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Article

Subjectica: A Lateralized Embodied Model of Cognitive Stance

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Abstract

The mind–body problem remains a central unresolved issue in contemporary cognitive science. Although research on hemispheric asymmetry has yielded extensive knowledge about neural specialization and functional localization, it provides limited explanatory power for how lateralized neural processes become expressed as observable embodied behavior. Existing approaches typically treat bodily asymmetry either as an epiphenomenon or as a static anatomical correspondence, leaving a conceptual and operational gap between neural activity, subjective experience, and kinematic expression. This manuscript presents **Subjectica**, a purely theoretical neurophenomenological model that addresses this gap by conceptualizing hemispheric asymmetry as a dynamic, embodied process. Rather than positing a fixed mapping between hemispheres and body sides, the model frames lateralization as a continuous sensorimotor pattern manifested through bodily kinematics. Cognitive stance is thus understood as an embodied orientation that becomes observable through structured asymmetries in posture, movement, and segmental motor activity. The model introduces four interrelated operational constructs: **Personal-Oriented Left Side (PO-LS)**, **Society-Oriented Right Side (SO-RS)**, **Asymmetric Neurobehavioral Signal (ANS)**, and **Body Segments (BS)**. Together, these constructs function as interpretative intermediaries linking hemispheric functional dominance, phenomenological orientation, and measurable bodily dynamics. The framework enables the analysis of lateralization through continuous, probabilistic patterns of whole-body and segment-level motor dominance, rather than through discrete anatomical or task-specific indicators. Subjectica is intended as a generative theoretical framework that produces testable hypotheses and operational pathways for future empirical research at the intersection of embodied cognition, hemispheric asymmetry, and neurophenomenology.

Keywords: embodied cognition; hemispheric asymmetry; neurophenomenology; lateralization; body kinematics; cognitive stance; sensorimotor embodiment; Subjectica

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Introduction

This work presents the Subjectica model, a theoretical neurophenomenological framework. The model is defined by a set of internal axioms that specify its assumptions, scope, and operational commitments. These axioms are not proposed as universal metaphysical truths but as formal constraints necessary for the coherence and testability of the model. Embodied cognition proposes that cognitive states emerge from sensorimotor processes rather than from purely abstract or amodal computations. Within this perspective, cognition is not confined to neural activity alone but is enacted through the continuous interaction between brain, body, and environment. Despite substantial theoretical and empirical development in cognitive science, several foundational problems remain unresolved. First, there is no unified mechanism explaining how subjective cognitive stance systematically correlates with bodily asymmetry. Second, empirical findings linking hemispheric specialization to observable movement biases remain fragmented and, at times, contradictory. Third, there is a lack of a quantitative or operational index capable of capturing cognitive stance at a given moment through bodily expression.

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Research on hemispheric asymmetry has established that the cerebral hemispheres differ in their processing biases, particularly with respect to self-related, affective, social, and contextual information. However, these findings are predominantly confined to neural, perceptual, or task-based behavioral domains and rarely extend to whole-body kinematics as an integrated signal. Neurophenomenological approaches have further emphasized the necessity of linking first-person experience with third-person measurement, arguing that cognition cannot be adequately understood without accounting for lived bodily experience (Varela, 1996). Yet, while neurophenomenology highlights the epistemic problem, it does not provide a concrete operational framework for mapping cognitive stance onto observable bodily dynamics.

As a result, a conceptual gap persists between internal hemispheric activity, subjective experience, and externally measurable movement patterns. Existing models either remain at the level of neural description without specifying bodily manifestation, or they describe movement and posture without a principled link to cognitive orientation. What is missing is an intermediate, formally defined layer that connects lateralized cognitive processing with structured, interpretable kinematic expression.

The present work introduces such a framework. The proposed model defines a lateralized embodied system that treats bodily asymmetry not as a static trait but as a dynamic, interpretable signal reflecting shifts in cognitive stance. It does so by introducing four core constructs: (1) the Personal-Oriented Left Side (PO-LS), corresponding to self-referential and introspective orientation; (2) the Society-Oriented Right Side (SO-RS), corresponding to socially evaluative and normative orientation; (3) the Asymmetric Neurobehavioral Signal (ANS), defined as a continuous index of lateralized motor dominance; and (4) Body Segments (BS), which provide a structured anatomical basis for segment-level and whole-body interpretation.

Together, these constructs form an operational bridge between hemispheric lateralization, embodied cognition, and observable kinematics. Rather than claiming direct access to internal cognitive states, the model specifies a principled method for interpreting patterns of bodily asymmetry as probabilistic indicators of cognitive orientation. In doing so, it establishes a testable theoretical foundation for studying how cognitive stance is enacted through the dynamics of the body.

