Reportable Awareness vs. Foundational Competence: A Functional BAL/Looping Account of Split-Brain Phenomena

(Working Paper – updated February 2, 2026 – the only changes being the inclusion of the last three paragraphs of Section 4, explaining how recent findings also fit within the BAL-looping account.)

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Abstract

This paper offers a functional reframing of split-brain phenomena – but not one developed for that purpose. The framework described here was originally constructed to explain core features of brain function: perception, imagination, planning, internal modeling, and subjective access. Only once the model was complete did it become clear that it also accounted – with striking precision – for the puzzling dissociations observed after callosotomy. That unplanned alignment lends weight to the structure itself.

To frame this model, we treat the brain as a functional whole – what we call the brain at large – understood as a global cybernetic system responsible for goal formation, environmental modeling, and behavioral control. Within this system, we identify a specialized subsystem: the proxy transfer device (PTD), a lateralized expressive mechanism whose activity is reused internally (a process called looping) to enable reportable awareness. This functional distinction between the PTD and the broader brain at large proves critical for resolving long-standing puzzles in split-brain research and clarifying the architecture of conscious experience.

Beyond reinterpreting past data, the framework points toward a new line of research: identifying the difference between looped and unlooped responses. It proposes that what we call "consciousness" corresponds, functionally, to internal looping – a learned reuse of the expressive pathway that gives the brain a new internal resource that is highly effective for many purposes. On this view, split-brain phenomena are no longer peripheral puzzles or strange edge cases; rather, through the lens of the framework, they shed light on central facets of the brain's operation.

Introduction

In my work on brain function, I developed a framework – grounded in cybernetics, evolution, and child language development – before I had studied split-brain research in any depth. When I later encountered that literature, I noticed that many researchers described split-brain phenomena as difficult to explain, even enigmatic. But from the standpoint of the framework, everything seemed entirely expected. The apparent puzzles aligned so well with the model I had constructed that, even before reading the research in depth, I could have predicted the findings based on its core principles.

This paper reframes split-brain phenomena through a functional framework developed independently of that field. Grounded in cybernetics and observations of everyday brain operations – perception, imagination, recollection, language, and behavior – the framework provides a consistent account not only of nonhuman behavior but also of the many features unique to humans that arise from the language faculty.

These alignments serve to validate the framework and to shed light on the mechanisms underlying the split-brain phenomena. The framework may therefore be of interest to researchers in the field, as it dissolves some of the most enigmatic questions that conventional viewpoints have struggled to explain. The paper lays out the framework in Sections 1 through 3, and then goes on to show how these ideas account for the split-brain findings in Sections 4 through 7.

1. The Foundational Operator: The Brain at Large (BAL)

The account offered here does not begin with language, or even with human cognition. It begins further back – with the basic operational logic that governs any sufficiently complex nervous system. That logic is rooted in physical constraints, and in an evolutionary lineage that long predates hominids.

The framework treats the entire brain as a functional control system – goal-seeking, adaptive, and cybernetic in nature (Wiener 1948; Ashby 1956). This overall system is referred to as the brain at large (BAL), understood as the global agent responsible for guiding behavior, securing survival, and modifying its patterns through learning. Later sections will introduce a specialized subsystem within this whole – the proxy transfer device (PTD) – but for now, we focus on the BAL as the overarching architecture that governs the organism's interaction with the environment.

The BAL works by physical means – electrochemical signaling, dynamic networks – and its task is simple in outline: to move the organism from whatever initial state it is presently in toward a goal state that is good for that organism. These goals may be basic – nutritional balance, avoidance of harm, reproductive access – and the brain is informed about them through various sorts of interoceptive and sensory input (metabolic state receptors, sense organs, etc.).

It goes without saying that evolutionary selection would favor a brain system that actually helps the organism in its activities (cf. Edelman, 1987). It follows that the BAL cannot simply shift itself internally into a goal state – its goal state must depend on real, material changes, determined and verified through interoceptive and sensory input. If the stomach is empty, the BAL guides behavior that results in the ingestion of food, at which point the brain is informed through metabolic state receptors and sense organs that the goal state has been reached. This is a key imperative: the only way the BAL can reach the goal state is through interaction with the environment to bring about changes beneficial to the organism, confirmed by metabolic state receptors and sense organs. This results in a feedback cycle between internal states, behavior, and sensory input.

