Absorption as Predictive Constraint:

A Mechanistic Extension of Predictive Processing for Durable Human Change

Abstract

Predictive processing frameworks model cognition as an inferential process in which organisms continuously generate predictions and minimize prediction error through perception, action, or model revision. These frameworks have unified diverse phenomena across perception, motor control, learning, and cognition. Despite their explanatory power, they remain underspecified with respect to a persistent empirical problem: experiences of comparable informational content, emotional salience, or motivational relevance often produce markedly different degrees of durable change. Some experiences reorganize behavior, belief, or identity in lasting ways, while others generate prediction error without producing stable model revision.

This paper proposes absorption as a predictive constraint that modulates when experience functions as evidence capable of updating higher-level predictive models. Absorption is defined as a configuration of attention in which competing predictions are attenuated, interpretive alternatives are temporarily suppressed, and learning signals are integrated with greater relative weight. Framed as a constraint rather than a distinct state or novel computational mechanism, absorption alters the inferential context in which existing predictive processes operate. We argue that this extension accounts for variability in learning and change outcomes by specifying a gating condition for durable predictive updating. The proposal yields distinct, testable predictions concerning learning rate, outcome durability, the limits of insight and effort, and the effects of repetition under different attentional configurations. Implications are discussed for learning, psychotherapy, and intentional behavior change.

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1. Introduction

Across domains concerned with learning, adaptation, and behavior change, outcomes remain strikingly variable. Some experiences produce rapid and durable changes in behavior, belief, or self-concept, while others—delivered with comparable informational content, emotional intensity, or repetition—produce only transient effects or none at all. This variability persists despite advances in technique, motivation theory, and cognitive modeling, suggesting that a key explanatory factor remains underspecified.

Predictive processing frameworks have provided a powerful unifying account of cognition by modeling the brain as a hierarchical inferential system that continuously generates predictions and minimizes prediction error. Within this view, learning occurs when prediction error leads to

model revision rather than being resolved through alternative strategies such as attentional reallocation or action. While this framework explains how learning can occur, it offers less precision regarding when experience leads to durable updating of higher-level predictive models.

In practice, prediction error is frequently generated without producing lasting change. Individuals may repeatedly encounter disconfirming information without revising beliefs, acquire accurate insight without behavioral change, or engage in effortful practice without consolidation. Conversely, relatively modest experiences can sometimes produce disproportionate and enduring effects. These observations suggest that beyond prediction error magnitude and precision weighting, additional conditions influence whether experience is treated as evidence requiring revision.

The present paper proposes that absorbed experience functions as a predictive constraint that modulates model competition and learning integration. By introducing absorption as a constraint on inference—rather than a phenomenological state or novel computational process—predictive processing gains a principled account of variability in durable change outcomes. This extension preserves the core commitments of predictive processing while specifying a gating condition for when experience counts as evidence capable of revising higher-level models.

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2. Predictive Processing and the Problem of Durable Change

Predictive processing accounts conceptualize cognition as the hierarchical generation and updating of predictions about sensory input, bodily states, and environmental contingencies. Prediction error signals discrepancies between expected and observed input, which can be resolved through perceptual inference, action, or updating of generative models. Precision weighting modulates the influence of prediction error, shaping whether discrepancies are attributed to noise or treated as informative.

This framework has proven generative across a wide range of phenomena. However, its application to learning and change reveals an explanatory gap. Prediction error alone does not reliably produce durable updating, particularly when higher-level models related to habitual behavior, belief, or identity are implicated. Disconfirming evidence may be acknowledged without revision, reinterpreted as context-specific, or compartmentalized in ways that leave core predictions intact.

Precision weighting partially addresses this variability by modulating the influence of prediction error. Yet precision alone does not fully explain why similar error magnitudes under similar motivational conditions can lead to divergent outcomes. Nor does it specify the experiential conditions under which prediction error is integrated into higher-level models rather than resolved locally.

In applied contexts, this gap manifests as inconsistent change outcomes. Techniques emphasizing insight, repetition, or effort often succeed in some cases and fail in others without clear mechanistic explanation. These patterns suggest that beyond prediction error and precision, additional constraints shape whether experience leads to durable predictive updating.

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3. Absorption as a Predictive Constraint

Absorption is defined here as a configuration of attention characterized by sustained coherence around a limited set of predictions and attenuation of competing interpretive frames. Importantly, absorption is not treated as a discrete psychological state, an altered level of consciousness, or a subjective depth marker. Rather, it is conceptualized functionally as a constraint on inference that alters the conditions under which predictive processes operate.

Under absorbed configurations, attentional resources are organized such that alternative predictions—counterfactual interpretations, evaluative commentary, or contextual reframing—are temporarily suppressed. This does not eliminate prediction error; instead, it reduces the availability of competing explanations that would otherwise absorb or neutralize its informational impact. As a result, discrepancies encountered under absorption are more likely to be integrated into the dominant predictive model.

