The Grammar of Perception

Anil Seth's Controlled Hallucination and the Closure Framework: How the Brain Constitutes the World It Appears to Receive

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> *Perception is a controlled hallucination. It is a hallucination in the sense that it is internally generated, coming from the inside out. The control is what keeps it tied to reality: the sensory signals that correct the brain's predictions.*
> Anil Seth, Being You, 2021

> *Every finite closure generates remainder. The remainder is not noise. It is the proof that the grammar is finite.*
> CF Dietz, Consciousness, Closure, and the Cosmos, 2026

Abstract

Anil Seth is Professor of Cognitive and Computational Neuroscience at the University of Sussex and Co-Director of the Sackler Centre for Consciousness Science. His central thesis, developed across two decades of experimental and theoretical work and consolidated in Being You: A New Science of Consciousness, is that conscious perception is a controlled hallucination: the brain's best guess about the causes of its sensory signals, generated from the inside out and corrected by the outside in. Perception is not the passive reception of a pre-given world. It is an active construction, a prediction about what is out there held honest by the sensory remainder that the prediction does not fully account for. This paper argues that Seth's controlled hallucination is the closure framework's account of perceptual closure applied to the neuroscience of consciousness: the brain as a closure regime constituting a perceived world from sensory signals it can never directly verify, generating a perceptual reality that is organized by the closure's identity criteria and corrected by what the closure cannot absorb. Seth's beast machine account of conscious selfhood, the self as the brain's prediction of its own body's regulatory state, extends this to the first-person perspective: the sense of being a self is itself a controlled hallucination, a closure regime constituting a self from interoceptive signals. And Seth's divergence from the hard problem, his commitment to explaining the specific content of experience rather than the bare fact of experiencing, is the productive boundary between his empirical program and the closure framework's account of C as the primitive that his program must presuppose. Seth explains c, the organized content of consciousness, with extraordinary precision. C, bare conscious presence, is what makes his explanations possible.

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1. The White Paper That Stays White

Take a white sheet of paper from inside a room to outside in daylight. The wavelengths of light reflected from the paper change dramatically: the spectrum of outdoor light is very different from indoor artificial light, and the paper reflects both differently. If the brain simply reported the incoming light, the paper would appear to change color as you carried it. It does not. It stays white. The brain has corrected for the change in illumination, maintaining a stable perceptual representation of the paper's surface reflectance across changing viewing conditions.

This is color constancy, one of the simplest and oldest demonstrations in perceptual psychology, and Anil Seth uses it to illustrate something radical. The brain is not reporting what is out there. It is predicting what is out there. The prediction is constructed from prior knowledge about typical illumination conditions, about how surfaces reflect light, about what the paper probably is, and it is maintained across changing sensory input by updating the model rather than the perception. The white paper is not perceived as white because the brain detected whiteness. It is perceived as white because the brain predicted whiteness and the incoming sensory signals did not produce a large enough error to revise that prediction.

Follow this observation all the way in, Seth argues, and you arrive at something startling: every perceptual experience, not just color constancy but the entire experienced world, the red chair, the sound of traffic, the felt pressure of your feet on the floor, is a controlled hallucination. It is a prediction, a brain's best guess about the causes of its sensory signals, generated from the inside out and held honest by the outside in. The world you experience is not given to you by your senses. It is constructed by your brain and corrected by your senses. The correction is real and important. But the construction comes first.

This is Seth's central claim. It is also, the closure framework argues, a precise description of what any perceptual closure regime does: constitutes a world from sensory input that it can never directly access, generating facts that are organized by the closure's identity criteria and updated when the remainder, the sensory signals that the current prediction does not absorb, produces an error large enough to drive revision. Seth has described the grammar of perception in the language of predictive neuroscience. The closure framework names the structural logic his description presupposes.

2. Seth's Four Claims

Seth's account of consciousness and perception has four interconnected components developed across his experimental program and consolidated in Being You.

