DOCUMENT SUMMARY

This paper proposes a foundational framework for integrating evolutionary, cultural, and computational approaches to psychiatry into a single, multilevel systemic model called the Evolutionary, Cultural, and Computational (ECC) model. It argues that mental disorders are not reducible to biology but emerge from complex interactions between evolved vulnerabilities, developmental trajectories, and the "looping effects" of cultural labels and social systems. This work provides direct, powerful scientific justification for Enlitens' mission by critiquing bioreductionist approaches (like the RDoC and DSM), validating the need to understand an individual's unique social and cultural context, and offering a formal method (computational phenotyping) for modeling the whole person, not just their brain circuitry.

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METADATA

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CRITICAL QUOTES FOR ENLITENS

- "In the notion of ‘Harmful dysfunction, the harmful and the dysfunctional must be given equal scientific consideration."
- "However, objects classified as human kinds, such as mental disorders, do not only undergo efficient causality; they undergo practical causality that is, they change their behavior by virtue of the act of being classified or labeled."
- "The resultant models of pathology trace the circuits of the mind, which reside not only in the brain but in the social world."
- "Unfortunately, we have no animal models of many distinctive components of human experiences relevant to mental health and illness, such as narrativity, morality, racism, political violence (91)."

- "Reductionism thus is bound to operate with a stripped-down biology that emphasizes brain circuitry over psychological functions and social systemic processes."
- "In short, active inference assumes that, along with many other functions, perception and action are processes of inference in the brain..."
- "Crucially, to reach the MDD state, the agent had to be endowed with a fixed prior preference for high social reward that would incentivize her to keep exposing herself to social partners, despite continued negative evidence (or outcomes)."
- "Indeed, the goal of the ECC model is to allow researchers and clinicians to consider how phenomena like adaptation can contribute conceptually to an understanding of culture, and vice versa, that is, how cultural context and meaning shape the exigencies and outcomes of adaptation in health and illness."

KEY STATISTICS & EVIDENCE

- **Negative Interpretation Bias in MDD:** Patients with Major Depressive Disorder (MDD) form negative sentences more often and more quickly than healthy controls when given both optimistic and pessimistic options in tasks like the scramble sentence test.
- **Attentional Bias in MDD:** In eye-tracking studies, depressed patients gaze for longer periods at negative stimuli (information about negative outcomes) and spend more time examining them. They also report less positive emotion when viewing positive images and more arousal in response to aversive images.
- **Rumination in MDD:** Rumination is often driven by a belief that it will lead to insights that can solve the problems causing the rumination in the first place.

METHODOLOGY DESCRIPTIONS

The Evolutionary, Cultural, and Computational (ECC) Model

The paper proposes a unified framework called the Evolutionary, Cultural, and Computational (ECC) model, which aims to integrate the three distinct approaches into a single systemic view of mental disorders.

- **Evolutionary Component:** Uses "adaptationist thinking" to understand mental traits as potential vulnerabilities that stem from phylogenetically old adaptations. It leverages concepts like mismatch theory, constraints, and trade-offs to explain why evolution has left humans vulnerable to certain disorders. In the model, these are represented as "adaptive priors" that are endowed by evolution and are slower to change than learned beliefs.
- **Cultural Component:** Focuses on the "looping effect of human kinds," where social labeling and cultural models shape an individual's experience, behavior, and even biology. It defines culture as shared knowledge, practices, and values that are modeled as the calibration between an agent's generative model and the generative model of their environment (including other people and institutions). It explicitly incorporates the social and constructed nature of "harm".
- **Computational Component:** Uses active inference as a formal framework to model the other two components. It employs "computational phenotypes"—generative models whose parameters (priors) can be adjusted to simulate a specific individual's or group's

cognition and behavior. The framework is extended to create "ecosocial computational phenotypes" that model the dynamics of the entire agent-environment system, not just the brain.

THEORETICAL FRAMEWORKS

Evolutionary Psychiatry: Adaptationist Thinking

Evolutionary psychiatry attempts to distinguish between disorders and protective responses by exploring the plausible evolutionary functions of the mind and brain. It often uses adaptationist reasoning, which focuses on natural selection's role in shaping mental traits. The core question is "why are we vulnerable to some mental disorders?". The answer is that ultimate causes (evolutionary pressures) shape genetic traits that can be expressed as vulnerabilities under certain proximate (developmental) conditions.

- **BOX 1 | Adaptationist explanations for psychopathology.**
    - **Mismatch:** Vulnerabilities emerge when there is a mismatch between evolutionarily old dispositions and the current cultural or developmental environment. This happens when the environment changes faster than individuals can adapt.
    - **Constraints:** A vulnerability may be preserved by natural selection if the cost of adapting it away is higher than the cost of keeping it. For example, the cost of reengineering the human birth canal is higher than the risks of childbirth.
    - **Trade-offs:** This "smoke detector" principle suggests it is often more cost-efficient to select for traits that produce false alarms (like anxiety) than to fail to detect a genuine threat. Heightened sensitivity to anxiety increases fight-or-flight success but also creates vulnerability to anxiety disorders.