Theoretical Axioms

The Subjectica model is formalized on the following structure

Axiom 1. Neurobehavioral Unity of Cognition and Bodily Expression

The human mind and physical body do not function as independent entities but constitute a single, integrated neurobehavioral system. Within this system, internal cognitive states—such as thoughts, emotions, intentions, beliefs, and internal conflicts—are probabilistically expressed at physiological and behavioral levels, subject to regulatory, contextual, and social constraints. This formulation avoids strict one-to-one determinism while maintaining the core assumption that bodily dynamics systematically covary with ongoing cognitive states. Hemispheric asymmetry is therefore not reducible to neural localization or abstract cognitive function alone. Instead, it is continuously expressed through patterns of bodily kinematics, posture, and sensorimotor regulation. From this perspective, lateralized neural dynamics unfold over time through embodied action, rather than remaining confined to intracranial processes. The model is grounded in the principle of neurobehavioral unity, according to which cognitive states are not statically represented but dynamically enacted through bodily organization and movement. Consistent with the framework of embodied cognition, postures, gestures, and movements are treated not as secondary by-products of cognition but as structural components of the cognitive process itself (Barsalou, 2008; Wilson, 2002). Empirical research demonstrates robust links between bodily states and perception, memory, affect, and decision-making, supporting the view that cognition is fundamentally grounded in sensorimotor systems. From a neurophenomenological standpoint, this integration enables the reduction of the explanatory gap by relating phenomenological categories—such as intention, motivation, or

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attentional orientation—to objectively measurable kinematic and postural indicators. Within this framework, the body is not interpreted as a literal or infallible readout of mental content but as a structured and partially constrained expression of the individual's current cognitive state. While a substantial body of research supports the general coupling between cognition and bodily expression, the systematic mapping of specific cognitive contents onto lateralized motor and postural features remains underdeveloped. Addressing this gap constitutes a central objective of the present model.

Axiom 2. Contralateral Embodiment of Hemispheric Functional Asymmetry

Functional lateralization of the brain gains systematic access to behavior through a crossed neurobehavioral control architecture. Due to contralateral organization, lateralized cortical dynamics are expressed through asymmetric patterns of bodily movement, posture, and sensorimotor regulation. In this framework, the left hemisphere—associated with sequential analysis, normative regulation, and rule-based control—predominantly projects to the right side of the body (SO-RS), forming a behavioral vector oriented toward social coordination, external regulation, and adaptive conformity. Conversely, the right hemisphere—characterized by holistic processing, contextual integration, and self-referential awareness—projects to the left side of the body (PO-LS), providing a kinematic interface for personal relevance, internal evaluation, and subjective orientation. This interpretation is consistent with established models of cortical asymmetry linking hemispheric dynamics to motivational orientation, particularly approach–withdrawal tendencies. Affective and cognitive neuroscience demonstrates that hemispheres differ systematically in processing style, emotional regulation, attentional deployment, and self-related information, with measurable consequences for behavior (Tucker, 1981; Davidson, 1992; McGilchrist, 2019). However, while neural lateralization is well documented at the cortical level, its translation into reliable, observable behavioral markers remains insufficiently specified. The present model addresses this gap by treating whole-body kinematics as an intermediary level at which lateralized neural activity becomes functionally embodied. Rather than assuming direct correspondence between isolated neural functions and discrete movements, the model emphasizes patterned asymmetries across posture, movement direction, and segmental activation as the primary behavioral expressions of hemispheric dominance. Clear operationalization of these kinematic patterns is therefore necessary to move from abstract neural asymmetry to empirically testable neurobehavioral indicators.

Axiom 3. Segmental Differentiation and Hierarchical Embodiment of Cognitive Asymmetry

The human body does not manifest cognition as a homogeneous whole but exhibits functional segmentation, whereby different body segments preferentially contribute to distinct classes of cognitive activity and behavioral expression. This segmentation is grounded in established principles of neuromotor control, evolutionary specialization, and physiological function, and is used here as an analytic framework rather than a claim of strict modular determinism. Advances in motion capture and pose estimation techniques allow for precise quantification of segmental displacement, lateralized movement bias, and postural asymmetry (Martinez et al., 2017), providing measurable kinematic variables that can be examined on temporal scales relevant to ongoing cognitive and sensorimotor processes. The present model integrates three convergent lines of research. First, work on gesture and embodied action demonstrates a tight coupling between bodily movement—particularly of the upper limbs—and cognitive processes such as conceptual structuring, memory retrieval, and problem solving, indicating that movement is not merely an epiphenomenal output but participates in cognition itself (McNeill, 1994; Goldin-Meadow, 2014). Second, hemispheric approach–withdrawal models link lateralized cortical dynamics to motivational orientation, offering a neural basis for systematic asymmetries in motor expression and postural bias. Third, research on motor compensation and interlimb adaptation shows that when activity in one body segment is constrained or suppressed, other segments reliably increase their output to maintain functional goals (Hylin, Kerr, & Holden, 2017). In the current framework, this compensatory redistribution is treated not only as a mechanical adjustment but as a potential indicator of changes in the underlying cognitive and motivational state, a hypothesis that extends, rather than replaces, existing motor control accounts. A consistent finding across motor control and embodied cognition research is a

