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Hypothesis

The Subjectic Hypothesis: A Lateralized Neurophenomenological Model of Embodied Cognitive Dynamics

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Abstract

Embodied cognition and hemispheric asymmetry remain fragmented fields with unresolved explanatory gaps. Existing models describe lateralized emotional processing, motor asymmetry, and context-dependent behavior, but they lack an integrated explanation linking subjective phenomenology to measurable kinematic patterns. This article proposes the Subjectic hypothesis: a neurophenomenological model that proposes that cognitive states are manifested through a stable lateralized pattern of embodiment, expressed as asymmetric movement dynamics. The hypothesis formalizes five axioms. It introduces three core operational constructs: personal-oriented left side (PO-LS), social oriented right side (SO-RS), and asymmetric neurobehavioral signal (ANS). This theoretical paper provides four testable predictions linking question type, attentional position, and embodied asymmetry. This article presents testable criteria and brief methodological considerations to guide empirical evaluation. No empirical data are presented; the paper defines a theoretical framework intended to guide future experimental research and reasoning.

Keywords: embodied cognition; hemispheric lateralization; neurophenomenology; kinematic asymmetry; operationalization; cognitive neuroscience

Introduction

Embodied cognition proposes that cognitive states arise from sensorimotor processes (Barsalou, 2008; Wilson, 2002) rather than from purely abstract computations, and relies on causal narratives of the mind to attempt to interpret them through this hypothesis. Despite extensive work in cognitive science, key issues remain unresolved: (1) the lack of a unified mechanism explaining the correlation of subjective content with body side asymmetry; (2) conflicting evidence linking hemispheric processing to behavioral movement bias; and (3) the lack of a quantitative measure of cognitive states at any given moment in time. Research on hemispheric asymmetry (Davidson, 1992; Tucker, 1981; McGilchrist, 2019) establishes directional biases in how the hemispheres process information. Neurophenomenology emphasizes the need to integrate first- and third-person perspectives (Varela, 1996). However, existing theories fail to provide an operational bridge between cognitive stance and kinematic outcome (Martinez et al., 2017). This hypothesis addresses this gap by proposing a succinct axiom structure and a directly operationalizable kinematic index that, together, generate falsifiable predictions and offer the prospect of understanding the fundamental underpinnings of hemispheres as manifested through bodily dynamics.

Theoretical Explanations

Embodied Cognition

The concept of embodied cognition proposes that cognitive processes are based on sensorimotor systems; posture, gestures, and movements are not epiphenomena but components of cognition (Barsalou, 2008; Wilson, 2002). Empirical research links body states with perception, memory, and

affect; however, mapping specific cognitive contents to lateralized motor features remains underdeveloped.

Hemispheric Asymmetry

Neuroscience documents functional lateralization: hemispheres differ in information processing style and function, with implications for emotion, attention, and self-referential information processing (Davidson, 1992; Tucker, 1981; McGilchrist, 2019). Translating these neural asymmetries into reliable behavioral markers requires a clear operationalization of how lateralized brain dynamics relate to whole-body kinematics.

Neurophenomenology

Neurophenomenology requires the integration of first-person and third-person data to bridge the explanatory gap (Varela, 1996). The Subjectivity Hypothesis adopts a neurophenomenological approach: subjective positional designations (e.g., "personal" versus "social") are viewed as phenomenological categories that must be linked to objective kinematic indicators.

Kinematic Behavior as Cognitive Proxy

Advances in motion capture and pose estimation allow for the precise measurement of motion bias and segmental displacement (Martinez et al., 2017). These methods enable the calculation of lateralized motion indices on time scales relevant to cognitive processes at any given moment. Theoretical integration and empirical guidelines: The hypothesis brings together three interrelated lines of research. First, studies of gesture and action show that hand movements and posture are closely linked to cognitive and thought processes, suggesting that bodily activity is not merely an epiphenomenon but rather underlies certain cognitive operations (McNeill, 1994). Second, hemispheric approach/withdrawal models link lateralized cortical dynamics to approach and avoidance behavior, providing a neural basis for lateralized motor expressions of motivational stance. Third, the literature on motor compensation and interlimb adaptation shows that when one segment is limited or suppressed, other segments reliably increase output to maintain action (Hylin, M. J., Kerr, A. L., & Holden, R., 2017). Clearly, the factors underlying compensation and postcompensatory cognitive performance need to be examined.

Axioms

The Integrative Nature of Body and Mind (Neuro-Behavioral Connection)

This axiom postulates that the human mind and physical body are not independent entities, but form a single, inseparable neurobehavioral system, where every internal cognitive state (thought, emotion, intention, belief, internal conflict) inevitably and instantly manifests at the physiological and behavioral levels. This means that the body is a direct and objective reflection of the individual's current cognitive state.

