Before the Prompt: Heteromorphic Imagination and the Cognitive Cost of Premature Crystallization in Human-AI Co-Creativity

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Abstract

Generative AI systems can enhance individual creative output while reducing the collective diversity of produced works. Current explanations for this paradox focus primarily on artifacts, model distributions, or design fixation. This paper proposes a complementary cognitive-phenomenological account grounded in the distinction between two modes of imaginative cognition: heteromorphic imagination, characterized by pre-articulatory associative play across real and unreal combinatory spaces, and creative imagination, in which emergent patterns achieve sufficient resonance to warrant articulation. We argue that prompt-based interaction imposes a demand for premature crystallization: a pressured translation from heteromorphic exploration into linguistically structured, model-interpretable expression. This demand can incentivize bypassing a cognitive phase that helps generate semantically remote, personally resonant, and meaning-bearing possibilities before they stabilize as concepts. Drawing on work on the Default Mode Network, divergent thinking, and dynamic switching between spontaneous and controlled cognition, we frame the neural component as a falsifiable hypothesis rather than an established effect. The resulting implication for computational creativity is that evaluation of human-AI co-creative systems should extend beyond outputs to upstream human cognitive processes and their possible long-term modification.

Introduction

A growing body of research has documented a paradox at the intersection of generative artificial intelligence and human creativity. Access to large language model outputs can enhance the perceived creativity of individual works, with benefits especially pronounced among less creative writers, while collective diversity decreases when AI assistance is introduced (Doshi and Hauser 2024). A reanalysis of brainstorming experiments similarly found that ChatGPT-aided conditions yielded less diverse idea pools across several embedding-based diversity measures (Meincke, Nave, and Terwiesch 2025). Exploratory work in engineering design education points in a related direction, suggesting premature convergence in AI-assisted teams, though with limited statistical power (Tsakalerou et al. 2026).

Existing explanations tend to operate at the level of the artifact or the model. Exposure to AI-generated images during visual ideation increases design fixation and reduces the fluency, variety, and originality of sketches compared with no-support and conventional image-search baselines (Wadinambiarachchi et al. 2024). Yet these accounts leave a prior question underexamined: what happens to the human cognitive processes that precede creative expression when the primary mode of interaction with a creative tool demands linguistic articulation as the point of entry?

This paper proposes that the answer requires attention to a distinct phase of imaginative cognition, which we have termed *heteromorphic imagination* (Polyak and Balkhyoor 2024). We argue that prompt-based AI interaction imposes a structural demand for *premature crystallization*: the translation of nascent, pre-articulatory ideation into language sufficiently explicit for a generative system to interpret. This demand can incentivize bypassing the heteromorphic phase, with potential consequences for the cognitive infrastructure that sustains meaning-bearing creative origination.

Heteromorphic Imagination as a Use-Dependent Capacity

Two Modes of Imaginative Cognition

Prior work distinguished two phenomenologically distinct modes of imaginative cognition (Polyak and Balkhyoor 2024). *Heteromorphic imagination* refers to the fluid play of mental associations, episodic memories, sensory traces, affects, and speculative projections that intermingle before they become stable enough to name. It operates across real and unreal combinatory spaces and resists premature categorization. Casey described each act of imagining as instantaneous, self-contained, and given all at once: an evanescent "mini-world" operating in "sheer time" rather than clock time (Casey 1976). Heteromorphic imagination extends this insight from discrete imaginative acts to their contamination of one another, where remembered, perceived, and speculative scenes mingle across temporal registers. The account also draws on phenomenological treatments of imagination, perception, and embodied projective possibility (Sartre 2004; Merleau-Ponty 2012).

Creative imagination, by contrast, emerges from heteromorphic imagination when a configuration becomes sufficiently coherent, novel, and personally significant to war-

rant capture and articulation. We call the transition between these modes a *metamorphic gesture*: a moment in which pre-articulatory associative play becomes directed toward expression. This framework differs from Boden's taxonomy of combinational, exploratory, and transformational creativity (Boden 2004). Boden's exploratory creativity presupposes movement within a defined conceptual space. Heteromorphic imagination names activity before such a space is necessarily bounded: the pre-articulatory interval in which episodic memory, sensory experience, counterfactual projection, and affective salience are still reorganizing.