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proximal–distal gradient in functional contribution. Proximal segments, including the trunk, shoulders, and hips, are engaged earlier in action preparation and are more strongly associated with global motor planning, postural intention, spatial orientation, and motivational stance. These segments contribute disproportionately to whole-body asymmetry and stable postural configurations, making them particularly informative for assessing global embodied states. Distal segments, such as the hands and fingers, support fine-grained sequencing, symbolic manipulation, and communicative functions. Gesture–speech coupling and motor simulation studies indicate that distal upper-limb activity is closely linked to linguistic processing and reflective cognition, allowing rapid modulation and expressive precision within an already established postural and motivational context. Within this framework, the Asymmetric Neurobehavioral Signal (ANS) is not localized to a single body segment but is understood as a distributed phenomenon generated by lateralized neural dynamics and expressed through coordinated segmental activity. Proximal segments contribute primarily to the global embodiment and stabilization of asymmetry, while distal segments—especially the upper limbs—serve as high-resolution expressive channels through which symbolic, deliberative, and communicative aspects of the ANS become observable. This distinction resolves the apparent tension between global postural dominance and localized expressive asymmetries by separating the levels of generation, stabilization, and expression. Axial segments (torso and spine) and lower-body segments (hips, legs, feet) play a central role in balance regulation, stance, and locomotor intention. Research in affective neuroscience and embodied emotion links posture and weight distribution to motivational states such as approach, withdrawal, dominance, and submission. Hemispheric models of motivational asymmetry further suggest that lateralized cortical activity biases these postural and locomotor tendencies, making axial and lower-body segments critical channels through which hemispheric asymmetry is embodied at the level of orientation and readiness for action rather than fine motor execution. Facial musculature occupies a distinct position within this segmental hierarchy. Although facial expressions are central to emotional signaling and social communication, they are subject to substantial voluntary control, social display rules, and strategic modulation. Research in nonverbal communication and deception demonstrates that facial signals are frequently regulated in accordance with contextual expectations, which can obscure underlying affective or motivational states. For this reason, facial activity is treated as informative but conditionally reliable within the model and is not interpreted as a direct marker of the ANS in isolation. An important partial exception within the facial domain is oculomotor behavior. Saccadic eye movements operate on time scales of approximately 20–50 ms (Rayner, 1998) and are therefore less accessible to conscious control than most facial expressions or gestures. Extensive research shows that eye movements, fixation biases, and attentional shifts reflect lateralized neural processing and asymmetric allocation of sensorimotor and attentional resources (Posner & Petersen, 1990; Corbetta & Shulman, 2002; Munoz & Everling, 2004). Accordingly, oculomotor asymmetries are afforded greater interpretative weight within the model, particularly when they converge with postural or limb-based indicators. Segmental decomposition thus enables differentiation between global asymmetries (e.g., postural bias and proximal dominance), local asymmetries (e.g., unilateral hand use or localized tension), and compensatory asymmetries arising from redistribution of activity across segments. Consistent with findings from motor adaptation research (Hylin et al., 2017), the model proposes that such compensatory patterns, when observed systematically, may reflect shifts in the embodied cognitive background rather than purely mechanical substitution. This proposal is explicitly framed as a testable hypothesis, providing a basis for future empirical work rather than a settled conclusion.

Axiom 4. Bidirectional Neurobehavioral Feedback and Adaptive Self-Regulation

Principles of neuroplasticity and dynamic adaptation indicate that individuals are capable of influencing their cognitive background through deliberate modification of bodily movement and posture. Neural systems governing perception, action, and cognition are characterized by experience-dependent plasticity, allowing changes in sensorimotor activity to alter attentional, affective, and motivational states over time (Pascual-Leone et al., 2005). Within this framework, bodily action is not

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merely an output of cognition but a modulatory input capable of reshaping ongoing cognitive dynamics. A substantial body of research in embodied cognition and affective neuroscience supports the existence of bidirectional feedback between bodily states and cognitive processes. Manipulations of posture, facial configuration, and movement patterns have been shown to influence emotional appraisal, confidence, memory retrieval, and decision-making, consistent with sensorimotor grounding theories (Barsalou, 2008; Wilson, 2002; Niedenthal, 2007). These findings establish a correlational and, in some cases, causal link between bodily configuration and cognitive–affective state, providing empirical grounding for active self-regulation through bodily practice.Research on motor dynamics and interlimb coordination further demonstrates that suppression or constraint of activity in one body segment leads to compensatory activation in other segments in order to preserve functional goals (Hylin, Kerr, & Holden, 2017). This compensatory behavior reflects the adaptive organization of the motor system and its capacity to redistribute control across degrees of freedom. From a neurobehavioral perspective, such redistribution is accompanied by changes in sensorimotor prediction, attentional allocation, and action planning.Within the framework of *Subjectics*, this compensatory principle is extended beyond purely mechanical substitution. The model proposes that segmental compensation precedes and modulates cognitive embodiment: changes in segmental activation alter the embodied cognitive context itself, thereby biasing motivational orientation, attentional priorities, and subjective interpretation of the situation. This view aligns with dynamical systems approaches to motor control and cognition, which treat behavior and cognition as emergent properties of coupled brain–body–environment systems rather than separable modules (Thelen & Smith, 1994; Kelso, 1995). Accordingly, targeted modification of movement and posture constitutes a mechanism of active self-regulation, through which individuals can influence cognitive priorities and behavioral tendencies. This mechanism does not imply direct voluntary control over specific mental contents but operates through lawful neurobehavioral feedback loops grounded in plasticity, sensorimotor coupling, and adaptive compensation.