2.1 Perception Is Prediction: The Brain as Controlled Hallucination Machine

The brain does not receive a world through its sensory organs. It receives electrical signals that are causally related to the world through a chain of transduction, processing, and transmission, but that are not the world and do not resemble the world. Everything the brain knows about what is out there it has inferred from these signals. The inference is never direct: there is no point in

neural processing where the signal becomes the thing itself. The brain is always constructing a model of what is causing the signals, and that model is what consciousness presents as perception.

Seth calls this predictive processing: the brain maintains a generative model of the world and the body, produces predictions about what sensory signals should be received given that model, and compares the predictions to the actual incoming signals. Discrepancies, prediction errors, are used to update the model. The perceptual experience is the prediction, not the signal. What changes when prediction error accumulates is the model, and with it the experience. The experienced world is the brain's best current guess, not a report from outside.

The hallucination metaphor is precise. Ordinary hallucinations are perceptions that are entirely internally generated, not controlled by incoming sensory signals. Ordinary perception is a hallucination that is controlled: it is internally generated but tightly coupled to sensory input through the prediction error minimization process. When that coupling fails, when psychedelics suppress the brain's ability to update its model from incoming signals, the hallucination becomes uncontrolled: the model runs without correction and the experienced world loses its usual relationship to the physical one.

2.2 The Self as Beast Machine: Interoceptive Inference

Seth extends the controlled hallucination account from perception of the external world to perception of the self. The sense of being a self, of being a particular person with a particular body in a particular location, is itself a prediction. The brain maintains a model not only of the external environment but of the body it inhabits: its temperature, its heart rate, its metabolic state, its position in space. This interoceptive model, the brain's prediction of the body's internal regulatory state, is what generates the felt sense of being a self.

Seth calls this the beast machine account: the self is fundamentally a body-regulating machine, and conscious selfhood is the felt surface of that regulatory activity. The brain's predictions about the body's state, its moment-to-moment inference about what is happening inside, constitute the experienced self. When those interoceptive predictions are disrupted, as in certain neurological conditions or under the influence of certain drugs, the sense of self is disrupted with them. The self is not behind or beneath experience. It is a prediction, a controlled hallucination of the living body from the inside.

2.3 Consciousness Levels, Contents, and Self: A Tripartite Structure

Seth distinguishes three dimensions of consciousness that require independent explanation. The level of consciousness is how much consciousness there is: the difference between waking and dreamless sleep, between anesthesia and arousal. The content of consciousness is what experience is of: the particular colors, sounds, thoughts, and feelings that occupy experience at any moment. The self is the particular perspective from which experience is organized: the phenomenal character of being this experiencer rather than another.

This tripartite structure is useful because the three dimensions dissociate. A person under general anesthesia may have a reduced level of consciousness but detailed dream content. A patient with certain disorders of consciousness may have intact content while lacking the capacity to report

or integrate experience. The dimensions require different explanatory resources and probably have different neural implementations. Seth's experimental program addresses all three, but his most distinctive contribution is to the content dimension and the self dimension, through the controlled hallucination and beast machine accounts respectively.

2.4 The Real Problem: Content Over Chalmers

Seth explicitly sets aside the hard problem of consciousness, Chalmers's question of why there is any subjective experience at all, in favor of what he calls the real problem: explaining the specific content and character of conscious experiences in terms of neural mechanisms. The hard problem asks why experience exists. The real problem asks why experience is like this rather than like that, why pain feels painful rather than pleasant, why red looks red rather than blue, why the experience of seeing my hand is spatially organized in the particular way it is.

Seth's position is not that the hard problem is unreal or unimportant. It is that it may be unanswerable with current conceptual resources, and that the real problem is both tractable and scientifically productive. By explaining the specific content of experience in terms of specific neural mechanisms, we build up a detailed account of the relationship between brain and consciousness that may eventually dissolve the hard problem by showing that once all the real-problem questions are answered, nothing further needs to be explained. Or we may find that something genuinely remains. Either way, the real problem is where the scientific work is.

