

The Space In-Between: Creative Skill and Cognitive Transitions in the Age of Prompt-Based AI

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Abstract

Every time, a creative professional prompts an AI and accepts the output, a small cognitive transaction takes place: a mode of thinking that used to belong to them is quietly outsourced. Neuroscientific evidence now confirms what many practitioners sense that prompt-based AI weakens the very neural connectivity that makes creative work possible. This paper argues that the damage is not incidental but designed in: the prompt-response loop structurally eliminates the transitions between cognitive modes, and those transitions are essential for developing and maintaining human creative skill. Drawing on two decades of practice in algorithmic composition, the author proposes a four-mode framework — documented in the making of *Opalescence*— which names what is being lost and offers a methodology for getting it back.

CCS CONCEPTS

- Human-centered computing → HCI theory, concepts and models
- Computing methodologies → Cognitive science • Applied computing → Arts and humanities

Additional Keywords and Phrases: deskilling, creative agency, generative AI, algorithmic composition, metacognition, cognitive offloading

1 Introduction: Cognitive Debt and the Creative Mind

In June 2025, researchers at the MIT Media Lab publish a noteworthy study with EEG results: participants who used ChatGPT to write essays showed the weakest neural connectivity of any group in the experiment, compared with participants using a search engine and those who were writing unaided. Cognitive activity, the authors observed, scaled down in relation to external tool use [1]. The authors found that cognitive engagement was decreasing along with the increase in the use of external tools. In addition, ChatGPT users were unable to cite their ideas adequately and felt the least ownership toward the created material. The phenomenon described in the paper was referred to as cognitive debt, which represents a pattern of low levels of engagement accumulating throughout time. Later in 2025, Zhang [2] asked the same question explicitly in the quasi-experimental research's title, namely, enhancement or atrophy? Comparing the creative processes in traditional and AI-assisted learning activities in a five-week span and finding differential impacts on various dimensions of creative cognition. A growing number of studies prove that the implications of the cognitive activity performed when using generative AI technologies are rather negative and could result in the weakening of humans' creative skills in AI users.

As for me, an educator and a researcher in creative fields, such findings are not theoretical anymore because they are consistent with the survey data collected from creative professionals and students who have been experiencing the

increasing use of AI technologies and the reduction of their creative self-confidence [3, 4, 5]. For instance, in my classroom observation, I noticed that those students who can create competent outputs using AI-powered technology cannot explain why they chose one approach over another. Besides, the reliance on AI technology makes them feel that the intuitive process of decision-making is significantly delayed and unreliable. As for now, the deskilling concerns in creative practices are neither imaginary nor measurable from the perspectives of neural networks, human behavior, and education.

This paper will discuss a conceptual solution for preventing the cognitive offloading resulting from the usage of prompt-based AI systems. This will be grounded in theoretical and historical reflection on what creative engagement requires. The main question that needs to be answered is how the creative practitioners should preserve and improve their creative agency by using prompt-based AI technologies. I argue that the answer lies not in avoiding AI, nor in better prompts, but in deliberately re-introducing forms of cognitive engagement [4, 6].

To answer this question, I look backward. There is a particular value in revisiting work made before a dominant paradigm took hold because practices from outside the current frame can reveal what the frame has rendered invisible. One can argue that those practices are closer to the original way of creative work. Today, the prompt-response loop is so dominant, that it is difficult to see it as a design choice at all because it appears simply as the way one interacts with AI. Returning to a moment when human-AI creative collaboration looked structurally more “primitive” makes the choice visible again, and with it, the alternatives.