Axiom 5. Cultural Modulation of Embodied Neurobehavioral Expression

Although the basic neurobehavioral mechanisms through which consciousness is embodied are assumed to be universal, the specific forms, nuances, and interpretative meanings of bodily manifestations are substantially shaped by cultural, social, and individual contexts. Consequently, accurate analysis of embodied cognition requires consideration of the dynamic interaction between biologically grounded signals and culturally acquired patterns of behavior.Cross-cultural psychology and cultural neuroscience demonstrate that culture systematically shapes habitual cognitive styles, attentional biases, emotional regulation, and action tendencies, leading to stable, culturally patterned cognitive–behavioral profiles (Markus & Kitayama, 1991; Nisbett et al., 2001; Han et al., 2013). These culturally conditioned patterns influence not only abstract cognition but also embodied practices, including posture, gesture, interpersonal distance, and motor habits, which become chronically reinforced through socialization.Ethnographic and historical analyses provide clear examples of culturally specific lateralized social rituals. The use of the right or left hand for greeting, eating, or ritual actions varies across societies and historical periods, often governed by symbolic norms rather than biological dominance alone (McManus, 2002). The handshake, frequently cited as a “natural” right-hand gesture, is in fact a culturally stabilized convention whose distribution and meaning are shaped by social norms, power relations, and historical contingencies rather than neurobiological necessity. Cultural neuroscience further indicates that culturally reinforced motor habits can modulate neural activation patterns associated with action planning and self-referential processing, suggesting that long-term cultural practice alters the embodied expression of cognition without eliminating underlying neural asymmetries (Han & Northoff, 2008; Chiao et al., 2010). These findings support the view that culture operates as a modulatory layer, shaping the surface expression and habitual weighting of embodied signals rather than negating their biological foundations.For theoretical completeness, this model views cultural rules and social norms as modulators of bodily expression, rather than as factors distorting the underlying neurobehavioral principles. Universal mechanisms provide the structural foundation, while cultural context determines how, where, and

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with what relative intensity these mechanisms manifest in observable behavior in a particular individual.

Terminology Models

The concepts of Right-Hemisphere Dominant Embodiment (RHDE) and Left-Hemisphere Dominant Embodiment (LHDE) describe lateralized neural states associated with differences in processing style, self-related awareness, and contextual integration. However, at present these constructs function primarily as neurophysiological descriptors and do not, by themselves, entail a formally specified kinematic vector. In other words, RHDE and LHDE characterize patterns of hemispheric activity but do not provide an operational account of how such neural states are expressed spatially through the body.

This limitation highlights an explanatory gap between internal hemispheric dynamics and observable bodily behavior. Without an explicit mapping between neural lateralization and bodily orientation, posture, or movement bias, RHDE and LHDE remain conceptually informative but behaviorally underspecified. Bridging this gap requires the introduction of an intermediate interpretative level that systematically links lateralized neural activity to measurable whole-body kinematic patterns. Such an operationalization is necessary for translating hemispheric dominance from an abstract neural construct into an empirically testable neurobehavioral framework. Thus, we introduce four basic operational constructs:

1) Personal-Oriented Left Side (PO-LS)

PO-LS is proposed not as a mere descriptor of left-sided bodily movement but as a specific kinematic interface through which Right-Hemisphere Dominant Embodiment (RHDE) becomes behaviorally instantiated. While the right hemisphere provides the neural substrate for self-referential, internally oriented, and holistic processing associated with the "Personal Self," this state remains neurocognitive until it is expressed through action. Owing to contralateral motor organization, right-hemispheric dominance is projected onto the left hemibody, where it can be observed as a structured pattern of bodily engagement rather than as isolated movement events.

Within this framework, PO-LS is defined as the sustained and preferential recruitment of the left hemibody as the dominant channel of expression. It functions as a physical anchor for Personal Orientation, translating an otherwise abstract RHDE signal into a stable and observable behavioral vector. The introduction of this term allows for a principled distinction between incidental or task-driven left-sided movements and the intentional, embodied maintenance of a personal, internally referenced cognitive stance. Without such differentiation, lateralized behavior cannot be meaningfully interpreted at the level of cognitive orientation.

Conceptually, PO-LS is defined as a cognitive position rooted in right-hemispheric functional patterns and expressed through coordinated motor activity on the left side of the body. Its semantic domain encompasses self-oriented processing, intuitive evaluation, holistic integration, and access to autobiographical information. These cognitive characteristics are not inferred from isolated gestures but from coherent patterns of lateralized engagement.

Behaviorally, PO-LS is indexed by relative movement displacement, spatial occupation, and frequency of activity on the left side of the body. Displacement is treated as a general kinematic indicator of embodied cognitive activation, reflecting the degree to which a given segment participates in ongoing cognitive organization. The model provides an interpretative framework for relating these displacement patterns to phenomenological position, rather than assuming a direct one-to-one correspondence between movement and mental content.

The activation context of PO-LS is defined by conditions that prioritize autobiographical reflection, intuition-based judgment, and internally oriented evaluative processing. Under such conditions, left-hemibody dominance is interpreted not as motor preference alone but as the embodied expression of a personal cognitive orientation structured by right-hemispheric dynamics.

2) Social-Oriented Right Side (SO-RS)

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The left hemisphere is functionally associated with language, sequential analysis, normative regulation, and socially oriented control, forming the neural basis of what is termed the "Social Self." Within this framework, SO-RS is defined as the kinematic projection of Left-Hemisphere Dominant Embodiment (LHDE). SO-RS refers to the preferential recruitment of the right hemibody as the primary channel for social-communicative and norm-regulated action.