3. What Seth Needs

Seth's experimental and theoretical program is among the most scientifically productive in contemporary consciousness research. His controlled hallucination account is empirically tractable: it generates specific predictions about perception, hallucination, and the effects of clinical and pharmacological interventions on conscious experience. His beast machine account provides a grounded explanation of selfhood that connects consciousness to the biology of life rather than treating it as a purely cognitive phenomenon.

There are two questions Seth's framework does not close. The first is the relationship between predictive processing as a computational account and the felt quality of experience. Seth explains why the brain generates specific perceptual contents through prediction error minimization. He does not explain why those computations feel like anything. This is the hard problem, which Seth explicitly defers. The closure framework does not solve the hard problem either. But it names the structural position the problem occupies: C, bare conscious presence, is the primitive that Seth's real-problem program presupposes and cannot derive from the neural mechanisms it studies.

The second question is about the control in controlled hallucination. Seth uses the term to distinguish ordinary perception, which is tightly coupled to sensory signals, from pathological hallucination, which has lost that coupling. But what exactly is the sensory signal doing in the predictive process? Seth says it provides prediction error: the signal corrects the prediction when the prediction is wrong. But what is the signal itself? Seth describes it as a causal trace from the

physical world, but the nature of that trace, what makes it carry information about what is out there rather than being just another internal state, is not fully resolved in his framework.

The closure framework addresses both questions with a single structural account. C is the primitive that makes the felt quality of prediction possible: not a product of the prediction process but the condition under which the process is experienced rather than merely computed. And the sensory signal is the remainder that the current perceptual closure cannot absorb: the portion of what the closure opens onto that exceeds its current predictions and drives update. The signal is not a report from outside the closure. It is the remainder that every closure generates at its boundary, pressing back against the prediction that does not fully account for it. The control in controlled hallucination is the pressure of remainder on the current perceptual closure.

4. Two Concepts in the Language of Perception

The closure framework is introduced here at the minimum level needed to ground Seth's account.

4.1 Perceptual Closure: The Brain's World-Constituting Grammar

A closure regime is a system that stabilizes some content by drawing distinctions, establishing identity criteria, and maintaining lawful relationships among its elements. The brain's perceptual generative model is a closure regime in this precise sense: it draws distinctions between objects, surfaces, sounds, and textures; it establishes identity criteria for when a perceptual representation counts as stable and accurate; and it maintains lawful relationships among its elements through the predictive hierarchy that organizes sensory processing from low-level feature detection through object recognition to scene understanding.

The perceptual closure constitutes a world: the experienced environment of objects, surfaces, events, and relationships that occupies conscious attention. This world is not the physical environment described by physics. It is the physical environment as constituted by the closure's distinctions and identity criteria. The redness of the red chair is not a property of the chair's surface reflectance spectrum. It is a fact constituted by the visual closure's color-processing organization: a stable perceptual category maintained across changing illumination by the prediction mechanisms Seth describes.

Remainder is what the perceptual closure cannot absorb: the sensory signals that do not fit the current prediction, the prediction errors that accumulate when the model is wrong. Remainder is not noise to be filtered out. It is the pressure that drives perceptual updating: the signal from what the closure opens onto that the closure cannot currently constitute, pressing back against the prediction and driving revision. Seth's prediction error is the closure framework's remainder in the language of Bayesian inference. The correction that keeps the hallucination controlled is the remainder making itself felt.

4.2 C and c in the Language of Predictive Processing

Seth's real problem is about c: the organized content of conscious experience, the specific quality of what it is like to see red, to feel pain, to hear a voice. His program explains c by showing how the brain's predictive organization produces specific experiential contents through specific neural mechanisms. This is rigorous, productive, and important.

