

Substance and Relationality: Reassessing the Authenticity Objection to Intellectual Neuroenhancement

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Abstract: *Objections to cognitive neuroenhancement frequently appeal to authenticity, yet they rarely specify the standard against which authenticity is to be measured. Drawing on Schmid's distinction between substance and relationality, this paper argues that authenticity is properly located in substance - the prereflective capacity for subjective evaluation, rather than in the socially observable self through which substance is expressed. Two accounts that would collapse this distinction are examined: Northoff and Smith's brain activity-based theory of selfhood, on which the ecological layer of the point of view partly constitutes the prereflective self, and Hume's bundle view, on which relationality constitutes the self entirely. Against both, the paper argues that the comparative regulation of concurrent mental states presupposes an evaluative standpoint that is not itself a member of the bundle, and that the incommunicability of subjective content limits what external encounters can constitute. Case evidence on trait self-knowledge preserved under episodic and anterograde memory impairment, together with findings on cross-role variation in trait expression, is used to distinguish change in relational expression from change in substance. On this basis, and treating intervention in idealized terms, the paper argues that the Parieto-Frontal Integration Theory locates individual differences in intelligence within relational information processing, so that the authenticity objection has not established that enhancement alters substance; and that because enhancement accelerates intellectual processes the individual already performs, prospective users can consent to it knowingly.*

Keywords: *Authenticity; cognitive neuroenhancement; substance and relationality; bundle theory of the self; prereflective self; Parieto-Frontal Integration Theory*

I. INTRODUCTION

1. Authenticity

Within the encounter philosophy of dialogical anthropology—an approach that treats the person as constituted in the meeting with others—human existence emerges through the continuous interaction between “substance” and “relationality” (Schmid, 2001). Substance refers to the individual's underlying, genuine experience of what they recognize as themselves, whereas relationality concerns how this internal self becomes expressed through encounters with others and made intelligible within social relations. Human nature can therefore be understood as the interaction between a substantial self that precedes recognition and a relational self-formed through encounters with others.

For Schmid, authenticity increases as relationality more faithfully expresses the underlying substance. A genuine person, on this account, lives in a way that accurately represents their moment-to-moment organismic experience in consciousness. In this sense, authenticity ultimately locates the self within substance rather than relationality (Schmid, 2001).

2. The ethical issue regarding the inauthenticity of neuroenhancement

The objection that enhancement threatens authenticity is well established in the bioethics literature, and three lines of argument may be distinguished. The first holds that enhancement substitutes a manufactured self for a given one: Elliott (2003) treats pharmacological self-transformation as a form of self-alienation, and Parens (2005) frames the debate as a standing tension between an ethic of gratitude toward what one has been given and an ethic of creativity toward what one might become. The second replies that identity is not fixed in the way the objection assumes, so that enhancement may express rather than betray the self: DeGrazia (2005) argues that identity-altering change is compatible with authenticity where it issues from the agent's own values, and Bublitz and Merkel (2009) and Erler (2012) develop the point for personality traits specifically. A third, narrative approach locates authenticity in the coherence of a self-told story rather than in any prereflective core. What these discussions largely leave unspecified is the standard against which authenticity is to be measured. The present paper addresses that gap by distinguishing substance from relationality within selfhood and asking which of the two intellectual neuroenhancement in fact modifies.

Where, then, does substance reside? Since selfhood—understood as the combination of substance and relationality—depends on brain function, substance may reasonably be located within the brain, although it remains intertwined with relationality.

Drawing on Schmid, substance can be understood as the prereflective awareness of self that precedes relational engagement with the external world. Relationality then actualizes this underlying self through interaction, allowing the individual to express and verify their intuitive self-awareness into a completed selfhood. Similarly, Baumeister argues that although the completed self may be shaped by both external encounters and internally generated processes, it must remain accessible to and ultimately governed by the individual's subjective perception (Baumeister, 2011).

Authenticity therefore depends both on the continuity of substance within the brain (C1) and on awareness of relational changes, which allows new expressions to be evaluated against that substance and recognized as authentically one's own (C2). However, without neural evidence that substance is a stable foundation independent of relationality, the self could instead be understood as reciprocally constituted by both. More radically, Hume's account denies substance altogether, leaving relationality solely responsible for constituting the self.

Although the distinction between substance and relationality remains largely conceptual, this research challenges accounts that derive the self solely from relationality or from their reciprocal interaction. It argues that relationality cannot arise without prior substantive criteria of subjective evaluation. It further contends that external encounters cannot by themselves constitute substance, because subjective values cannot be fully communicated or transferred; this is a claim about what constitutes substance, not a denial that encounters may causally modify it over time. Substance therefore functions as the primary reference against which relationality is evaluated, rather than as something reciprocally determined by it.