SO-RS is not treated as a generic description of right-sided movement but as a specific construct that operationalizes Social Orientation at the level of whole-body kinematics. By isolating this construct, the model enables the assessment of social orientation independently of linguistic content, relying instead on spatial dominance and patterned engagement of the right side of the body. This distinction is essential, as it reframes social compliance and normative alignment not merely as internal cognitive states but as lateralized embodied stances mediated by left-hemispheric control over the right hemibody.

Conceptually, SO-RS is defined as a cognitive stance grounded in functional patterns of the left hemisphere and expressed behaviorally through coordinated motor activity on the right side of the body. Its semantic domain includes social adaptation, verbal-analytical regulation, normative evaluation, impulse control, and role-based performance. These features are inferred not from isolated gestures but from consistent lateralized patterns of bodily organization.

Behaviorally, SO-RS is indexed by relative movement displacement, spatial occupation, and frequency of activity on the right side of the body. As in the complementary PO-LS construct, displacement is treated as a general kinematic indicator of embodied cognitive engagement, reflecting the degree to which the right hemibody participates in structuring ongoing action. The model provides an interpretative basis for relating these displacement patterns to phenomenological stance rather than assuming a direct mapping between specific movements and mental content.

The activation context of SO-RS is defined by situations that emphasize normative evaluation, externally referenced decision-making, role adherence, and deliberate regulation of behavior in accordance with social rules. Under such conditions, right-hemibody dominance is interpreted as the embodied expression of a socially oriented cognitive stance structured by left-hemispheric dynamics.

4) Body Segments (BS)

This framework provides a functional basis for analyzing how embodied cognitive dynamics are distributed across the body. Rather than treating the body as a homogeneous motor output system, it assumes that distinct anatomical segments contribute differentially to cognitive expression, lateralization, and neurobehavioral signaling. Cognitive states are thus not expressed uniformly but are spatially organized through segment-specific patterns of activation.

Segment-based interpretations are not novel in isolation; relevant findings exist across gesture research, motor control, affective neuroscience, posture analysis, and nonverbal communication. However, this literature remains fragmented and lacks a unifying model that systematically integrates segmental differentiation with hemispheric asymmetry. *Subjectica* consolidates these lines of research into a coherent segmental framework aligned with principles of embodied cognition and lateralized neural control.

Within this model, the body is divided into functional segments (head, neck, shoulders, arms, trunk, legs), further differentiated into subsegments (e.g., eyes, mouth, forearms, hands, fingers, chest, spine, hips, knees, feet). Proximal segments are assumed to contribute more strongly to global lateralization and postural bias than distal segments, which are more susceptible to task demands and compensatory modulation. This gradient allows for the segmental decomposition of the Asymmetric Neurobehavioral Signal (ANS), enabling identification of momentary variations in the cognitive background through patterns of differential segmental engagement.

Empirical literature provides convergent support for segment-specific behavioral semantics. Upper-limb segments, particularly hands and forearms, are closely linked to symbolic action, gesture production, and the structuring of thought, reflecting the well-established gesture–cognition relationship. Axial and lower-body segments, including the torso, hips, and legs, are associated with approach–withdrawal dynamics, postural intention, and motivational orientation. Facial

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musculature, while central to social communication, is subject to higher levels of voluntary control and strategic modulation, often reflecting communicative masking rather than direct cognitive or affective state (Burgoon, 2018). These empirical regularities support the segmental assignments adopted in *Subjectica* and are consistent with classical findings in gesture cognition and emotional expression.

Segmental semantics are therefore defined as probabilistic associations between specific body segments and classes of cognitive–affective processes. These associations are not deterministic mappings but interpretative constraints grounded in observed regularities. Within this framework, the following segmental tendencies are emphasized:

- **Hands / forearms:** symbolic processing, cognitive sequencing, communicative intent
- **Shoulders / upper trunk:** action readiness, agency, boundary regulation
  Chest / axial spine: motivational orientation, emotional valence, engagement versus withdrawal
- **Hips / legs / feet:** approach–avoidance dynamics, stability, intentional directionality
  Face: communicative display, affect regulation, social masking

This segmentation enables the decomposition of the ANS into segment-specific subsignals, allowing more precise interpretation of embodied cognitive dynamics at a given moment rather than reliance on isolated movements or expressions.

To reduce overinterpretation, the model employs a hierarchical interpretative scheme that prioritizes segments based on their susceptibility to conscious control and compensatory distortion. Axial and postural segments are afforded the highest interpretative reliability, followed by proximal limb segments, distal limb segments, and finally facial musculature, which is assigned the lowest reliability unless corroborated by convergent segmental evidence. This hierarchy directly addresses longstanding criticisms of simplistic body-language decoding and aligns the model with contemporary methodological caution in nonverbal analysis.

At the same time, the framework acknowledges current limitations. A more detailed understanding of muscular and ligamentous dynamics—such as inward versus outward activation patterns and their biomechanical constraints—is required to refine segmental interpretation further. Such granularity would allow more precise inference of intention and motivational nuance within the individual's cognitive context at the moment of activation.