What Seth's program cannot explain, and what he correctly identifies as the hard problem, is C: the bare fact that the prediction feels like anything from the inside, that there is a subject for whom the controlled hallucination is experienced rather than merely computed. The closure framework names C as the primitive that Seth's program presupposes: not derivable from the neural mechanisms that generate c, but the condition under which those mechanisms are experienced rather than merely processed. Seth explains the architecture of the hallucination. C is what makes it a hallucination for someone rather than a computation for no one.

This is not a deficiency in Seth's program. It is the appropriate boundary of an empirical research program on consciousness. The real problem is exactly where Seth says it is: the specific content and character of experience, explainable through neural mechanisms, generating a rich account of c. C is the condition that makes that account both possible and incomplete: possible because experience occurs and can be studied, incomplete because the bare fact of its occurrence is not itself a product of the mechanisms studied. Thompson's neurophenomenology makes the same acknowledgment from the phenomenological direction. Seth makes it from the neuroscientific direction. The closure framework names what they both must presuppose.

5. Four Claims, One Structure

The vocabulary correspondence between Seth's neuroscience of consciousness and the closure framework is precise and practically important. What Seth calls the brain's generative model, the closure framework calls the perceptual closure regime: the organized system of distinctions and predictions that constitutes the experienced world. What Seth calls prediction error, the framework calls remainder: the sensory signal that the current closure cannot absorb, pressing back against the prediction and driving revision. What Seth calls the controlled hallucination, the framework calls perceptual closure activity: the constitution of a world from what the closure opens onto, constrained but not determined by the sensory remainder that keeps the closure honest. What Seth calls the beast machine, the framework calls interoceptive closure: the brain's prediction of its own body's regulatory state, constituting the felt self from the inside. And what Seth calls the real problem, the framework calls the study of c: the organized content of conscious experience that neural mechanisms produce and that the closure framework maps onto the organizational structure of the perceptual closure.

5.1 The Controlled Hallucination Is Perceptual Closure

Seth's phrase controlled hallucination captures both the constructive and the constrained character of perception with unusual precision. The construction is what the closure framework calls constitution: the perceptual closure producing a world from sensory signals rather than receiving a world from them. The control is what the framework calls remainder: the sensory input

that the current closure cannot absorb, that generates prediction error, that drives the closure to update its predictions.

The balance between construction and constraint is what makes ordinary perception different from pathological hallucination and from illusion. In ordinary perception, the closure is tightly coupled to sensory remainder: predictions are updated frequently, errors are small, and the constituted world closely tracks the physical environment. In pathological hallucination, the coupling is weakened: the closure runs on its own predictions without adequate correction from remainder, and the constituted world diverges from the physical one. In visual illusions, the coupling is locally disrupted: the closure is correct about most of the scene but constitutes a specific element incorrectly because the local sensory signals match a pattern that the closure's identity criteria assign to a different object or dimension.

5.2 The Beast Machine Is Interoceptive Closure

Seth's beast machine account of conscious selfhood, the self as the brain's prediction of its own body's regulatory state, is in closure framework terms the account of interoceptive closure: the brain maintaining a model of the body it inhabits, drawing distinctions between normal and abnormal regulatory states, establishing identity criteria for what counts as this body in this state, and constituting the felt sense of being a self from the interoceptive signals that the model cannot fully absorb.

The interoceptive remainder, the signals from the body that the current self-model does not fully predict, is what keeps the self-experience grounded: the felt sense of a heartbeat, of breathing, of hunger or satiation, of warmth or cold. These signals are not merely accompaniments to selfhood. They are the material from which the self-closure constitutes the felt self. When interoceptive signals are dramatically altered, as in certain dissociative conditions or under particular pharmacological interventions, the felt sense of self is altered with them. The self is not behind the body. The self is the closure that constitutes the body from the inside.