To further support the claim that the self is expressed most authentically when relationality represents substance with the greatest possible transparency, this research also draws on the self-report evidence reported by Sheldon et al. (1997), which indicates a separation between individuals' perceptions of their "authentic selves" and their externally observable relational selves. This perceived authentic self is therefore more plausibly associated with substance, which, because it remains isolated from direct encounters with external reality, cannot itself be objectively observed.

The analysis asks whether neuroenhancement alters authentic substance or only relational capacities (a), and whether its prospective effects can be sufficiently understood when individuals choose to undergo it (b). Working at the level of idealized intervention and setting aside implementation risks, it argues that the authenticity objection has not established that intellectual neuroenhancement alters substance rather than relational capacity, and that its intended intellectual outcomes are sufficiently conceivable to permit a conscious choice to align relational capacities more closely with one's underlying substance.

II. THEORETICAL FRAMEWORK: The brain activity-based theory of selfhood and the Humean bundle view of the self

1. The presentation of selfhood in the brain's scale-free activity

Through a broad account of the relationship between the self, the brain, and nature's broader dynamic systems, Northoff and Smith's (2023) theory of self suggests that, through scale-free activity, the brain, and thus an observable representation of its self, is dynamically related not only to other selves it encounters but also to the larger social and ecological systems within which it is "nested".

To develop their argument, the researchers begin with Vázquez Campos and Liz Gutiérrez's (2015) account of point of view (POV), as reconstructed by Northoff and Smith (2023), and extend it into an explanation of the pre-reflective sense of self—that is, the phenomenological awareness individuals instinctively have of themselves prior to intentional self-reflection. On this account, a complete POV consists of two components: a mental surface layer and an ecological background layer. This structure is then used to frame the phenomenological experience of selfhood, since the self must already be experientially present before it can become an object of deliberate reflection.

By identifying the combined mental and ecological dimensions of POV with the most fundamental form of self phenomenologically experienced by an individual, Northoff and Smith relate the ecological layer of POV, and its contribution to the complete POV, to the brain's continuously changing scale-free activity as it engages with the environment. They argue that the ecological dimension changes in response to the environments encountered by the individual and that these changes, in turn, alter the combined POV, as reflected in corresponding adaptations in brain activity. Within this framework, the combined POV is represented by the brain's overall scale-free activity during the resting state, a condition in which deliberate self-reflection is assumed to be absent.

Consequently, because changes in the previously encountered environment were found to alter participants' present resting-state brain activity, Northoff and Smith conclude that the prereflective, phenomenologically experienced self—identified with the complete point of view—is constituted not only by the mental layer traditionally associated with selfhood, but also by the ecological layer.

Scale-free brain activity has been proposed as a distinctive form of neural organization that varies across individuals and contributes to selfhood (Huang et al., 2016; Scalabrini et al., 2017, 2019; Wolff et al., 2019). The World-Brain relation extends this view by noting that many natural systems also exhibit scale-free dynamics, suggesting that intrinsic brain activity may continually adapt to the temporal structure of the surrounding environment. This process can be understood through "complexity matching": repeated exposure to unfamiliar music, for example, may gradually attune neural activity to its temporal structure, enabling fuller perception of its melody (Teixeira Borges et al., 2019).

If the authentic self is instantiated in ongoing scale-free activity, environmental interaction may therefore contribute to shaping it. Selfhood would then develop not from a fixed substance with an immutable evaluative orientation, but through relational patterns acquired as neural activity adapts to surrounding complex systems (Klein, 2012). This may help explain why childhood and adult selfhood can differ under markedly different environments, consistent with divergent developmental trajectories of scale-free activity reported in healthy individuals and those exposed to traumatic conditions (Gupta et al., 2017; Nakao et al., 2013).

Yet such change does not undermine the phenomenological unity of the self across time. Although continuously evolving, scale-free neural activity preserves developmental coherence because each moment is influenced by earlier activity and, in turn, shapes later activity. This continuity is supported by the long-range temporal correlations (LRTC) characteristic of scale-free brain dynamics.

Existing neural patterns are not replaced when new conditions arise; rather, they are progressively modified through repeated adjustments that preserve continuity with earlier activity.