Functional Asymmetry: Brain Lateralization and Behavioral Projection

This axiom posits that the functional lateralization of the brain, which consists of the specialization of its hemispheres in processing different types of information and cross-control over opposite sides of the body, has a direct and observable manifestation in behavioral patterns. The hypothesis interprets this innate asymmetry through the concept of two primary neurobehavioral domains, or "sides of the body," each reflecting a specific cognitive orientation.

Semantic Segmentation of the Body: Cognitive Projections and Behavioral Dominants

This axiom asserts that the human body is not homogeneous in its cognitive manifestations, but rather functionally segmented, with each part (or group of parts) serving primarily to express specific categories of cognitive activity and behavioral responses. This segmentation is based on principles of neuromotor control, evolutionary adaptation, and the physiological functions of various body parts.

Neurobehavioral Adaptation and Modification

This axiom postulates that, thanks to the principles of neuroplasticity and dynamic adaptation, an individual is able to consciously influence their cognitive background and, consequently, their behavioral manifestations through the targeted modification of bodily movements and postures. This creates a mechanism of active self-regulation and transformation, allowing the formation of desired cognitive priorities and behavioral patterns.

Cultural Modification and Contextual Interpretation

This axiom recognizes that, although the basic neurobehavioral mechanisms of consciousness manifestation (described in Axioms 1-4) are universal for all people, the specific forms, nuances, and interpretations of bodily manifestations are significantly shaped and modified by cultural, social, and individual contexts. This means that an accurate analysis must consider the dynamic interaction between universal biological signals and acquired cultural patterns. Cultural aspects of personality are hypothesized to shape chronic cognitive-behavioral aspects.

Operating Structures**Personal-Oriented Left Side (PO-LS)**

Definition: A cognitive position primarily associated with right-hemisphere functional patterns, expressed behaviorally through left-sided motor activity.

Key semantics: self-oriented processing, intuition, holistic integration, autobiographical access.

Behavioral indicators (operationalization): relative displacement of movement and occupied spatial domain or frequency of activity on the left side of the body; movement displacement is viewed as a general kinematic indicator of embodied cognitive activity; the hypothesis provides an interpretative framework for correlating displacement patterns with a phenomenological position.

Task/state activation profile: autobiographical reflection, intuition-based tasks, internalized evaluative processing.

Social-Oriented Right Side (SO-RS)

Definition: A cognitive position primarily associated with functional patterns of the left hemisphere of the brain, expressed behaviorally through right-sided motor activity.

Key semantics: social adaptation, verbal-analytical control, normative regulation, role performance.

Behavioral indicators (operationalization): relative displacement of movement and the occupied spatial domain or frequency of activity on the right side of the body; movement displacement is considered a general kinematic indicator of embodied cognitive activity; the hypothesis provides an interpretative basis for correlating displacement patterns with the phenomenological position.

Task/state activation profile: normative evaluation, role-based behavior, impulse control, external decision making.

Asymmetrical neurobehavioral signal (ANS)

Definition: A quantitative index of lateralized motor activity used to classify PO-LS or SO-RS dominance during a given cognitive epoch.

Interpretation:

ANS $\approx +1$ $\rightarrow$ left-sided dominance (PO-LS).

ANS ≈ -1 $\rightarrow$ right-sided dominance (SO-RS).

Segment-level dominance calculation: For each bilateral segment (e.g., shoulder, upper arm, forearm, trunk tilt, head rotation, leg), the local dominance index can be defined as the difference between the absolute left and right displacements during a given epoch.

The global ANS is a normalized aggregation of these local dominance values and thus directly reflects the dominance structure of paired segments while preserving the contribution of each segment. Operational computations (brief description): For each functional segment, lateral activity is quantified as the total absolute displacement of tracked joint positions within a defined interpretation period (typical factors include task performance while maintaining conscious awareness of the context). Segment-level dominance is discretely categorized (+1/-1) for conceptual clarity in some analyses, although continuous ANS formulations are conceptually equivalent and may be preferable in statistical modeling. Coordinates should be normalized relative to participant proportions, smoothed to reduce high-frequency noise, and checked for artifacts.

Segmentation: The body is divided into functional segments (head, neck, shoulders, arms, trunk, legs), which are further divided into subsegments (eyes, mouth, shoulders, forearms, elbows, hands, fingers, chest, abs, lower back, upper back, hips, knees, shins, feet). Proximal segments typically contribute more to lateralization than distal segments, allowing for segmental decomposition of the ANS, identifying associative variations in the cognitive background at the moment.