Relation to Neighboring Constructs

Freud's primary-process thinking is the closest historical antecedent: heteromorphic imagination shares its tolerance for condensation, displacement, imagistic association, and non-propositional recombination, but it is not an account of dream-work, wish fulfillment, or drive discharge (Freud 1953). Divergent thinking research, by contrast, usually measures stabilized responses after reportable ideas have already formed; our term names the less reportable interval in which those possibilities are still reorganizing. Heteromorphic imagination is also compatible with contextual focus and honing theory. These accounts explain how creators shift between associative and analytic modes and recursively restructure a worldview around unresolved or high-entropy material (Sowden, Pringle, and Gabora 2015; Gabora 2017). The narrower contribution here is to identify a specific vulnerability created by prompt-based co-creative systems: they require a linguistic handle before this restructuring has necessarily matured.

The loss is the possible narrowing of semantically remote and meaning-bearing connection-making: the slow emergence of a felt, personally salient configuration before it becomes a stable instruction, prompt, or plan. Gendlin's process philosophy is useful here because it treats meaning as something that can be implicit, bodily, and not yet fully formed in propositions (Gendlin 2018). In this respect, heteromorphic imagination also intersects with accounts of inner speech, dialogic thought, and the gradual verbal mediation of cognition (Vygotsky 1987; Fernyhough 2008; 2009), while retaining a focus on what precedes or exceeds verbal form.

Heteromorphic imagination marks a zone that many theories presuppose but do not isolate at the level of interface design: the interval between diffuse associative movement and the first stable handle by which a creator can ask a system for help. Honing theory explains why creative work may proceed as recursive restructuring of an unresolved worldview; contextual focus explains how attention can shift between associative and analytic modes; divergent thinking tasks measure some reportable consequences of this activity. Heteromorphic imagination adds a design-relevant question: does the tool invite the creator to remain within this unresolved, pre-articulatory movement, or does it require the creator to crystallize a handle before the movement has matured?

Use-Dependent Neural Infrastructure

If heteromorphic imagination is a cognitive capacity, it is likely use-dependent. Neuroscience identifies the Default Mode Network (DMN) as centrally involved in spontaneous cognition, autobiographical simulation, and internally generated association. Creative idea production depends on dynamic coupling and switching between default and executive systems (Beaty et al. 2015; Chen et al. 2025). Causal evidence further indicates that disrupting DMN activity can impair originality in divergent thinking (Bartoli et al. 2024). While these findings do not prove that prompt-based AI use alters the DMN, they support the weaker claim that creative cognition relies on dynamic coordination between spontaneous and controlled systems, and that systematic changes in practice may matter for the capacities creators habitually exercise.

Training studies in other domains show that repeated practice can induce measurable structural change in the adult brain (Draganski et al. 2004). If creative practice increasingly routes early ideation through prompt formulation, creators may exercise prompt selection, evaluation, and linguistic refinement while exercising heteromorphic exploration less. Over time, such displacement could attenuate the cognitive routines that support pre-articulatory association. This remains a falsifiable longitudinal hypothesis.

The likely mechanism is attentional and procedural: users may gradually become better at converting vague intentions into promptable requests, while becoming less practiced at tolerating ambiguity, deferral, and internally generated associative drift. Such a shift could be adaptive for production environments and still costly for some forms of creative origination. The same user might produce more acceptable artifacts in less time while generating fewer idiosyncratic starting points, fewer delayed discoveries, or fewer ideas whose value only becomes apparent after a period of nonverbal incubation.

Premature Crystallization and Double Compression

Prompt-based interaction with generative AI requires a user to convert an emerging intention into language before the system can respond. For many creative tasks this is useful: language can focus attention, externalize possibilities, and become an exploratory medium in its own right. The risk arises when linguistic formulation is required too early. At that point, the creator must select a describable version of a not-yet-stable configuration, thereby replacing heteromorphic exploration with an instruction the system can process.