On Northoff and Smith's account, neither substance nor environment alone explains this continuity. Instead, unity is mediated by accumulated ecological experience: environmental signals are filtered through subjective perceptual capacities and incorporated into an evolving relational ecology. Because perceptual capacity provides the stable lens through which this ecology is constructed, altering that capacity through neuroenhancement risks disrupting the mechanism that integrates change into the self's developmental trajectory. A sufficiently altered perceptual lens may therefore prevent new changes from being assimilated as coherent extensions of the prior self. Whether enhancement in fact alters the perceptual lens to that degree is addressed in Section IV.2.

Although this account rejects any component independent of relationality as the sole determinant of selfhood, it does not exclude a reciprocal model in which substance and relationality contribute equally to authenticity. It therefore remains broadly compatible with Schmid's framework and may still allow substance and relationality to exist as distinct components. Some researchers, however, reject substance entirely and assign relationality sole responsibility for constituting both selfhood and authenticity. This stronger relationalist position must therefore be addressed before relationality can be rejected as either the sole or a co-determinant of selfhood.

2. David Hume's account of the self as wholly dependent on relationality: The self born through consistent changes in the experience of perception

For Hume, the self is a bundle of distinct perceptions arising through encounters with the external world and varying across time. Relations of resemblance, contiguity, and causation lead the mind to treat these successive perceptions as states of a single self rather than as separate experiences. The appearance of a constant identity is therefore produced by imagination, which unifies changing perceptions into a continuous self. From this perspective, any intervention that alters either the components of this bundle or the way they are connected also alters the self constituted by them. Neuroenhancement, insofar as it changes intellectual capacities, may therefore be understood as an intervention into the self itself (Hume, 1739/1978).

In Book I, Part IV, Section VI, Hume rejects the idea of an enduring substance, such as the soul, underlying changing perceptions. What philosophers take to be a persistent self is, in his view, an imaginative construction arising from the mind's limited comparison of successive states. Because one state disappears before another emerges, the mind cannot compare them directly and instead connects them through memory. Through repeated habit, the mind therefore treats distinct but related states as manifestations of one enduring identity, despite their underlying differences.

To challenge this account, and in particular its denial of a subjective self independent of externally generated perceptual relations, the present research identifies a limitation in conceiving selfhood solely as a succession of perceptions. Specifically, it argues that certain mental states necessarily presuppose a subjective experiential and evaluative standpoint that cannot itself be generated exclusively from externally derived perceptions. Once these states are excluded from what can be explained by the bundle of perceptions alone, an explanatory gap emerges within the mentally experienced self that the bundle account cannot close. A Humean may reply that Book II supplies what is missing: the passions are impressions of reflection, arising from within rather than from external objects, and could therefore furnish evaluative standards without any substance. The difficulty is that such impressions are themselves states that are evaluated and regulated, so the ordering among them still presupposes a standpoint that is not one further member of the bundle.

III. THE SEPARATED SUBSTANCE WITHIN AN INDIVIDUAL'S SELFHOOD

1. A proposal for a separated substance from the relational portion of the self

Throughout what follows, "substance" denotes the prereflective capacity for subjective evaluation. Identifying it with Schmid's substantial self, with Husserlian prereflective self-awareness, and with the mental surface layer of the point of view is a proposal of this research, not a claim that these three traditions describe the same thing.

The problem with this interpretation is that the changing perceptions arising from a person's encounters cannot be treated as independent elements preceding a substantial framework of subjective evaluative criteria, nor can those criteria be treated as products of the encounters that constitute the bundle.

Mental experiences are not constituted solely by encounters with external objects. Experiences involving personal evaluation, such as happiness, presuppose a foundational capacity for judgment through which external events are interpreted as sources of happiness. Moreover, mental states such as beliefs, desires, pain, and anger are causally interdependent, insofar as each arises from and contributes to the conditions that produce the others. Even if these experiences were initially perceived as distinct and unaffected by one another, they would still have to be comparatively evaluated and regulated, with their respective intensities increased or diminished to enable their harmonious coexistence within a single shared mental subject (Lowe, 1991). This regulatory process already presupposes a prior sense of personal value that cannot be reduced to any external object represented within the "bundle of perceptions." It is therefore distinct both from the external encounters that give rise to particular perceptions and from the subsequent interactions among the mental experiences themselves (Lowe, 1991).