Framing absorption as a constraint aligns with predictive processing principles. Hierarchical inference already depends on constraints such as attention, context, and precision weighting to determine which predictions dominate processing. Absorption can be understood as a higher-order constraint that stabilizes a particular predictive stream, reducing competition among models without introducing new representational entities.

This formulation distinguishes absorption from related constructs such as attention intensity, arousal, or engagement. High arousal or effortful focus does not necessarily produce absorption if it amplifies self-monitoring or competing goals. Conversely, absorption can occur at moderate levels of intensity when attentional coherence is high and interference is minimized. The defining feature is not subjective immersion but reduced competition among predictive alternatives.

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4. Mechanism: Constraint, Competition, and Learning Integration

Predictive systems maintain multiple candidate models that compete to explain incoming information. Under ordinary conditions, this competition supports flexibility and robustness but also permits discrepancies to be explained away without revising higher-level models.

Prediction error may be attributed to transient context, insufficient effort, or irrelevant variance, leaving core predictions unchanged.

Absorption alters this dynamic by constraining the space of active competing models. When attention is coherently organized around a limited predictive stream, alternative interpretations lose influence. Prediction error generated under these conditions is less easily compartmentalized and more likely to be integrated into the dominant model.

This mechanism improves learning efficiency not by amplifying error magnitude, but by reducing interference. The signal-to-noise ratio of learning increases because discrepancies are processed within a constrained interpretive context. This explains why experiences of similar content or intensity can have divergent effects depending on attentional configuration at the time of encoding.

The constraint account also clarifies why insight and effort often fail to produce change. Effortful control can increase internal commentary and evaluative monitoring, expanding the space of competing predictions. Insight delivered outside absorbed configurations may be processed as information without being treated as evidence requiring revision. In both cases, prediction error is present but insufficiently integrated due to high competition among models.

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5. Durability, Repetition, and Higher-Level Updating

Durable change requires not only initial model revision but also consolidation across contexts. Higher-level predictions related to identity, habitual behavior, or self-concept exhibit greater inertia because they integrate information across longer time horizons. Updating such models typically requires repeated evidence under conditions that consistently favor revision.

The present framework predicts that repetition under absorbed configurations will produce more durable updating than isolated high-intensity experiences. Singular events may fail to reorganize higher-level models if absorption is brief or unstable. In contrast, moderate absorbed experiences repeated over time provide multiple opportunities for incremental revision, allowing updated predictions to generalize across contexts.

This account distinguishes rate of updating from potential for change. Individuals may differ in how readily they enter or sustain absorbed configurations, influencing the efficiency of updating. These differences do not imply fixed limits on the magnitude of change but suggest that timing, stability, and dosing of absorption are critical variables.

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6. Testable Predictions

Introducing absorption as a predictive constraint yields several testable predictions that differentiate this proposal from existing accounts:

1. **Absorption as Moderator:** Manipulations that increase absorption—operationalized as reduced prediction competition—should enhance learning and updating even when prediction error magnitude and expectancy are matched. Failure to observe this moderation would challenge the constraint account.

2. **Durability over Intensity:** Outcome durability should correlate more strongly with stability and coherence of absorbed configurations than with intensity of isolated experiences.

3. **Repetition Effects:** Repetition under absorbed conditions should produce incremental predictive updating, whereas repetition without absorption should primarily increase familiarity without durable revision.

4. **Insight Failure:** Insight delivered outside absorbed configurations should predict limited behavioral or identity-level change despite accurate understanding.

5. **Individual Differences:** Measures indexing susceptibility to absorption disruption should predict variability in change outcomes beyond trait absorption or engagement measures.

These predictions can be evaluated using experimental designs that manipulate attentional coherence and interference while controlling for error magnitude and expectancy.

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7. Boundary Conditions and Limits

Absorption is proposed as an enabling condition, not a sufficient cause of change. Updating may fail when experiences target inappropriate model levels, when environmental reinforcement contradicts revised predictions, or when competing incentives stabilize existing models. Additionally, absorbed encoding of inaccurate information may stabilize maladaptive predictions, underscoring the importance of accuracy and context in absorbed updating.

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8. Discussion

By introducing absorption as a predictive constraint, this paper extends predictive processing frameworks with a principled account of when experience becomes evidence capable of durable model revision. The proposal preserves the inferential architecture of predictive processing while specifying a missing condition governing learning variability.

This extension clarifies why insight, effort, and repetition yield inconsistent outcomes and why timing and context exert disproportionate influence on change. It also provides a foundation for ethical considerations, as absorbed updating carries both transformative potential and risk when inaccurate information is encoded.

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9. Conclusion

Predictive processing offers a powerful account of cognition as inference but remains underspecified with respect to the conditions under which experience produces durable change. By framing absorption as a predictive constraint that modulates model competition and learning integration, this paper accounts for variability in learning and adaptation without introducing new computational primitives. Future empirical work can test and refine this proposal, advancing a more precise understanding of how and when experience reshapes predictive models.

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