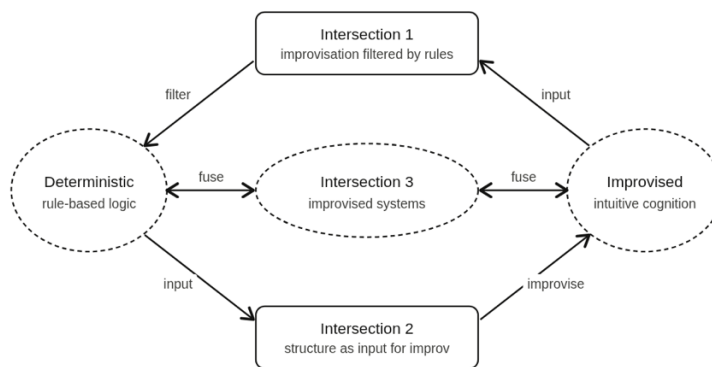
In doing so, I will refer to my professional practice from 2004-2005 during which I worked with a particular type of computational systems: algorithmic composition. Those systems to some may be seen as belonging to a 'primitive' or 'primary' form of interaction with ai, as it was documented in my PhD practice-based research document [7]. At that time, working with algorithmic composition meant something very different from what 'using AI' means today. Without the presence of any prompting or natural language interface, it was instead necessary to determine the probabilities, set rules for the building blocks of the creative output: intervals, define relations between rhythm, harmony, and texture, analyze, deconstruct, and synthesize different possible results so as to arrive at their codification into a computer program. The system did not collaborate with me through conversation; it collaborated with me because I had built the conditions of its collaboration. In other words, one needed to compose the system before composing with it, and in doing so, one had greater influence and control over the way of interacting with the system, as well as the capacity to re-shape the system itself.

What I documented during the time of the making of *Opalescence* (for three female vocalists and electronics) shows not one way to approach the system, but four different approaches to working with it, with its most productive times coming in transitioning from one mode to another [7]. Nearly twenty years later, looking at the prompt-response loop that defines current generative AI, I recognise that these tools have eliminated precisely those transitions. I argue that the transitions are not incidental to creative work but essential to it: it is in moving between cognitive modes that creative skill is built, maintained, and renewed. What prompt-response systems eliminate is therefore not a feature of older interfaces but a condition for evolving and developing of creative skill development itself.

This article offers a practical proposal grounded in historically informed reflection. The multiple mode framework I describe was not designed as a response to generative AI. But I argue that it offers a usable structure for what creative practitioners and educators can do now to resist the cognitive debt that prompt-based AI accumulates, because it reflects something closer to a more ‘organic’ creative cognitive process: one which requires the practitioner to build the elements of their own creative scaffolding — the system — and then manipulate it in various ways. The framework is not a tool. It is a way of using the tools we already have, with more of the brain switched on.

2 Opalescence (2004/5): Modes of interaction for content generation.

Between 2004 and 2005 I composed *Opalescence*, a work for three female singers and electronics, as part of my practice-based PhD research at Queens’ University Belfast [7]. The piece was written using algorithmic composition software (ACToolbox). The software is built around nodes of user interface, where one introduces lines of codes as parameters for algorithmic procedures. To produce any sound or notational material one needs to specify probability distributions, define rules for intervallic movement, write the relationships between rhythm, harmony, and texture as code, and then



Adapted from Glowicka (2008)

Figure 1: Modes of interaction between the intuitive and deterministic systems from “Opalescence”.

evaluate, dissect, and iterate on the outputs. One can do parts or all of those procedures while in addition, a complete user defined material is also possible to serve as an input.

The process of creation of this work emerged as several structures of working with those constraints and around them: on two poles, the opposites that served as a source of material –one fully deterministic process at one end and the other a fully improvised. The most interesting form of creativity happened when the intersection between these methods took place: improvisation under the guidelines of the deterministic structure, structure providing input into the improvisation process, and improvised structures (Figure 1). This will be explained further in the following parts.

2.1 Intersection 1: improvisation filtered by rules.

Prior to composing the piece, I had recorded a series of vocal improvisations using the Eastern European folk technique known as white voice. These improvisations were fully intuitive, embodied, raw material with no apparent formal logic, only a result of the musicality of performer (in this case me). To bring this material into the structured world of the composition, I extracted intervallic and rhythmic content from the recordings and then submitted it to a proportional system I had built around Fibonacci-derived ratios that it apparently resembled. The improvisation was the input while the rule-based system was the filter. Some elements from the improvisation fitted “the system”, while other elements were rejected by the system. What this required cognitively was a particular act: I had to first formalise what I had intuitively produced — to recognise, in my own raw material, what its underlying logic was — and then submit that material to a logic external to me. The output was no longer the improvisation, but it was no longer just the system either. Most importantly, the act of formalising required me to articulate to myself what I had been doing intuitively. That articulation is itself a form of skill development that the prompt-response loop bypasses entirely.