2. A substance unaffected by unstable external experiences that relationality depends on

Once a subjective evaluative standpoint is acknowledged, Northoff and Smith's account requires reconsideration. Their view suggests that environmental encounters not only (1) supplement an existing subjective self by enabling its reflective and observable actualization, but also (2) help constitute the prereflective "phenomenal self." The second claim therefore implies that environmental

influence can alter what is here termed substance. While the evidence supports (1), (2) appears to exceed what it can establish. It assumes that completed selfhood, comprising the “mental surface” and “ecological background” layers, is identical to the more fundamental self that precedes experiential actualization. Yet the evidence does not exclude the alternative that completed selfhood is an experientially supplemented expression of a prior substantial self. On this view, substance remains distinct from relational additions and is instead grounded in what this research identifies as the “mental surface layer.”

According to Husserl, as presented by Zahavi (2005), the self is prereflectively experienced rather than constructed through deliberate conceptual reflection, contrasting with Kant’s more reflective account of selfhood. The phenomenological self therefore precedes reflective reference to objectively describable experiences, such as declarative memories through which the self is relationally represented. Building on this distinction, Northoff and Smith found that resting-state brain activity changed following alterations in the preceding environment, suggesting that prereflective selfhood remains responsive to ecological context.

However, the absence of externally prompted tasks does not exclude self-reflection. During wakeful rest, individuals may spontaneously recall past experiences, engage in undirected thought, or interpret their surroundings through previously formed evaluations, all of which may implicitly involve self-reflective processing. Resting-state measurement therefore cannot cleanly separate prereflective from reflective self-processing (Christoff et al., 2009), and so cannot on its own establish that environmental experience constitutes the phenomenal self rather than its reflective elaboration.

However, in an ideal circumstance, if both immediate environmental input and declarative memories of prior encounters were removed, the environmentally mediated self could be reduced to a more fundamental form resembling Hume’s account of selfhood as constituted by changing perceptual experiences. The present account, however, additionally proposes an underlying capacity for subjective evaluation that precedes such encounters and is absent from Hume’s bundle theory. Following Northoff and Smith, ecological selfhood may therefore develop through experiences initially elicited by environmental encounters. Once formed, these experiences may become detached from their original external sources and persist internally without requiring ongoing reflection or environmental interaction. They may thus continue to shape the phenomenological self while remaining distinct from the proposed environmentally independent dimension of selfhood.

Yet, this research questions whether such a phenomenologically grounded experience of self can genuinely arise from external encounters. The incorporation of a novel experience originating outside the individual into an already existing subjective experience appears problematic, given that one subject cannot fully access or reproduce another’s subjective worldview without some prior shared experience to serve as a common point of reference. Accordingly, an entirely new subjective sense of self cannot simply arise *ex nihilo* from an external encounter.

As Nagel’s “What is it like to be a bat?” suggests, individuals directly access only their own consciousness, while others’ consciousness can only be inferred from observable processes that accompany but are not identical with subjective experience (Nagel, 1974). Drawing on Nagel’s notion of point of view, Northoff and Smith attribute this inaccessibility to uncorrelated temporo-spatial scales between individuals, suggesting that neural changes might align these scales, much as brain activity can become attuned to the temporal structure of music.

However, such correlations may involve only externally accessible phenomena, such as sound waves. In music, neural alignment may simply reflect the processing of shared temporal and acoustic patterns that generate enjoyment through successful pattern recognition (Vuust & Kringelbach, 2010). Correlation between neural activity and musical structure therefore does not imply transmission of another person’s subjective experience. By contrast, the temporo-spatial scale of the prereflective self—including the underlying capacity for subjective evaluation—cannot itself be represented through words, gestures, or other observable signals. Northoff and Smith’s proposed scale correlation therefore cannot occur directly between such subjective standpoints.

Accordingly, when traumatic experiences alter neural activity, these changes may represent a relational extension of the original phenomenological self rather than a transformation of that self. The underlying evaluative standpoint may remain stable while its relation to external objects changes, producing different observable and reflective expressions of selfhood.

Individuals understand another person’s description of subjective experience not by accessing that person’s mental content directly, but by drawing on meanings and representations they themselves associate with the words used. These meanings may arise when different individuals encounter the same event, experience it privately, express sufficiently similar reactions, and then treat their inaccessible experiences as comparable enough to share a linguistic label. Language therefore does not transmit subjective experience itself; it provides a shared reference to independently experienced states assumed to be similar because of common causes and expressions. In this sense, words do not create meaning from nothing but point toward ideas or values already available within the mind (Wittgenstein, 1953/2009, §§243–275).