In accordance with cybernetic principles, the BAL must possess an internal model of its environment. Without it, the system could not adjust behavior based on past outcomes or anticipate the effects of its actions.

In other words, it has an internal model of those parts of the world that are relevant to its behavior. This brings us to the next element in the framework, which is called the "neuronal proxy." This compound word simply denotes neuronal states or configurations – either distributed or localized – that persist and stand for given elements in the external environment. That's why they are called "proxies." There is nothing complex or representational about them. Think instead of the traditional Micronesian stick charts – no longer used today, in former times they were delicate lattices of sticks, strings, reeds, and shells that mapped the sea by mirroring its features. No names, no coordinates, only a sort of one-to-one mapping. The structure in these stick charts was the knowledge they contained. A curve of reed marked a current. A knot meant an island. The chart didn't describe the ocean; it stood in for it. In just the same way, these neuronal proxies don't "represent" things in the usual symbolic sense. They don't explain the world. They hold its shape. And by adjusting their configuration, the brain at large can steer behavior – pushing the organism toward its next goal state, closer to what its biology demands.

The identity of these proxies – their relationship to elements, relationships, and qualities in the environment – can be deduced by observing behavioral patterns across species. Scientists observe, for example, squirrels with the ability to distinguish between perishable and nonperishable food as a basis for whether or not to store a food item (Hadj-Chikh, Steele, & Smallwood, 1996). They also observe ravens that are able to select and use appropriate tools in novel settings, in carefully designed experiments (Veit et al., 2025). Such observations reveal that internal structures corresponding to objects and qualities are formed through past experience – structures that exhibit a behaviorally verified, enduring fixed identity. In humans, there are further ways to identify these proxies, including cases where associated bundles of qualities naturally seen as constituting a discrete element in the environment can split, recombine, or generalize. A classic example is the furriness transfer in Watson's Little Albert experiment (Watson & Rayner, 1920). Some proxies reflect elemental features the brain uses to organize its internal model of the world – like a hard edge or a warm lap, as opposed to discrete objects an organism might interact with. Others are more layered, built up over time and shaped through reinforcement and repeated exposure. Their structure tends to be idiosyncratic and variable, and not necessarily ruled by the tidy categories of the words used in human language. In nonhuman animals, these proxies operate entirely without words. And even in humans, they retain their nonlinguistic form – they serve as a basis that informs language, which is superficial in relation to these underlying, nonlinguistic proxies. A detailed account of these architectures lies beyond the scope of the present paper, but readers interested in further exploration are referred to the full exposition of the framework in the book-length text *Seven Dialogs between Haplous and Synergos* (Norman, 2025).

These proxies are shaped through interaction. They form and adjust through activity-dependent plasticity (Hebb 1949; Kandel 2001), and they persist only if they're useful. If acting on a proxy brings the organism closer to a goal, the pattern stabilizes. If it doesn't, it fades or shifts. The system learns by success and failure, one outcome at a time.

At any moment, there will be an active configuration of proxies, which constitutes the BAL's internal model of its environment in the current situation. The links between them – connecting causes to effects, locations to objects, actions to consequences – form a structure the BAL can use to decide what to do. It's not a question of blind choice and trial and error, but about prediction: anticipating how the sensory world will shift depending on what it does next. And deciding which actions will bring it toward its goal state.

This entire system – the BAL, its proxy-based internal model, and its reliance on sensory feedback – is capable of supporting complex, adaptive behavior. And in most animals, it accounts for the full range of cognition. It operates without language, and without the particular kind of internal access that will be discussed in the next section (2). This intrinsic competence of the BAL, capable of sophisticated processing and guidance without reportable awareness, serves as the necessary baseline upon which later capabilities, including subjective experience, are built – thus suggesting that competence without reportable presence is a widespread feature of cognition, not merely an anomaly.