This process entails a double compression. First, pre-articulatory experience is compressed into natural language. Affective tone, bodily orientation, sensory atmosphere, and associative ambiguity must be reduced to describable content. Second, ordinary language is compressed into model-interpretable language: a prompt optimized for the probable behavior of the system. Beyond expressing an idea, the user learns to express it in ways likely to elicit productive completions. The prompt therefore potentially does more than communicate a prior intention, because it may reshape what

counts as a viable intention.

The important feature of this compression is that it occurs before the system's output appears. A writer who asks for "a haunting but hopeful scene about memory," a designer who asks for "futuristic organic furniture," or a composer who asks for "melancholic cinematic chords" has already selected a public, genre-recognizable, and model-legible route through a much less stable field of possibility. The AI response may then feel like expansion, because it provides fluency, detail, and variation. At the level of the user's prior cognitive search, however, the route may already have narrowed. This helps explain why individual judgments of quality and collective measures of diversity can diverge: the artifact is elaborated, while the upstream space of origination has been compressed.

This account complements work arguing that generative AI creativity is disembodied and constrained by the prompt as a thin channel of expression (Casacuberta and Guersenzvaig 2025). It also explains why AI assistance can increase productivity while narrowing diversity. If many users crystallize early ideas into similar promptable formulations, the resulting outputs may converge before the model produces anything. Alongside the model's distribution, the homogenizing force includes the cognitive adaptation users undergo when they learn to think in prompt-shaped units.

Poets, theorists, and prompt writers often discover ideas by writing them. Language itself can do exploratory work. Heteromorphic imagination is also distinct from nonverbal cognition. In music, dance, visual art, and design, crystallization may occur in sonic, motor, spatial, or material form without verbal description. A melody, gesture, or visual configuration can cease to be heteromorphic once it stabilizes as an auditory-motor or perceptual intention, even if it has never been named. In visual art, for example, the exploratory line or mark may carry thought forward before it becomes a concept, a point emphasized by phenomenological accounts of perception and painting (Merleau-Ponty 1993). The specific risk analyzed here is narrower: interfaces that require creators to translate an unstable configuration into model-interpretable instructions before they have had a chance to reach a metamorphic gesture. This risk is likely strongest in early ideation, novice practice, time-pressured production, and low-commitment generation; expert creators may avoid it by using AI only after self-directed exploration has produced a sufficiently formed intention.

Prompting can be beneficial in many cases: collaborative coordination, rapid prototyping, constraint satisfaction, and tasks where the creator already knows the intended direction. If a creative environment repeatedly rewards promptable fragments at the expense of slower heteromorphic development, then creators may adapt to that environment. The relevant design question is therefore when and through what interface AI enters the creative process.

Implications for Computational Creativity

Computational creativity has long recognized that evaluating creative products alone is insufficient. Colton argued that creative process and the perception of creativity must also be considered (Colton 2008), and Jordanous developed a multidimensional procedure for evaluating creative systems (Jordanous 2012). Our argument extends this process orientation to the upstream cognition of the human participant in co-creative systems. Current evaluation methods tend to assess what the human-AI dyad produces, and sometimes how the interaction unfolds, but rarely what the interaction does to the human's independent capacity for ideation.

This suggests the need for *longitudinal cognitive impact assessment*: studies that track changes in human creative capacity over extended engagement with prompt-based tools, using measures sensitive to divergent, associative, and recombinatory processes. Three testable predictions follow. First, early-prompt conditions should increase short-term fluency or elaboration while reducing semantic distance, intra-group diversity, or delayed originality relative to delayed-prompt conditions. Second, the effect should be strongest for novices, time-pressured creators, and tasks where users have not yet formed a stable intention. Third, interfaces that postpone linguistic prompting through sketches, fragments, sound, gesture, ambiguous stimuli, or staged incubation should preserve more heteromorphic exploration than linear chat interfaces requiring immediate declarative instruction.