Accordingly, an account of the self as an evolving combination of mental and ecological layers requires two dimensions. The first consists of external objects that are perceived and evaluated. The second is an underlying subjective standpoint through which these perceptions are assessed. This evaluative capacity must already be phenomenologically present before needs or values can be directed toward particular external objects. Thus, the most fundamental self that Schmid calls “substance”—the prereflectively experienced self prior to reference to external objects—can be located in this underlying evaluative dimension.

Thus, the essay rests on two foundational claims. First, a phenomenologically experienced subjective self exists prior to and independently of perceptual engagement with the external world and its incorporation into the ecological background layer. Second, authenticity arises through the embodiment of this subjective self in action, rather than from the total recorded self formed by the

mental surface and ecological background layers. Accordingly, within Schmid's framework, this subjective self constitutes substance, while relationality provides the means through which substance is expressed and actualized, while also shaping the individual's ecological self-understanding through reflective experience.

Empirical support for the first claim may be found in cases where severe impairment in autobiographical memory limits the integration of perceived external experiences into a subjective system of valuation, yet a stable sense of self nevertheless persists. One such case is R.J., reported by Klein and Lax in their study of the independence between episodic memory and semantic self-knowledge.

R.J. was a 21-year-old man with autism and severe impairment in episodic autobiographical memory, particularly the recall of specific personal events. Such memories would normally contribute to relational engagement with the external world and to reflective self-development. Despite this impairment, R.J. retained stable and accurate knowledge of his personality traits. His self-ratings on McCrae and Costa's Five-Factor Model (FFM) remained consistent over time and closely matched caregiver evaluations (Klein & Lax, 2010).

The FFM organizes observable behavioral patterns into a coherent representation of personality and therefore depends partly on relational expression to make otherwise private characteristics socially accessible (McCrae & Costa, 1999). It can thus be understood as capturing both internal self-knowledge and its relational manifestation. If stable personality knowledge persists despite severe limitations in the episodic experiences through which relational selfhood is ordinarily developed, this is consistent with at least some aspect of the self persisting independently of the environmental relations through which it is expressed. The inference is limited in two ways: semantic self-knowledge is itself abstracted from earlier relational experience, so the case bears on independence from ongoing relational access rather than from relational origin; and a single case cannot establish more than possibility.

3. The authenticity that lies deeper than observable trait behaviors

Beyond supporting the first claim, the preceding evidence also supports the second by suggesting that reported changes in personality across the lifespan or after amnesia need not reflect changes in the underlying substance of the self. Because personality measures capture both enduring characteristics and their expression through environmental interaction, observed changes may instead reflect shifts in relationality. On this view, developmental changes in personality represent adjustments in how individuals engage with the external world, allowing their thoughts, feelings, and behaviors to become increasingly aligned with an enduring substantive self.

The hypothesis that authenticity functions as an underlying aim of changes in personality expression can be further supported by the studies of Sheldon and colleagues on cross-role variation in the Big Five traits. Their findings showed that individuals expressed different levels of the same traits across social roles, suggesting that particular roles and environments may either facilitate or constrain the expression of certain aspects of personality. Moreover, variations in role-specific trait expression were systematically associated with variations in felt authenticity. Participants tended to feel more authentic in roles in which they were less neurotic and more extraverted, agreeable, conscientious, and open to experience, and they reported greater overall satisfaction in the roles they experienced as more authentic (Sheldon et al., 1997). Authenticity was operationalized in those studies in self-determination terms—acting from one's own volition—rather than as the substantive core proposed here.

The remaining difficulty concerns the ambiguity of "authenticity." It cannot be assumed that participants understood authenticity as identical to the substantive core of the self, nor that their role-dependent personality adjustments therefore represented movement toward that substance. To make this inference, the personality profiles reported across different roles and environments must first be shown to reflect only participants' observed relational expressions, rather than changes in substance itself. If these fluctuations can be confined to relationality while the substantive self remains outside the domain of change, then substance may reasonably be interpreted as the stable ideal of authenticity toward which participants believed their changing behaviors were directed.

A particularly informative study by Garland and colleagues examined semantic self-knowledge in seven individuals with severe anterograde amnesia, which impaired their ability to form new declarative memories from interactions with the environment. Across five assessments over one year, participants rated their current personalities using the Big Five Inventory, while caregivers rated both their current personalities and, retrospectively, their pre-amnesic personalities.