5.3 Prediction Error Is the Felt Pressure of Remainder

In Friston's free energy principle, prediction error is the signal that drives model updating: the mismatch between predicted and received sensory input that is minimized by revising either the model or the action. Seth extends this to conscious experience: prediction error is not merely a computational signal but the felt quality of being surprised, of encountering something that does not fit the current model, of having attention drawn to what the brain did not expect.

In closure framework terms, this is the felt pressure of remainder: the sensory signal that the current perceptual closure cannot absorb pressing back against the prediction in a way that is experienced rather than merely processed. The surprise when an expected face does not appear, the jolt when a step is shorter than anticipated, the cognitive friction of an unexpected word in a sentence, these are all the felt texture of remainder making itself known at the boundary of the current closure. Seth's prediction error is remainder with phenomenal character. The control in controlled hallucination is the remainder that keeps the closure honest by making its failures felt.

5.4 The Real Problem Is the Study of c

Seth's methodological commitment to the real problem over the hard problem maps precisely onto the closure framework's distinction between c and C. The real problem is tractable because c, the organized content of conscious experience, is produced by neural mechanisms that can be studied, manipulated, and modeled. The specific quality of pain, the spatial organization of visual experience, the felt sense of presence: these are all properties of c, the perceptual closure's constituted world, and they stand in determinate relationships to the neural mechanisms that implement the closure.

The hard problem is not tractable by the same methods because C, bare conscious presence, is not a product of the neural mechanisms that produce c. It is the condition under which those mechanisms are experienced. Seth is right that science should focus on the real problem and that progress there will eventually clarify what remains at the hard problem's location. The closure framework agrees and adds the structural account of why: once all the real-problem questions are answered, what remains at the hard problem's location is C, the primitive that was always presupposed and never derived. Whether that remainder constitutes a further problem or a dissolving of the problem depends on what one thinks C is. The CC-C framework has a view on that. Seth wisely suspends judgment and does the science.

6. Seth and Friston: The Experimental and Mathematical Sides of One Structure

Seth and Friston are the two thinkers in the series who address the predictive brain most directly, and they deserve to be read alongside each other. Friston's free energy principle provides the mathematical formalization of what Seth's controlled hallucination describes phenomenologically and experimentally. The free energy principle shows why prediction error minimization is the organizing principle of any self-organizing system that maintains its states against thermodynamic dissolution. Seth's program shows what that principle looks like from the inside, in the specific contents and qualities of conscious experience.

The closure framework connects them at the structural level. Friston's Markov blankets are the mathematical boundary of closure regimes: the computational formalization of how any closure distinguishes its own states from the states of what it is not. Seth's controlled hallucination is the phenomenological account of what it is like to be inside a perceptual closure: the world as constituted by prediction, corrected by remainder, felt from the inside as experience. The closure framework names the structural logic that both are formalizing: a system that draws distinctions, constitutes facts, generates remainder, and updates its constitution when remainder is too large to absorb.

Together, Friston and Seth provide the most complete available account of c in the series: the organized content of conscious experience as produced by a predictive hierarchy of closure regimes, each minimizing prediction error at its level, each constituting a portion of the experienced world, each generating remainder that drives the update of the closure above it. What neither provides is C. What both presuppose is C. The closure framework names it.

7. The Grammar of Perception

The white paper stays white. Across changing illumination, across the passage from indoor to outdoor light, across the warming and cooling of the day, the paper's color is held constant by a brain that knows what papers are, what illumination does, and what whiteness means for a surface that reflects light the way paper does. The brain is not reporting. It is predicting. The perception is the prediction.

Anil Seth has built a neuroscience of consciousness on this foundation. His controlled hallucination account is the most precise and experimentally grounded available description of how the brain constitutes the experienced world from signals it can never directly verify. His beast machine extends it to the self: the felt sense of being a person is the brain's prediction of its own body's regulatory state, a controlled hallucination of selfhood from the inside. And his real problem, the commitment to explaining the specific content and character of experience through neural mechanisms, is where the scientific work is and where Seth's program has made extraordinary progress.