These predictions could be tested without assuming that heteromorphic imagination is directly observable. Experiments could compare immediate-prompt, delayed-prompt, and non-prompt multimodal conditions; measure semantic dispersion, transformation distance, fixation, and delayed recall of self-generated alternatives; and include follow-up tasks after repeated use. Qualitative protocols could examine whether creators describe the AI as amplifying a prior intention, replacing an uncertain one, or teaching them to formulate intentions in prompt-shaped terms. The crucial dependent variable would be the evolution of the creator's ideational repertoire across time.

If the heteromorphic phase contributes to meaning-bearing creative origination, then tools that sustain rather than bypass this phase would be important. Systems that present ambiguous, incomplete, multimodal, or contradictory stimuli, rather than demanding precise linguistic input, might support associative and speculative exploration. Phenomenological study of one such interface, an ambiguous tactile input device used by twenty designers, describes how this kind of input can sustain imaginative flow during early ideation (Balkhyoor 2026). Other possibilities include interfaces that accept fragments rather than instructions, preserve rejected paths, encourage incubation before generation, visualize divergence across a session, or deliberately return outputs that resist the user's most conventional formulation. The goal is delayed articulation, allowing the creator time to dwell with unstable possibilities before forced articulation.

Many current systems optimize for responsiveness: the user says what is wanted, and the system supplies candidates quickly. A heteromorphic perspective suggests that some valuable systems may instead optimize for latency, ambiguity, and medium-sensitive exploration. Such tools would protect the upstream conditions under which the user can continue to become a source of unexpected meaning.

Limitations and Scope

The central limitation of this paper is that heteromorphic imagination is proposed as an explanatory construct rather than reported as a directly measured variable. It must be operationalized carefully in future work. No single behavioral measure will capture it. A plausible empirical strategy would triangulate among semantic distance, delayed originality, fixation, self-reported incubation, process logs, and qualitative accounts of whether a user began from a felt but unstable direction or from an already stabilized request.

A second limitation concerns individual differences. Creators vary in their vulnerability to premature crystallization. Experienced artists, writers, designers, and composers often possess disciplined ways of postponing closure. They may use AI late in a process, as an externalization tool, a critic, or a variation engine, rather than as the source of first ideational movement. Conversely, novices may benefit from AI scaffolding while also being more likely to adopt the system's categories as their own. This double possibility is central: the same technology may expand access and reduce intimidation while also training some users toward more generic forms of ideation.

A third limitation is domain specificity. Prompt-based text systems make the problem especially visible, but the phenomenon is not restricted to language. Any interface that asks for early specification may produce premature crystallization, including menu-driven design tools, style-transfer systems, or music generators that require genre labels before exploration. Conversely, some language interfaces may avoid the problem if they support fragments, hesitation, contradiction, and revision without immediately optimizing toward polished output. The argument is therefore about the timing and structure of mediation.

Conclusion

The rapid integration of generative AI into creative practice raises questions beyond output quality and authorship. This paper has argued that prompt-based creative interaction may carry a cognitive cost that current computational creativity evaluation frameworks do not capture: the potential attenuation of heteromorphic imagination, the pre-articulatory, associative, and recombinatory mode through which not-yet-stable possibilities can acquire personal and expressive meaning. The double compression of prompt-based ideation, from pre-articulatory experience to language and from language to model-interpretable language, creates a structural incentive to bypass that mode. Although language, prompting, and AI assistance carry clear creative value, the argument here specifies a boundary condition: when articulation becomes the compulsory entry point to creative support, the pre-articulatory ecology of imagination may be narrowed. The claim is deliberately framed as a testable hypothesis. Beyond what machines can produce with humans, computational creativity must attend to what happens in the human mind before the prompt is written.

Author Contributions

Emil Polyak developed the central theoretical framework and drafted the manuscript. Rghad Balkhyoor contributed to the phenomenological framing and manuscript revision.

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