Cultural Psychiatry: Looping Effects and the Ecosocial Model

Cultural psychiatry argues that human neurobiology is fundamentally social and that mental disorders are configured at subjective and social systemic levels. It focuses on the "looping effect of human kinds," a concept developed by Ian Hacking.

- **The Looping Effect:** Unlike "natural kinds" (e.g., atoms), "human kinds" (e.g., people with a specific diagnosis) change their behavior *because* they are classified. A person can become aware of their label and may change their behavior based on their understanding of that label, self-perception, or the internalization of social stigma. This creates a feedback loop where diagnostic categories and treatments can reshape clinical presentations, which in turn reinforce the validity of the category.
- **Ecosocial Model:** This model views humans as part of a hierarchically organized, dynamical social ecosystem that includes the brain, body, and the social/physical environment. Psychopathology can arise not just from dysfunctions in a single component, but from the systemic dynamics and feedback loops that connect them. The models of pathology must trace the "circuits of the mind, which reside not only in the brain but in the social world".

Computational Psychiatry: Active Inference and Computational Phenotypes

This approach uses computational models to understand the mechanisms of psychiatric disorders. The paper focuses on active inference, which views the brain as an organ that predicts sensory inputs and the effects of its actions.

- **Pathology as Suboptimal Inference:** Mental disorders are defined as a failure of cognitive functions like perception and action, or "Bayesian suboptimality". The key question is: "Assuming that the brain operates optimally, how is it that the brain can generate suboptimal behavior?". The answer is that the optimization process "goes wrong" due to factors like lesions, neurodevelopmental anomalies, or changes in brain circuitry resulting from environmental interactions and learning histories.
- **Ecosocial Computational Phenotypes:** This approach extends the idea of a phenotype beyond the brain to include the agent's interaction with their environment. Just as a brain makes inferences about its sensations, the environment (including other people) can be modeled as making inferences about an agent's actions. This allows for a formal, principled way to model the relationship between neurocomputational processes (e.g., attention), ecological features (e.g., social cues), and culturally patterned looping dynamics.

POPULATION-SPECIFIC FINDINGS

Major Depressive Disorder (MDD) Under the ECC Model

The paper uses MDD as a prime example to illustrate the integrated ECC model.

- **Core Computational Failure:** MDD symptoms like anhedonia and diminished drive are modeled as failures in evaluating long-term rewards ("secondary utility"). This dysfunction is often caused by the acquisition of "pessimistic priors" that bias the learning of environmental states.
- **Reinforcing Pessimistic Priors (The Depressive Loop):**
    1. **Biased Attention:** Pessimistic priors guide a person's attention toward negative information, as these cues are deemed more informative for confirming their beliefs (a process called self-evidencing).
    2. **Rumination:** The person engages in rumination, persistently focusing on their depressive state and its negative causes and consequences.
    3. **Biased Learning:** This constant sampling of negative information reinforces and consolidates the pessimistic priors over time.
    4. **Cultural Reinforcement:** This internal loop is amplified by the external social world. As depression becomes a common diagnostic label, the associated "idioms of distress" become more available, guiding a person's attention toward experiences that conform to the label, further reinforcing the illness belief.
- **Evolutionary Component:** The tendency to learn pessimistic priors can be accelerated by an evolved predisposition to attend to threatening information, which has survival value. A computational study showed that an agent with a strong, fixed "adaptive prior" for social reward would continue to seek social interaction even in a volatile environment with negative outcomes. This persistence, adaptive under normal conditions, led to the development of pessimistic beliefs and social withdrawal characteristic of MDD, illustrating a "mismatch" between an adaptive prior and the current context.

PRACTICAL APPLICATIONS

The ECC model provides a framework for integrating diverse perspectives in psychiatric research and practice.

- **In Silico Testing:** ECC models can function as "heuristic descriptions of the brain" in its environment. Researchers can simulate pathological behavior and test the potential efficacy of various interventions (pharmacological, psychotherapeutic, social) by changing model parameters and observing the outcome. This allows for testing how sensitive illness trajectories might be to different interventions in more ecologically valid contexts.
- **Identifying Clinically Relevant Phenotypes:** ECC methods can be used to simulate specific types of cognitive and behavioral patterns associated with disorders. By fitting these models to large, diverse datasets—including data from social media interactions, psychophysics (eye-tracking), and neuroimaging (EEG)—researchers can identify and compare different computational phenotypes and their underlying mechanisms.
- **Bridging Disciplinary Boundaries:** By providing a common computational language, the ECC model can serve as a "multidisciplinary platform" that allows practitioners and researchers from different backgrounds (evolutionary, cultural, clinical) to see how their perspectives connect and converge, enriching each other's understanding of mental disorders.