2. Two Evolutionary Add-Ons

2a: Interindividual communication

While the BAL alone is generally sufficient for adaptive behavior, something further developed in humans – something that allowed for a new kind of coordination between individuals. That development wasn't magic, and it wasn't separate from the rest of the system. It was a new tool, grounded in the same principles of function and feedback.

The framework calls this tool the *proxy transfer device* (PTD). Others might call it the language faculty, but that term often comes loaded with assumptions. Here, we define it only by what it does: it allows one BAL to convert its currently active proxy configurations into signals that another BAL can receive and then use to activate the same or similar proxy configurations within its own internal model.

The BAL uses the PTD in the same way it uses any other tool. It can initiate its use, just as it initiates the action of reaching out a hand, walking, or vocalizing. And the likely reason it took hold in evolutionary terms was simple: it allowed internal states – what the BAL is tracking, thinking, or feeling – to be transferred across individuals in a structured and usable form.

Next comes a key assumption, but an entirely plausible and perhaps necessary one: for this tool to be of any use to the BAL, the transfer must be proxy-based. Proxy activation on one end, and proxy activation on the other. Meaningful communication, in this system, isn't about symbols or ideas in the abstract. It's about activating one proxy configuration in one BAL, and triggering a matching activation in another. That's the essential purpose of this system, its whole point. Since these proxies are the BAL's fundamental functional elements – its internal correlates of environmental or bodily significance – they must form the basic units of meaning.

To achieve this transfer of proxy configurations, the PTD operates through a structured, multi-stage pathway that translates internal proxy configurations into external signals and – on the receiving end – back into internal states. On the expressive side, the process begins when the BAL selects a proxy configuration for outward transmission. It does so to achieve a goal, using the PTD as it would any tool. It activates the PTD the same way it moves a hand or begins to walk – it simply initiates the action. After initiation, the signal passes through increasingly concrete stages as it moves toward externalization:

Output (o-series): Encoding

(Production stages broadly in line with classic stage models; cf. Levelt, 1989.)

- o1. Concept selection. From among its overall proxy configuration, the BAL strategically selects a subset it intends to externalize (the intended message).
- o2. Message structuring. The conceptual content is organized into a preverbal message format – ordering, scope, and intended relations.
- o3. Linguistic encoding. The message is converted into linguistic form: lexical choice and syntactic frame are assigned.
- o4. Phonological/gestural encoding. Words are converted into sound structures, gestures, or graphemic units; motor programs are prepared.
- o5. Articulation. Motor plans are executed – speech, writing, or gesture – and the signal enters the environment.

(between the two series lies the environment)

Input (i-series): Decoding

- i1. Signal detection. Sensory organs detect the external signal – sound waves, graphemes, or gestures – and transduce them.
- i2. Phonological/gestural parsing. The continuous signal is segmented into discrete symbolic units (phonemes, graphemes, gesture primitives).
- i3. Lexical/syntactic parsing. Units activate stored proxies for words and grammatical relations; the stream is assembled into syntactic frames.
- i4. Message structuring. The syntactic frame is integrated into a coherent “message-level” configuration, reflecting semantic scope and relations.
- i5. Concept reconstruction. The BAL incorporates the structured message as a proxy configuration, ideally corresponding to the sender’s original o1.

In other words, the o-series and i-series are the output and input channels. Think of parallel rails linked by rungs, like a ladder. In functional terms, this PTD structure extends from an individual BAL and connects to similar PTD structures of other individuals. This allows for the transfer of proxy configurations. Expressive output moves outward toward articulation, while receptive input moves inward toward conceptual reconstruction. The stages in each channel are congruent, and there is natural resonance across the rungs between corresponding stages.

The existence of this resonance is well established: the TRACE model shows bidirectional links extending backward and forward within the input channel (McClelland & Elman, 1986), while research in psycholinguistics and neuroscience demonstrates exchanges between the two channels – comprehension routinely draws on production (Pickering & Garrod, 2013), and production likewise draws on comprehension (Hickok & Poeppel, 2007). In the initial development of speech, the infant learns auditory-motor mappings based on its babbling (e.g., the DIVA framework: Guenther, 2006; Tourville & Guenther, 2011), and studies with infants have also demonstrated that processes of speech comprehension draw on motor areas on the production side (Imada et al., 2006). I use “resonance” as shorthand for what is often called production-comprehension coupling or functional cross-activation across corresponding stages of the two channels; the cited work supports the coupling phenomenon, not this particular label.

