the NOMS should aim to further isolate distinct philosophical positions, potentially through expert review to minimize conceptual conflation while maintaining accessibility for lay participants.

Further, while the NOMS provides reliable measurement of mind–body belief dimensions, an important limitation is that it does not address the psychological mechanisms underlying these beliefs. Our psychometric approach establishes what beliefs people hold and how these beliefs relate to other constructs, but it does not explain why individuals develop particular philosophical orientations or how precisely these beliefs manifest cognitively. However, the distinct correlation patterns we observe across the eight dimensions provide an important empirical foundation for future investigations. Future research may, for example, draw on dual-process theories of cognition, individual differences in cognitive development, or cultural transmission models to explain how and why people develop specific mind–body beliefs.

An additional consideration is that the NOMS measures explicit, reportable beliefs about mind–body relationships, which may not fully capture tacit or intuitive beliefs. Some individuals might hold implicit dualistic intuitions while explicitly endorsing physicalist positions due to education or cultural factors. However, explicit mind–body beliefs remain psychologically meaningful regardless of their underlying cognitive origins, as they represent the conscious commitments that was found to be predictive of other attitudes and actual behavior (e.g., Forstmann et al., 2012; Burgmer & Forstmann, 2018). The coherent factor structures and systematic correlation patterns we observe suggest that explicit responses reflect genuine psychological phenomena rather than arbitrary outcomes of internal conflicts between competing processes. In fact, reliable measurement of explicit beliefs provides the very foundation for future research investigating the association between implicit and explicit beliefs, as well as factors contributing to the formation of the latter.

Another important direction for future research involves identifying constructs that uniquely correlate with specific philosophical positions. Our analyses revealed that despite the eight subscales showing adequate discriminant validity and the factor structure consistently holding up across all four studies, several subscales (particularly the less materialistic positions) demonstrated notably similar patterns of correlations with external measures. For instance, Substance Dualism, Panpsychism, and Mystical Monism all showed comparable positive correlations with religiosity, ontological confusion, and fatalistic determinism, despite themselves not being intercorrelated to a problematically high degree. This suggests that while these positions represent conceptually distinct philosophical stances that participants can differentiate, they might share common psychological foundations or cognitive tendencies. Finding unique correlates for each philosophical position is therefore particularly important. For Panpsychism, measures of anthropomorphism and connectedness to nature might serve as unique correlates, reflecting its distinctive view that consciousness pervades all physical entities. For Substance Dualism, specific beliefs about *personal* survival beyond bodily death (vs. becoming part of a greater consciousness) and mind–body separation experiences might be uniquely predictive. Mystical Monism might be uniquely associated with self-transcendent experiences and feelings of universal oneness that go beyond general spirituality.

The current validation was limited to UK-based samples, raising questions about cross-cultural applicability. Many philosophical positions measured by the NOMS (but certainly not all) have emerged primarily from Western philosophical traditions, and their relevance or conceptualization may differ in other cultural contexts. Future research should examine whether the factor structure holds up across cultures with different philosophical and religious backgrounds, such as predominantly Christian societies, Eastern cultural contexts influenced by Buddhist or Hindu philosophy, or indigenous communities with animistic traditions. Cross-cultural validation would enhance the scale's generalizability and potentially reveal how cultural factors shape intuitions about mind–body relationships.

Additionally, future studies should explore the predictive validity of the NOMS dimensions across various domains. Prior research has linked dualistic beliefs to health behaviors (Forstmann et al., 2012), theory of mind (Berent et al., 2022), and prosocial behavior (Genschow, 2024). The more nuanced approach offered by the NOMS could provide more precise predictions about how different mind–body beliefs influence these and unrelated outcomes. For example, Non-Reductive Physicalism might foster different attitudes toward artificial intelligence compared to Reductive Physicalism, despite both acknowledging the physical basis of mental phenomena.

Another promising direction involves examining the stability and malleability of mind–body beliefs over time and across contexts. While the present research treated these beliefs as relatively stable individual differences, it remains unclear how sensitive they are to contextual priming or educational interventions. Longitudinal studies could track how these beliefs develop over time, particularly during formative educational experiences in philosophy, psychology, or neuroscience.

Conclusion. The Nature of Mind Scale represents an advancement in measuring beliefs about the mind and its relationship to physical processes. By capturing eight distinct philosophical positions, the NOMS offers a more comprehensive framework for

understanding how people conceptualize the mind–body relationship compared to previous unidimensional or simplified approaches. The strong psychometric properties established across four studies demonstrate the scale's reliability and validity as a measurement tool.

As research on the mind–body problem continues to evolve across disciplines, the NOMS provides researchers with a validated tool to measure a larger spectrum of beliefs people hold about this fundamental issue. By acknowledging the complexity and multidimensionality of these beliefs, the NOMS contributes to a more sophisticated understanding of how people conceptualize the mind and its place in the physical world.

Ethics

Studies 1 and 2 were approved by the Faculty Research Ethics Committee at the University of Southampton. Studies 3 and 4 received ethical approval via the Ethics Self-Assessment Tool of the University of Zurich.

CRediT authorship contribution statement

Matthias Forstmann: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Pascal Burgmer:** Writing – review & editing, Methodology, Investigation, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.concog.2025.103961.

Data availability

Data will be made available on request.

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