Overall, the concept of body segments extends existing research on embodied cognition and hemispheric asymmetry by introducing a structured, non-reductive model of bodily asymmetry; a mechanism for linking neural dominance to observable kinematics; and a scalable interpretative framework compatible with qualitative, quantitative, and phenomenological methods. By integrating segmental differentiation with the ANS, the model provides a coherent basis for analyzing embodied cognitive dynamics without collapsing complexity into simplistic movement–meaning correspondences.

3) Asymmetrical neurobehavioral signal (ANS)

To integrate the lateralized projections described above into a single coherent framework, the model introduces the **Asymmetric Neurobehavioral Signal (ANS)**. The ANS functions as the integrative construct that provides internal consistency to the interpretative system, allowing lateralized bodily dynamics to be treated as a unified, continuous phenomenon rather than as isolated movements.

Within this framework, the body is not assumed to merely produce discrete actions but to exhibit a dynamic oscillation between two dominant embodied orientations: the personal orientation (PO-LS) and the social orientation (SO-RS). The ANS conceptualizes this oscillation as a continuous signal reflecting the momentary balance between these orientations. As such, it serves as a holistic metric of the subject's embodied cognitive state, capturing shifts in dominance rather than categorical states.

Operationally, the ANS is defined as an **Index of Lateralized Motor Activity**, used to quantify and classify the relative dominance of PO-LS and SO-RS. This index can be computed at multiple levels of analysis. A *global ANS* reflects the overall dominance of one body side over the other, integrating the contributions of all segments while preserving their relative weights. At the same

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time, *local ANS values* can be derived for individual segments or segment groups, enabling fine-grained analysis of how different parts of the body participate in the expression of lateralized cognitive orientation.

In addition to side dominance, the model incorporates segmental activation amplitude as a key variable. Segment activity is treated as a graded parameter ranging from relative passivity to high-amplitude engagement, with displacement occurring along multiple spatial axes (forward–backward, upward–downward, lateral, and their combinations). These amplitude and directional parameters provide additional resolution for interpreting how embodied cognitive dynamics unfold in space, rather than reducing analysis to binary left–right distinctions.

Together, these variables constitute the empirical substrate upon which behavioral interpretation is based. They allow the entire posture and movement configuration of the body to be interpreted coherently within the proposed model, linking segmental kinematics to global cognitive orientation. Formal operational examples and illustrative implementations of the ANS index are provided in the Appendix.

Appendix

This appendix presents an illustrative operationalization of the Asymmetric Neurobehavioral Signal (ANS) introduced in the main text. Its purpose is to clarify how the proposed conceptual construct may be translated into measurable variables in future empirical research. The material presented here does not constitute a finalized measurement protocol, a preregistered procedure, or a validated analytic method.

The ANS is defined as a relative index reflecting the balance between two lateralized embodied orientations: the person-oriented left side (PO-LS) and the socially oriented right side (SO-RS). Conceptually, the ANS represents a continuous shift in embodied cognitive orientation rather than a discrete categorical state. Accordingly, any operational representation of the ANS prioritizes relative dominance, temporal variability, and differential segmental contribution over absolute motor values.

For illustrative purposes, the body may be decomposed into bilateral functional segments, such as shoulders, upper arms, forearms, hands, trunk, hips, legs, and head orientation. Each segment is treated as a potential contributor to lateralized bodily expression, rather than as an isolated indicator.

Segmental activity can be represented using kinematic parameters including relative spatial displacement, range of motion, postural bias, or sustained orientation along relevant spatial axes. These parameters are not interpreted independently but are considered components of an intersegmental configuration that reflects embodied cognitive organization.

At the segmental level, lateral dominance may be expressed as a relative comparison between left- and right-side activity within a defined observation window. One illustrative representation involves calculating a local dominance value as the difference between left- and right-side activity for a given segment:

- **Positive values (+)** indicate relative left-side dominance, corresponding to PO-LS–aligned expression.
- **Negative values (−)** indicate relative right-side dominance, corresponding to SO-RS–aligned expression.
- **Values near zero** indicate approximate bilateral balance, reflecting symmetrical segmental engagement and contextual consistency within the dual orientation framework.

This representation is intended to capture directional bias and relative engagement rather than precise motor output or task performance.

A global representation of the ANS can be obtained by aggregating local segmental dominance values across the body. This aggregation is conceptually weighted rather than uniform, reflecting differences in interpretative reliability across segments. In accordance with the theoretical framework, axial and proximal segments (e.g., trunk, shoulders, hips) are afforded greater interpretative weight due to their close association with postural intention, balance, and global action

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planning. Distal segments (e.g., hands and fingers) contribute more flexibly and are more susceptible to task demands and compensatory modulation. Facial segments are assigned the lowest interpretative reliability unless their signals converge with those of less consciously regulated segments.

The ANS is inherently dynamic, and any operational representation is therefore sensitive to temporal scale. Short observation windows may capture transient fluctuations in embodied orientation, whereas longer windows may reflect more stable tendencies. The selection of temporal parameters is a methodological decision contingent on research goals and context and is not specified by the present theoretical model.