Segment Semantics – Empirical Parallels. The behavioral semantics of various segments have been described in the literature: hands/forearms are closely correlated with symbolic actions and gesture production (gesture-thought connection), while axial segments (torso, hips, legs) indicate approach/retreat and postural intention; facial musculature is regulated more consciously and reflects communicative masking (microexpressions) (Burgoon JK (2018)). These empirical associations support the segmental assignments in Subjectica and are consistent with classical data on gesture cognition and emotional expression.

Observed Variables

The following variables represent measurable inputs from which segmental dominance estimates are derived: absolute joint displacement (the primary metric for the ANS), segmental path length within a moment, lateral displacement of the extraocular muscles, shoulder and trunk rotation displacement, fine hand movement displacement, and activation frequency of other segments. These metrics can be obtained using standard motion capture methods or markerless pose estimation methods.

ANS, dominant hand and postural bias.. The ANS is not proposed as a simple substitute for handedness or habitual posture. Handedness and cultural postural conventions are explicit covariates in the model: they shape baseline lateral tendencies and should be modeled as moderators at the participant level. The ANS is designed to capture task-dependent changes in relative segmental bias after accounting for baseline handedness/posture. In practice, this requires (1) measuring baseline lateral bias, (2) modeling handedness and culturally learned gestures as fixed effects or covariates, and (3) interpreting autonomic nervous system changes as context-dependent deviations rather than as absolute evidence of hemispheric state. Ethnographic and cross-cultural data (e.g., the history and distribution of greeting gestures such as the handshake) indicate that lateralized social rituals vary across cultures and can determine which side is used dominantly in social behavior; such factors should therefore be integrated into experimental design and interpretation. Claims about spontaneous reactions in isolated societies require ethnographic data and targeted fieldwork, not extrapolations from urban samples (Oxlund, 2020). For theoretical completeness, the hypothesis models cultural display rules as modulators, rather than falsifiers, of autonomic nervous system patterns.

Testable Hypotheses

Hypothesis 1 Activation of PO-LS. Self-related or introspective cues lead to statistically significant left-sided ANS dominance compared to neutral control tasks.

Falsification criterion: absence of systematic left-sided ANS dominance across participants in controlled self-focused tasks.

Hypothesis 2 Activation of SO-RS.. Social-evaluative or normative cues lead to statistically significant rightward dominance of the ANS compared to neutral control tasks.

Falsification criterion: absence of systematic rightward dominance of the ANS across participants in controlled social-evaluation tasks.

Hypothesis 3 Segment-level consistency. Axial and proximal segments (head, neck, shoulders, trunk) demonstrate stronger and more reliable lateralization than distal extremities during task manipulation; leakage or inconsistency at the segmental level will be evident during cognitive conflict.

Falsification criterion: lack of a consistent segmental pattern in controlled tasks.

Criteria for Falsification

The operational form of the hypothesis is empirically falsified if, in adequately controlled and powered experiments, at least one of the following conditions holds: (1) no robust left-right asymmetry is observed at the group level under controlled cognitive conditions (personal vs. social perception); (2) the ANS fails to distinguish between personal and social tasks with sufficient power to go beyond chance; (3) segment contributions fail to show a reproducible pattern across repeated experiments; (4) task-dependent polarity does not change when switching conditions within subjects. A robust null result after careful controls for measurement error, segmentation choice, cultural context, and handedness constitutes empirical refutation of the given operationalization.

Methodological Considerations

Recommended methods for initial empirical work include: using validated motion capture or markerless pose estimation methods to extract joint coordinates; normalizing coordinates according to participants' body proportions; transparently describing epoch definitions and smoothing procedures; explicitly treating handedness and culture-related variables as covariates; and preregistering primary outcome measures and analysis plans.

Discussion

The hypothesis defines a specific, testable correspondence between cognitive stance and lateralized kinematic expression. If confirmed, it provides a practical kinematic index (PKI) that can be combined with neural measurements to study embodied aspects of cognition and self-representation. Potential applications include therapeutic self-regulation protocols, behavioral diagnostics, and human-computer interfaces that measure cognitive stance, psychology, parenting, and learning. Robust empirical testing requires cross-cultural replication and multimodal triangulation (behavioral kinematics with neural and phenomenological measurements).

Alternative explanations that should be considered in future research include the influence of handedness, habitual posture, affective valence (approach/distance dynamics), and cultural display rules. These alternative explanations should be explicitly tested and controlled for in subsequent studies.

Conclusions

The "Subjectica" hypothesis offers a clearly formulated theoretical model linking lateralized bodily dynamics to cognitive stance and proposes an operational index (ANS) for empirical testing. The next step is the implementation of targeted empirical tests, transparent reporting, and collaborative replication with laboratories equipped for kinematic and neural measurements.

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