2.2 Intersection 2: structure as input for improvisation.

In other passages of the piece, the creative flow ran in the opposite direction. I generated material algorithmically by running probability-driven processes through the options of ACToolbox to produce intervallic sequences, rhythmic values, and pitch directions and then used the output as raw material for intuitive development. This meant returning to the system's output not as a finished thing to accept or reject, but as a substrate to inhabit, transform, and depart from. I selected passages that felt musically alive, retained some, discarded others, altered phrasings by ear, and let the system's logic become a

starting point rather than an endpoint. The cognitive work here is the inverse of Intersection 1: rather than formalising intuition, I was re-entering structure with intuition. Both required active engagement with the material's internal logic, but from opposite directions.

2.3 Intersection 3: improvised systems.

The third intersection is the most difficult to describe and, I will argue later, the most absent from current AI tools. I was not using a fixed system to generate material, nor using improvisation to develop generated material. I was building the system itself iteratively and intuitively. I would write a probabilistic rule — say, weighting the intervallic distribution toward small upward motion — run it, listen to the output, decide that the rule produced something musically interesting but not quite right, revise the rule itself, run it again, evaluate, revise, and so on. The rules therefore emerged through the same kind of trial, listening, and intuitive judgement that one would normally bring to composing a melody. The system became creative material in its own right, and the composer's authority extended not to choosing among outputs but to shaping the conditions of generation. This is the mode in which the boundary between improvising and systematising collapses, and it is the mode that current generative AI interfaces structurally cannot accommodate because the system's rules are fixed, opaque and unreshapable by the user.

Interestingly, across the whole work, what unified the working method was merely only being engaged any single mode but the constant movement between them. For example, a single passage of *Opalescence* might begin in Intersection 1, settle briefly into the deterministic pole as the system rendered a structure, then transition through Intersection 2 as I improvised against that structure, then back into Intersection 3 as I revised the rules in response to what I had heard. Each transition required me to step outside the mode I had just been operating in, recognise what I had been doing, and deliberately adopt a different stance. This metacognitive demand — the work of switching modes — was not incidental to this composition, nor it is unique. It was, I now understand, the creative work itself.

3 The Transition is the Cornerstone of the Creative Skill

The framework I developed in 2008 was a description of my own creative practice. It was not derived from cognitive science. But the structure it captured — two modes of cognition, their three intersections, and the constant movement between them — turns out to align closely with what the literature on creative cognition has been describing for nearly a century. In this section I situate the framework theoretically and argue that what current AI tools eliminate is precisely the cognitive structure that this literature names as essential to creative work.

Creativity is not a single mode of thought. Wallas's [8] foundational four-stage model — preparation, incubation, illumination, verification — already proposed, already 100 years ago, in 1926 that creative work requires a cycle of distinct cognitive stances, including the deliberate stepping-back of incubation in which conscious processing yields to unconscious association. Csikszentmihalyi's [9] account of creativity as sustained domain engagement extended this: deep creative work requires a surplus of focused attention iterated over time, not the rapid input-output cycles of immediate problem-solving. Dual-process theory of creativity [10] formalised this further, arguing that the optimal creative process alternates between a generative mode (associative, intuitive, low cognitive control) and an evaluative mode (deliberate, analytical, high cognitive control), and that this alternation produces more original output than remaining in either mode alone. Recent neuroimaging work has corroborated this: Beaty et al. [3] demonstrated that creative idea production depends on the coupling between the default mode network — associated with spontaneous, mind-wandering cognition — and the executive control network, with neither network alone sufficient. Xie et al. [11], using a continuous multitask paradigm, provided direct empirical evidence that creative thinking emerges from the dynamic interplay between these two latent cognitive modes.