Interpretation of any operational representation of the ANS is subject to several constraints:

- Segmental dominance is probabilistic rather than deterministic.
- Cultural norms, learned motor habits, and situational affordances may modulate expression.
- Compensatory activation between segments may occur, particularly under task or physical constraints.
- Isolated segmental indicators should not be interpreted independently of whole-body patterns.
- Segmental tension or tonic activation may not manifest as overt movement yet may still influence embodied cognitive orientation.

Accordingly, operational representations of the ANS should be understood as heuristic tools for pattern-level analysis rather than as direct or definitive indicators of internal cognitive states.

This appendix serves as an illustrative bridge between the conceptual framework and potential empirical implementation. It is provided for conceptual clarity and theoretical completeness. Validation, parameter specification, and methodological standardization are deferred to future empirical research and lie beyond the scope of the present manuscript.

Limitations

This manuscript is purely theoretical in nature and does not contain original empirical data. Accordingly, all statements made here should be interpreted as propositions based on the cited research and the formalization of the model, rather than as empirically supported results. The proposed framework is intended to generate testable predictions and operational hypotheses, not to provide supporting evidence.

A primary limitation concerns cultural variability in embodied expression and interpretation. Anthropological, sociological, and cross-cultural psychological research demonstrates that bodily movements, postural habits, and lateralized practices are shaped by culturally learned norms, interactional scripts, and display rules. Such cultural modulation may alter not only the surface form but also the salience and social meaning of lateralized bodily dynamics. Cultural context should therefore be treated as a systematic moderator of embodied cognitive expression rather than as random noise. At present, the model does not incorporate explicit parameters for cultural variation, which constrains its direct applicability across cultural settings.

A further limitation involves the risk of overinterpretation of kinematic signals. Observable bodily asymmetries and movement patterns can arise from multiple non-cognitive sources, including habitual motor routines, occupational training, handedness, prior injury, ergonomic constraints, and immediate situational affordances. In the absence of controlled empirical validation, there is a substantial risk of attributing cognitive or phenomenological significance to kinematic features that are primarily biomechanical or task-driven in origin.

Finally, the model currently assumes a relatively stable correspondence between lateralized bodily dynamics and cognitive orientation. This assumption is likely an oversimplification. Coupling between cognition and bodily expression is dynamic and context-sensitive and may fluctuate over short time scales in response to fatigue, emotional arousal, social pressure, or environmental constraints. These sources of variability are not yet formally integrated into the present framework.

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Addressing these limitations will require empirical testing, cross-cultural comparative research, and explicit modeling of potential confounding variables. Until such work is undertaken, the *Subjectica* framework should be regarded as a structured theoretical proposal designed to organize and guide investigation, rather than as a validated explanatory system.

Discussion

The model specifies a testable relationship between cognitive stance and lateralized kinematic expression. It introduces a practical kinematic index that can be integrated with neural and physiological measures to investigate embodied aspects of cognition, self-concept, and behavioral orientation. At a conceptual level, the framework has potential relevance for multiple applied domains, including psychology, learning and education, behavioral assessment, human–computer interaction, and the development of embodied metrics for artificial intelligence systems.

On this basis, the model generates explicit, empirically testable predictions:

- **Activation of PO-LS.** Tasks involving self-referential processing, introspection, or internally oriented evaluation are predicted to produce statistically significant left-sided dominance of the ANS relative to neutral control conditions.
- **Activation of SO-RS.** Tasks emphasizing social evaluation, normative judgment, role-based behavior, or externally referenced decision-making are predicted to yield statistically significant right-sided dominance of the ANS relative to neutral control conditions.
- **Segment-level consistency.** During task manipulation, axial and proximal segments (e.g., head, neck, shoulders, trunk) are expected to exhibit stronger and more reliable lateralization than distal extremities. Segmental leakage, instability, or inconsistency is predicted to emerge under conditions of cognitive conflict or competing task demands.

These predictions are intended to guide empirical investigation and provide clear criteria for falsification. Consistent with its scope, the present manuscript is purely conceptual and theoretical; it proposes a model and an operational framework but reports no original empirical data from human participants.

Conclusion

Subjectica offers a clearly formulated theoretical model that links lateralized bodily dynamics with cognitive stance through an explicit neurobehavioral logic. The framework integrates phenomenological, kinematic, and cognitive levels of description, thereby addressing a gap between abstract accounts of cognition and observable embodied behavior. By formalizing asymmetry not as a categorical trait but as a continuous, segmentally distributed and temporally dynamic signal, the model advances a coherent account of embodied cognitive orientation.

The contribution of the present work lies in its conceptual clarification and structural rigor rather than empirical demonstration. Subjectica defines core constructs, specifies their relations, and outlines an illustrative operationalization that enables the generation of falsifiable predictions. In doing so, it establishes a shared conceptual vocabulary for investigating lateralized embodiment without collapsing complex cognitive phenomena into simplistic motor markers.

Importantly, the framework explicitly acknowledges its current limitations, including the absence of empirical validation, cultural modulation of bodily expression, and the contextual instability of cognitive–body coupling. These constraints delimit the present claims and prevent overextension beyond what the model can currently support. Subjectica should therefore be understood as a structured theoretical proposal that organizes future inquiry rather than as a finalized explanatory system.

Taken together, this work provides a foundation for systematic empirical testing, cross-cultural comparison, and multimodal integration with neural and physiological measures. Its value lies in offering a precise and disciplined starting point for studying how cognitive stance is expressed, modulated, and negotiated through the dynamics of the living body.