The participants' post-onset self-ratings differed substantially from caregivers' current ratings but closely matched caregivers' retrospective evaluations of their pre-amnesic personalities. After independently assessing caregiver accuracy, the researchers concluded that the discrepancy largely reflected the participants' own judgments. Although asked to describe their current personalities, participants instead reported traits resembling those they had possessed before amnesia, apparently remaining unaware of later personality changes observed by caregivers (Garland et al., 2021). This suggests that conceptual judgments about one's personality normally depend, at least in part, on self-reflection supported by declarative memories of relational experience. The two studies are therefore complementary rather than conflicting: Garland and colleagues concern the updating of self-knowledge, which requires new declarative memory, whereas R.J. concerns the retention of self-knowledge already formed, which does not.

Accordingly, some component of selfhood may exist independently of relationality, as suggested by R.J.'s preserved self-knowledge despite severe disruption of relational access. Yet individuals may still rely primarily on relational evidence when evaluating their own personality traits, thereby overlooking an underlying subjective self-available only through phenomenological experience and not fully accessible through reflective analysis.

This tendency may also be applied to the subjects participating in the personality-trait self-assessments reported by Sheldon and colleagues, in which individuals perceived their personality traits as varying across different social roles. On this basis, it is plausible

that their judgments were derived primarily from their observed relational engagement with the external world, while the substantive dimension of selfhood—being inaccessible to direct evidence—was effectively set aside. Consequently, the stable sense of “authenticity” reported across these changing relational expressions is consistent with, though not evidence for, the view that what participants tracked was whatever remains within selfhood once relationality is excluded.

When participants describe their “personality traits” as changing while simultaneously experiencing a stable sense of “authenticity,” the changing traits may have been understood by the participants as manifestations of relationality, whereas authenticity may have thus been identified by them with that dimension of selfhood that relational expression does not fully encompass, that is, the underlying substance of the self.

IV. THE SCOPE OF INTELLECTUAL NEUROENHANCEMENT

1. How neuroenhancement is not shown to conflict with authenticity

This research considers only the idealized modification of neural components that account for individual differences in intelligence. It therefore excludes harms arising from the practical methods required to achieve such modification when those harms are not intrinsic to intelligence enhancement itself. Its purpose is instead to determine whether enhancing intelligence is morally problematic in principle, independently of implementation risks. If the goal itself is not objectionable, this may support further research into safer methods of achieving it. Its conclusions therefore bear on the in-principle permissibility of intelligence enhancement, not on policy for any currently available intervention.

For intellectual neuroenhancement to remain compatible with substance and authenticity, two conditions must be met. First, altering intelligence must not intrinsically harm selfhood (I). Second, the intervention must preserve autonomy by ensuring that individuals can reasonably anticipate the intended nature and consequences of the enhancement when consenting to it, rather than acting mainly under external influence without sufficient understanding (II).

To establish (I), the intended enhancement must be shown not to interfere with the fundamental phenomenologically experienced self. Because the neural basis of this underlying self remains uncertain, the research adopts an indirect approach: rather than identifying the neural substrate of substance itself, it seeks to show that enhancement affects only relational capacities involved in perceiving, processing, and organizing information from the external world. This requires treating intelligence as the capacity to process neural signals into meaningful cognitive associations, while substance remains the subjective reference point through which those perceptions and associations are evaluated.

The concept of “general intelligence” (*g*), introduced by Spearman (1904/1961) through his analysis of correlations among tests measuring different cognitive abilities, refers to a common factor underlying performance across diverse intellectual tasks. Spearman observed that individuals who performed well on one type of cognitive test also tended to perform well on others, despite the tests assessing different aspects of intelligence. As a numerical estimate, *g* tends to remain relatively consistent across different cognitive tests. This stability makes *g* a broadly applicable measure of intellectual ability, in contrast to task-specific intelligence, to which differences in an individual’s performance across particular tests are attributed that general intelligence alone cannot explain (Brody, 1999).

The construct of *g* has remained controversial as an indicator of a distinct mental faculty capable of explaining differences in intellectual performance. Schlinger (2003), in criticizing attempts to transform the *g* factor into an independently existing psychological faculty, argues that such interpretations risk circular reasoning, because a factor statistically derived from correlations among intellectual performances cannot subsequently be invoked as the cause of the very performances from which it was extracted. According to Schlinger, treating *g* as a distinct causative mental entity reflects a tendency to reify an observed statistical pattern—that is, to convert an abstract relation among measured performances into a presumed underlying psychological entity and then attribute causal power to that entity. Accordingly, if intelligence is to be understood as something more than a statistical regularity represented by *g*, investigation must shift toward the underlying processes that may causally generate both intellectual performance and the positive correlations among different intellectual tasks.