The closure framework names the structural logic that Seth's program implements and presupposes. The brain's generative model is a perceptual closure regime: it draws distinctions, establishes identity criteria, constitutes a world from what it opens onto. Prediction error is remainder: the sensory signal that the closure cannot absorb, pressing back against the prediction and driving revision. The controlled hallucination is perceptual closure activity: constitution constrained by remainder, world-building kept honest by what the world presses back with. The beast machine is interoceptive closure: the self as a closure regime constituting its own body from the signals the body generates.

What Seth has not explained, and does not claim to explain, is why the prediction feels like anything. Why the controlled hallucination is experienced rather than computed. That is C, the primitive the closure framework places at the foundation of its account. Seth explains the grammar of perception with extraordinary precision. C is what makes the grammar speak rather than merely process.

References

Seth, A. K. (2021). Being You: A New Science of Consciousness. Dutton.

Seth, A. K., and Tsakiris, M. (2018). Being a beast machine: the somatic basis of conscious selfhood. Trends in Cognitive Sciences, 22(11), 969-981.

Seth, A. K. (2019). Being a beast machine: the origins of selfhood in control-oriented interoceptive inference. In Andy Clark and his Critics. Oxford University Press.

Seth, A. K. (2020). The brain as a prediction machine. In The Philosophy and Science of Predictive Processing. Bloomsbury.

Seth, A. K., and Friston, K. J. (2016). Active interoceptive inference and the emotional brain. Philosophical Transactions of the Royal Society B, 371, 20160007.

Friston, K. J. (2010). The free-energy principle: a unified brain theory? Nature Reviews Neuroscience, 11(2), 127-138.

Chalmers, D. J. (1995). Facing up to the problem of consciousness. Journal of Consciousness Studies, 2(3), 200-219.

Dietz, C. F. (2026a). Consciousness, Closure, and the Cosmos. v3.3.

Dietz, C. F. (2026b). The Grammar of Knowing: What Conscious Knowers Actually Have.

Dietz, C. F. (2026f). The Grammar of Prediction: Friston's Free Energy Principle and the Closure Framework.

Dietz, C. F. (2026p). The Grammar of Experience: Thompson's Enactive Mind and the Closure Framework.

Helmholtz, H. von. (1867). Treatise on Physiological Optics. Translated by J. P. C. Southall. Dover, 1962.

Clark, A. (2016). Surfing Uncertainty: Prediction, Action, and the Embodied Mind. Oxford University Press.

Author's Note

This paper is the fifteenth in a series engaging thinkers whose work converges with the closure framework developed in Consciousness, Closure, and the Cosmos. Anil Seth is Professor of Cognitive and Computational Neuroscience at the University of Sussex and Co-Director of the Sackler Centre for Consciousness Science. His book Being You: A New Science of Consciousness reached a wide general audience and earned recognition as one of the most important popular science books of recent years. His TED Talk on the subject has been viewed over fourteen million times. This paper is the most directly neuroscientific in the series: Seth works not at the intersection of biology and philosophy but at the intersection of computational neuroscience and philosophy of mind, using experimental methods to test specific predictions of the controlled hallucination account. The paper places Seth in deliberate conversation with Friston, whose free energy principle provides the mathematical foundation for what Seth describes phenomenologically and experimentally. Together they constitute the series' most complete account of c in neuroscientific terms. The paper also names the productive boundary between Seth's empirical program and the closure framework's philosophical claims: Seth explains c with great precision and wisely suspends judgment on C. The closure framework names C as the primitive that Seth's program presupposes. This is not a disagreement but a division of labor. The author welcomes engagement from Seth and from neuroscientists, philosophers of mind, and consciousness researchers who find the convergence between controlled hallucination and the closure framework either illuminating or contestable.