2b. Looping

From infancy onward, this resonance ensures that every expressive act comes paired with its own shadow of meaning. When a baby babbles, the o-series does not just drive sound outward; it reverberates into the i-series, producing a felt gist of what is being said. Over time, the BAL learns that it does not need to carry the sequence all the way through to articulation. By truncating the o-series before the final motor act, it can still experience the internally generated gist. This shift – sensing meaning in incipient expression without speech – is the foundation of looping. Looping can begin as far outward as phonological encoding (o4); activity at this stage can propagate inward through lexical and message-level integration to produce a gist-like proxy configuration without overt articulation.

Once established, looping becomes the foundation for a range of higher operations:

- Recollection: forming a potential expression about past experience and looping it to reawaken the relevant proxies.
- Imagination: forming possible expressions about unreal scenarios and activating their associated proxies.
- Planning: looping proxy sets to simulate outcomes before acting.
- Conscious perception: reinforcing incoming input by shaping it for expression, then experiencing the reactivation (this step operates within the limits of overview and focus).

Because the PTD is sequential, these operations are inherently serial. You cannot deeply recall a memory and fully analyze a visual scene at once. What feels parallel is just fast switching.

Most important, this defines the boundary of subjective experience: if something cannot be prepared for expression, it cannot be looped. And if it cannot be looped, it is not available to conscious awareness. Looping marks the functional edge of the reportable mind. It is also important to note that most experiments in split-brain research have not been designed to distinguish looping from direct output. In those cases, what gets reported may simply be the output of the o-series, not the reactivation of proxies through looping.

3. Looping as a tool

This internal shortcut forms a self-contained feedback loop, allowing the BAL to sense and make use of its own incipient signals before they ever reach the world. In doing so, it reuses a pathway that was originally structured for outward expression – but now turned inward, for internal inspection. This is a clear case of neuronal reuse (Anderson 2010): the BAL learning to leverage a system developed for one purpose – external communication – to support a new one: internal processing. It does so functionally, not through an additional circuit or module. The same physical structure, running on the same principles, becomes a new kind of tool, once the BAL learns to use it that way.

When the BAL learns to use this shortcut, a new kind of operation becomes available, which provides the basis for the full range of activities typically associated with human subjective experience:

Recollection, where the brain at large begins to form an expression about prior experience, based on internal states – much like an archaeologist interpreting artifacts at a dig site. These potential expressions are then looped, activating proxies akin to those triggered during the original experience; Imagination, where possible expressions are considered and looped, bringing about proxy activations corresponding to hypothetical situations; Planning, where the brain uses expressive potential to pretest proxy configurations for viability; and Conscious Perception, where the brain at large examines and reinforces incoming sensory input by preparing potential expression about it, which gets looped back onto the same or closely overlapping neuronal proxies – though with some difference, due to the patterning imposed during the initial semantic workup in the expressive output pathway.

All of these rely on the same mechanism – looping through the PTD. And because the PTD is an internal channel that operates in sequence, these modes are inherently serial. One cannot vividly recall a memory and fully examine a visual scene at the same time. What feels like parallel experience is, within this framework, the result of rapid serial switching – not genuine simultaneity in the loop.

This process leads to a natural boundary. The domain of loop-accessible experience is coterminous with the domain of potential expression. If something cannot, even in principle, be shaped for expression through the PTD – whether through language, gesture, or symbol – then it is not subject to looping. And if it is not subject to looping, it does not enter into what we recognize as subjective experience. Reportability, in this functional sense, may thus define the practical boundary of this mode of awareness.

These functional operating principles underlie the analysis to follow. For the case of split-brain phenomena, the key distinction lies between the foundational competence of the bilateral BAL and the specific, often lateralized, function of the PTD/looping mechanism that enables reportable subjective examination.