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References

1. Barsalou, L. W. (2008). Grounded cognition. Annual Review of Psychology, 59, 617–645. https://doi.org/10.1146/annurev.psych.59.103006.093639
2. Wilson, M. (2002). Six views of embodied cognition. Psychonomic Bulletin & Review, 9(4), 625–636. https://doi.org/10.3758/BF03196322
3. Davidson, R. J. (1992). Anterior cerebral asymmetry and the nature of emotion. Brain and Cognition, 20(1), 125–151. https://doi.org/10.1016/0278-2626(92)90065-T
4. Tucker, D. M. (1981). Lateral brain function, emotion, and conceptualization. Psychological Bulletin, 89(1), 19–46. https://doi.org/10.1037/0033-2909.89.1.19
5. McGilchrist, Iain. (2019). The Master and His Emissary: The Divided Brain and the Making of the Western World. https://doi.org/10.2307/j.ctvcb5c0t
6. Varela, F. J. (1996). Neurophenomenology: A methodological remedy for the hard problem. Journal of Consciousness Studies, 3(4), 330–349.
7. Martinez, J., Hossain, R., Romero, J., & Little, J. J. (2017). A simple yet effective baseline for 3D human pose estimation. In Proceedings of the IEEE International Conference on Computer Vision (pp. 2640–2649). https://arxiv.org/abs/1705.03098
8. Mcneill, David. (1994). Hand and Mind: What Gestures Reveal About Thought. Bibliovault OAI Repository, the University of Chicago Press. 27. 10.2307/1576015. https://doi.org/10.2307/1576015
9. Oxlund, B. (2020). An Anthropology of the Handshake. Anthropology Now, 12(1), 39–44. https://doi.org/10.1080/19428200.2020.1761216
10. Hylin, M. J., Kerr, A. L., & Holden, R. (2017). Understanding the Mechanisms of Recovery and/or Compensation following Injury. Neural plasticity, 2017, 7125057. https://doi.org/10.1155/2017/7125057
11. Burgoon J. K. (2018). Microexpressions Are Not the Best Way to Catch a Liar. Frontiers in psychology, 9, 1672. https://doi.org/10.3389/fpsyg.2018.01672
12. Goldin-Meadow, S., Levine, S. C., Hedges, L. V., Huttenlocher, J., Raudenbush, S. W., & Small, S. L. (2014). New evidence about language and cognitive development based on a longitudinal study: Hypotheses for intervention. American Psychologist, 69(6), 588–599. https://doi.org/10.1037/a0036886
13. Michael I. Posner, Steven E. Petersen. 1990. The Attention System of the Human Brain. Annual Review Neuroscience. 13:25-42. https://doi.org/10.1146/annurev.ne.13.030190.000325
14. Munoz, D., Everling, S. Look away: the anti-saccade task and the voluntary control of eye movement. Nat Rev Neurosci 5, 218–228 (2004). https://doi.org/10.1038/nrn1345
15. Corbetta, M., Shulman, G. Control of goal-directed and stimulus-driven attention in the brain. Nat Rev Neurosci 3, 201–215 (2002). https://doi.org/10.1038/nrn755
16. Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. Psychological Bulletin, 124(3), 372–422. https://doi.org/10.1037/0033-2909.124.3.372

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Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 December 2025 doi:10.20944/preprints202512.1226.v3

17. Hylin, Michael J., Kerr, Abigail L., Holden, Ryan, Understanding the Mechanisms of Recovery and/or Compensation following Injury, Neural Plasticity, 2017, 7125057, 12 pages, 2017. https://doi.org/10.1155/2017/7125057
18. Alvaro Pascual-Leone, Amir Amedi, Felipe Fregni, Lotfi B. Merabet. 2005. THE PLASTIC HUMAN BRAIN CORTEX. Annual Review Neuroscience. 28:377-401. https://doi.org/10.1146/annurev.neuro.27.070203.144216
19. Niedenthal PM. Embodying emotion. Science. 2007 May 18;316(5827):1002-5. doi: 10.1126/science.1136930. PMID: 17510358.
20. A Dynamic Systems Approach to the Development of Cognition and Action By: Esther Thelen, Linda B. Smith https://doi.org/10.7551/mitpress/2524.001.0001
21. Kelso, J. A. S. (1995). Dynamic patterns: The self-organization of brain and behavior. The MIT Press.
22. Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. Psychological Review, 98(2), 224–253. https://doi.org/10.1037/0033-295X.98.2.224
23. Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. Psychological Review, 108(2), 291–310. https://doi.org/10.1037/0033-295X.108.2.291
24. McManus, C. (2002). Right hand, left hand: The origins of asymmetry in brains, bodies, atoms and cultures. Harvard University Press.
25. Han, S., Northoff, G. Culture-sensitive neural substrates of human cognition: a transcultural neuroimaging approach. Nat Rev Neurosci 9, 646–654 (2008). https://doi.org/10.1038/nrn2456
26. oan Y. Chiao, Katherine D. Blizinsky; Culture–gene coevolution of individualism–collectivism and the serotonin transporter gene. Proc Biol Sci 1 February 2010; 277 (1681): 529–537. https://doi.org/10.1098/rspb.2009.1650

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