To avoid these flaws, attention can instead be directed toward the physical information-processing mechanisms within the association areas that correlate with measures of general intelligence. Unlike the *g* factor, which is statistically derived from the very intellectual performances it is subsequently invoked to explain, the association areas possess independently established neurobiological functions in transforming and integrating perceptual information derived from external stimuli into cognition. The positive association of these neural processes with *g* therefore offers a more plausible foundation for a mechanistic account of intelligence, while retaining *g* primarily as a statistical index rather than treating it as a causal entity.

The cognitive processes underlying general intelligence are closely associated with the neural mechanisms described by the Parieto-Frontal Integration Theory (P-FIT) (Haier, 2016). According to this account, sensory information is first received through the primary visual and auditory cortices and then analyzed in greater detail within the corresponding unimodal association areas (BA 19, BA 18, BA 37, BA 21, and more). Multimodal association regions subsequently integrate information from these separate sensory domains (BA 40, BA 7, and more) and connect it with the planning and executive functions of the prefrontal cortex (BA 46, BA 9, and more) where motivational and memory-related processes from the limbic system are integrated for evaluation reference (Haier, 2016; Mesulam, 1998).

The proposed theory locates critical individual differences in intelligence within the associative processing performed by unimodal and multimodal association areas. Intelligence, on this account, reflects both the efficiency with which white-matter pathways

transmit information between relevant regions and the structural and functional capacity of gray matter within those regions to process and integrate incoming information (Jung & Haier, 2007). Drawing on Mesulam's account of association areas and on the regions synthesized by the P-FIT framework, Spearman's originally statistical construct thus concerns the efficiency with which an individual can integrate distinct externally derived stimuli into coherent patterns to which learned concepts can be assigned, as well as the flexibility with which those previously learned patterns can subsequently be decomposed and reorganized into more fundamental and broadly applicable associations according to the individual's current goals and the demands of the external context. Differences in intelligence, within this broader process of forming analogical associations toward a particular goal, may therefore be understood as arising from variations in the capacity of association areas to analyze, integrate, and reorganize ecologically available information acquired through the individual's interaction with the external environment (Sternberg, 1997).

Accordingly, it may be inferred that interventions directed at enhancing these processes would remain confined to the domain of relationality, insofar as they modify the efficiency with which externally derived information is analyzed, integrated with previously learned patterns, and decomposed into more fundamental associations. Such processes operate upon neural representations of stimulus patterns to which concepts have previously been assigned, rather than upon the subjective evaluative content of those concepts themselves. On this account, authenticity would remain possible because enhancement of relational capacity would leave intact the substantive self that exists independently of external relations and continues to function as the enduring reference point for their expression. This inference is, however, constrained by how substance has been defined. Because substance was characterized as that which is not represented in externally observable processes, no neuroscientific finding could show that enhancement reaches it. What the argument establishes is accordingly narrower than it may appear: objections to neuroenhancement have not supplied a criterion on which enhancement would count as altering substance, rather than enhancement having been shown to leave substance untouched.

2. How neuroenhancement still retains autonomy

In addition to the claim that intellectual neuroenhancement does not compromise authenticity, it is necessary to address the concern that enhancement may transform an individual's perceptual capacities so extensively that the enhanced state becomes incomprehensible from the pre-enhancement perspective. Individuals considering neuroenhancement may therefore be unable to understand how it will alter their capacity to engage with the external environment, let alone envision the forms of substantive self-actualization that the enhancement may enable or restrict, thereby limiting their ability to make a fully informed choice. Instead, they may pursue enhancement primarily for its anticipated social advantages, despite lacking a genuine desire for the enhanced state itself (Bublitz & Merkel, 2009). Such a choice would necessarily violate condition (II) required for a fully realized account of authenticity.

In formulating the Parieto-Frontal Integration Theory, Jung and Haier (2007) reviewed 37 neuroimaging studies and identified the brain regions whose gray-matter structure, functional activity, and white-matter connectivity were most consistently associated with individual differences in general intelligence. The structural and functional efficiency of these association areas, together with the white-matter pathways connecting them, has been proposed to account for a substantial proportion of individual differences in general intelligence (Jung & Haier, 2007). In this process, the prefrontal cortex will either integrate information supplied by association areas to support the planning and regulation of future behavior, or would, when established associations are inadequate for the demands of a novel situation, exert top-down cognitive control, directing other cortical regions to modify habitual patterns of association and construct a new conceptual interpretation of the stimulus.