4. Modeling Assumption: Functional Isolation Post-Callosotomy

Although some low-level coordination may remain after callosotomy – things like posture, mood, or general arousal – these are likely handled by subcortical systems, such as hypothalamic inputs, rather than any continued sharing between the hemispheres. For clarity, we'll work from a simplified model: once the corpus callosum is cut, the two sides no longer share intentional states or proxy configurations. Each hemisphere runs its own BAL, guided by its own inputs. The main disruption lies in the loss of proxy-level sharing – and in the fact that only one side typically retains access to the PTD and looping. That assumption fits well with what's been observed in experiments: after the split, the hemispheres can no longer coordinate on higher-order tasks that depend on internal sharing.

It should be noted that the BAL-looping interpretation does not require or predict a total, absolute split between the two hemispheres when the corpus callosum is severed. In the normal unsplit brain, the PTD is embedded within the left hemisphere and is connected to all relevant proxies on both sides – either through the rich associative fibers in the left hemisphere, or via commissural connections and then associative fibers to proxies in the right hemisphere.

So what happens after the split? Since the corpus callosum is by far the largest commissural connection, when it is severed the PTD loses most of its connections with relevant proxies in the right hemisphere. We must remember, however, that the corpus callosum is not the only commissural connection. There are various others, and although they are small, these could allow for some connection between the PTD and portions of the right hemisphere. Moreover, with neuroplastic adjustments over time, these connections could be strengthened.

Therefore, various recent experimental findings that raise questions about the classical near-total "split" following callosotomy are not surprising. Some patients have been found to show greater cross-hemispheric coordination in certain tasks than were reported in the classical studies – including some forms of pointing with both hands, visually guided action, and even limited reportability for certain proxies in specific tasks (de Haan et al., 2020). These cases are compatible with the BAL-looping framework under the assumption that some portions of the right-hemisphere proxies have retained, or reformed, connections to the PTD through the other commissures, aided over time by neuroplastic workarounds.

5. Explaining Split-Brain Dissociations

With the framework laid out, and this modeling assumption in place, the split-brain findings fall into place. They follow naturally from how the system is built. For clarity, we'll stick with the usual case – where the PTD and looping mechanism sit in the left hemisphere. Notably, none of the classic split-brain experiments were designed to isolate looping; nearly all observed behaviors could have resulted from direct output via the o-series alone.

▪ Action without Reported Awareness: A stimulus presented to the right hemisphere (e.g., in the left visual field) activates proxy configurations within the right-side BAL. This hemisphere remains behaviorally competent: it can guide its own contralateral response, such as the left hand selecting the correct object (Sperry 1968). However, the left hemisphere – where the expressive PTD is typically located – has no access to the right-side proxies and therefore cannot report the stimulus. This does not mean the stimulus was not processed, nor that it failed to influence internal states on the right. It means only that the hemisphere equipped for verbal expression cannot access the relevant content. The dissociation is straightforward: the right hemisphere processes input to guide its own behavior; the left hemisphere can report, but only on what it can access.

▪ Confabulation: When the right BAL initiates an action and the left hemisphere is asked to explain it, the left side has no access to the proxy configurations that gave rise to the behavior. It reconstructs a plausible explanation using whatever is locally available: contextual cues, memory fragments, and general knowledge. This is not deception, but the BAL behaving as it always does when data are missing – filling in the gaps. The left hemisphere acts like a “naïve archaeologist,” assembling a coherent story from fragments (cf. Schacter 1996; Gazzaniga 1985; Gazzaniga 1998). The resulting verbal account feels confident not because the system has access to the true cause, but because under normal circumstances, this same reconstructive process tends to yield reliable results – so there is no evolutionary need for a built-in uncertainty gauge.

▪ Right Hemisphere Competence (e.g., pointing/spelling): Although the right BAL lacks access to the PTD – and so can’t produce speech or engage in looping – it still retains full proxy-based competence. It can recognize objects, recall words it’s seen before, and guide the left hand to point or spell them using charts or letter tiles. These behaviors reflect real understanding, built from proxy associations and purposeful action. But they happen without the help of internal language structure or expressive rehearsal. The right BAL acts like a trained but nonverbal agent: it can map visual forms to meaning, based on experience, but it can’t carry out even a simple semantic workup. That function belongs to the PTD – and without it, the system can’t shape or structure new content for expression.

▪ No Access to Verbal Input: Because the right hemisphere lacks the PTD, it can’t decode structured verbal input into proxy configurations. Spoken instructions don’t trigger meaningful internal states on that side. It’s not that the system fails to comprehend; it’s that the required pathway just isn’t there. There’s no route from the incoming signal to the proxies it would need to act on.

▪ Apparent Unity vs. Subjective Division: Even with the corpus callosum cut, behavior can still appear coordinated. That’s not just because both sides are responding to the same environment – it’s also because they’re regulated by shared systems beneath the cortex. Hormones, arousal mechanisms, and mood circuits are all shaped by structures like the hypothalamus, which help keep both hemispheres broadly aligned, even when they no longer share content. Those overlapping influences can keep the whole system looking coordinated from the outside – even though the core channels of internal access are now divided. But under this framework, the true division lies not in behavior, but in access to reportable internal content. Reportability depends on expressive infrastructure – specifically the PTD and its internal feedback loop – and this capacity is typically confined to one hemisphere, usually the left. The right hemisphere continues to act based on its own proxy configurations, but cannot express or internally examine them. The result is a superficially integrated system masking a deeper asymmetry in subjective access.

6. Clarifying Agency vs. Reportability

A common mistake in reading split-brain cases is thinking that if a person can't report what's happening inside, then there must be no one in there – no agent behind the action. That confusion makes sense. In everyday life, the part that acts is usually the part that talks about it. But once the corpus callosum is cut, that link is broken.

The right hemisphere still has a fully working BAL. It can model its surroundings, form goals, adjust its actions, and handle changes just fine. What it lacks is access to the PTD and the looping mechanism – the tools that allow for internal inspection and structured expression. So it can't report. But it still acts.

In this framework, agency and reportability are two different things. The right BAL is still an intelligent operator. It just can't say what it knows. And if we judge intelligence by what can be said, we're making a category error. Reportable experience is only one kind of operation. The lack of access to it doesn't make the system passive, unintelligent, or a non-agent. It is an agent without a voice.

7. Conclusion: Resolving the Enigma Through Functional Distinction

The persistent puzzles of split-brain research dissolve when seen through the functional lens developed here. The core distinction is not between two consciousnesses, nor between a "knowing" hemisphere and a reactive one. It's between the foundational competence of the brain at large – operating bilaterally through proxy-based models – and the unilateral access to reportability, which depends on expressive mechanisms typically housed in one hemisphere.

After callosotomy, each hemisphere retains its own BAL intact. What's lost is the sharing of proxy configurations. The nondominant hemisphere still functions competently, guiding behavior with its own internal models, but it lacks access to the expressive system required for subjective reporting. The dominant hemisphere retains that expressive capacity, but its view is now partial. When asked to explain actions it didn't initiate, it does what the BAL always does: it works with what it has – reconstructing meaning from fragments, often yielding a coherent, even if confabulated, account.

This reframes reportable consciousness not as a unified state spread evenly across the brain, but as a specific operation tied to one hemisphere's ability to express its internal proxy activations. Split-brain cases don't imply a fractured self (see Pinto et al., 2017); they show a break in expressive access. The underlying intelligence remains bilateral. What looks paradoxical from a consciousness-first view turns out, under a functional one, to be entirely expected. While classic experiments have not yet distinguished looping from direct output, the framework here makes clear that such a distinction could define the next frontier in understanding the structure of subjective access. The framework offered here avoids metaphysical speculation by focusing on what each part of the system is able to do.

Notably, classic split-brain experiments were never designed to differentiate between looping (the use of incipient PTD activity as a cognitive tool) and direct output through the o-series as a report to the researchers. That's a real gap in the literature. Future studies that isolate these two processes could clarify when reportable expression involves internal reactivation of proxy configurations, and when it proceeds directly through the o-series without looping. Split-brain conditions may offer a uniquely useful setting for observing this distinction – a kind of test case that could reveal how looping functions in ways less visible in the intact brain. The implications would reach far beyond split-brain cases – into what people have long referred to, somewhat loosely, under the placeholder term of "consciousness." The framework suggests that this, too, might turn out to be another puzzle that dissolves away once the system is properly understood.

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