Comparisons between neuroimaging studies of individuals with higher and lower recorded levels of general intelligence have often shown lower levels of neural activation in the more intelligent group, both in the number of regions recruited and in the intensity of activity within those regions (Haier, 2016). This pattern can be interpreted as evidence that greater gray-matter volume and stronger white-matter integrity contribute to more efficient reasoning by preserving the fidelity of incoming signals as they are transmitted to association areas. Such efficiency may also enable the brain to revise established associations and construct new concepts appropriate to novel stimuli without repeatedly returning to the original sensory information, as may occur when insufficient gray-matter capacity limits information processing or reduced white-matter integrity weakens signal transmission (Deary et al., 2010).

In other words, an intelligent mind is characterized by the ability to flexibly deconstruct established associative concepts whose interpretations of particular stimulus patterns have become outdated, while preserving the still-valid constituent information from which those concepts were originally formed. It must also be capable of reorganizing these components into new conceptual structures that correspond to the individual's intended goal. More intelligent individuals may therefore need less time to identify a concept's components or to construct a replacement for an inadequate one, owing to a greater capacity to process several components at once without their losing their original informational properties in transmission.

This conclusion implies that the ideal aim of intellectual neuroenhancement is to increase an individual's capacity to retain and consistently process information, thereby enabling them to arrive more rapidly and easily at insights that they could, in principle, have reached without enhancement. Neuroenhancement would therefore accelerate or facilitate the individual's existing intellectual processes rather than introduce an entirely unimaginable form of cognition. Two qualifications follow. First, because the enhanced processes are continuous in kind with those the individual already performs, the enhanced state need not be wholly opaque from the pre-enhancement standpoint, although it need not be fully transparent either; condition (II) requires that the choice be informed, not that its outcome be exhaustively imagined. Second, this continuity also addresses the concern raised in Section II, that an altered

perceptual lens might prevent new experience from being assimilated as an extension of the prior self: an intervention that increases processing capacity without replacing existing associative patterns leaves intact the gradual, history-dependent adjustment on which developmental continuity depends. Whether this holds for large rather than incremental interventions remains open and is noted among the limitations below.

V. CONCLUSION

In conclusion, this paper has reviewed the literature concerning the ways in which cognitive neuroenhancement might divert an individual's relational development from the ultimate goal of facilitating authenticity, which technological enhancement is intended to support. It argues that claims regarding neuroenhancement's inability to preserve or promote authenticity require a clearer account of the standard against which authenticity is to be assessed. They also require a more rigorous examination of the distinctions within selfhood as instantiated in the brain, rather than treating physically observable and modifiable neural characteristics and those that remain inaccessible to objective observation as a single, unified self merely because of neuroscience's tendency toward physicalism. With respect to the two conditions set out in Section IV, the position reached is as follows. Regarding (I), no criterion has been offered on which intelligence enhancement would count as altering substance rather than the relational capacities through which substance is expressed, so the burden remains with the objection. Regarding (II), because enhancement of this kind accelerates processes the individual already performs rather than introducing wholly novel ones, a prospective user can form a sufficiently determinate expectation of it to consent knowingly. Taken together with the two foundational claims of Section III—that a prereflectively experienced subjective self precedes perceptual engagement with the world, and that authenticity consists in the embodiment of that self in action—these results place the standard for assessing enhancement in substance rather than in the socially observable self.

VI. LIMITATIONS

This paper is unable to reject either the view that authenticity is grounded exclusively in substance or the view that it depends on both substance and relationality. Nor does it affirm or deny claims that cognitive neuroenhancement is necessarily authentic or inauthentic. Instead, it identifies several evidential and logical limitations that have been overlooked in arguments supporting these conclusions. These include the tendency in some neuroscientific accounts to equate observable behavioral or neural manifestations of the self with the totality of what constitutes selfhood, as well as the conceptual inconsistencies that arise when the self is defined, as in Hume's account, solely as a bundle of continually changing perceptions shaped by its encounters with the world.

Because the subjective sense of self is presumed to exist exclusively at the phenomenological level and to contain no externally observable object, this research cannot establish its existence through direct empirical observation and must rest primarily on the necessity of such a subjective standpoint for making personal perception and evaluation possible, supplemented by a limited number of cases involving individuals whose capacity for self-reflection was severely impaired. In such cases, the persistence of a coherent awareness of self may provide evidence more specifically attributable to phenomenologically experienced selfhood, because the contribution of reflective self-conceptualization has been substantially excluded. Given the absence of evidence sufficient to eliminate either conclusion, the paper does not aim to do more than expose these unresolved conceptual issues as a foundation for further analysis.

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