What this literature consistently describes is a structure that mirrors what I documented in *Opalescence* while engaging in early version of artificial intelligence: two distinct cognitive modes (deterministic and improvised; deliberate and spontaneous; executive and default), and a creative process that depends not on either mode alone but on the dynamic transitions between them. The cognitive science framing names what the compositional framing showed in practice: creative work happens in the movement between modes.

3.1 Rhodes' 4Ps and the displaced dimensions of creativity in output-oriented world.

Rhodes' classical analysis of creativity [12] decomposes the phenomenon into four dimensions: Person (the creator's traits and identity), Process (the mental and procedural work of making), Product (the artefact produced), and Press (the environment that shapes creative work). Reading the current dominant use of generative AI through this lens is quite revealing: prompt-response interactions privilege Product almost exclusively. The tool exists to produce outputs; the user evaluates outputs; the cycle iterates around outputs. The other three dimensions — the Person doing the work, the Process by which they work, and the Press of the broader creative environment — are systematically displaced from the interaction. Yet the literature surveyed above is clear that creative skill development happens primarily in Process, not in Product. To optimise interaction design around Product alone is to optimise around the dimension least connected to skill formation.

3.2 Cognitive offloading and the loss of the transition.

Risko and Gilbert [13] define cognitive offloading as the use of external action to reduce the cognitive demands of a task. Their analysis is descriptive — sometimes offloading is beneficial (a calendar replaces strained memory), sometimes it is not (Google Maps atrophies space orientation skills). What the empirical work I cited in the introduction now suggests is that prompt-based AI use produces a particular kind of offloading: not the offloading of a discrete skill, but the offloading of the movement between cognitive modes. Kosmyna et al. [1] found that LLM users exhibited the weakest neural connectivity of any group studied — and connectivity is precisely what the Beaty [3] and Xie [11] studies identify as the neural signature of creative thinking. Zhang [2] reported differential erosion of creative skills among AI-assisted design students. The mechanism, I argue, is structural: the prompt-response loop is itself a single-mode interaction. The user formulates intent in language, the system produces output, the user evaluates. There is no moment in this cycle that requires the user to formalise their own intuition (the work of the deterministic→improvised intersection), to re-enter system output as substrate for further intuitive work (the work of the improvised→deterministic intersection), or to compose the rules of the system itself (the work of the hybrid intersection). The transitions are not merely absent from the interface, but they are precluded by it.

This is what I mean by the claim that the transition is the skill. Creative skill, as both my own practice-based research and the cognitive science literature describe, is not located in any single cognitive mode. It is located in the capacity to recognise which mode one is operating in, deliberately step outside it, and adopt a different one — and to do this iteratively, over sustained engagement with material, which is eliminated by design in the prompt-based system.

4 The Stakes for Creative Practice

The creative industry is the canary in the coal mine for AI-induced cognitive debt. Creative work is the kind of work where the transitions between cognitive modes are themselves the value being delivered and those transitions are exactly what the prompt-response loop eliminates. When a graphic designer outsources ideation to Midjourney and curates the outputs, they have become maybe more “productive” in the sense of output, but they have not become more creative. They have become a different kind of professional from creator to curator. One can name this shift precisely that: creatives became curators, but the consequences of this transformation for the industry have not yet been named, and the industry is treating it as efficiency rather than as transformation.

What is at stake is the long-term capacity of creative practitioners to do creative work at all, and by that the direction and the creative output of humankind. If the transitions between cognitive modes are the site where creative skill is built and maintained, and if professional practice increasingly displaces those transitions through prompt-based interaction, then the creative industry is consuming its own. Each cohort of practitioners enters the field with less practice in the very cognitive movements that the literature identifies as essential, and the gap compounds across generations. Two illustrations make the stakes concrete.

4.1 Advertising and copywriting.

The advertising industry was among the earliest professional sectors to integrate generative AI into core production workflows. Copywriters now routinely brief LLMs to draft headlines, taglines, and body copy, then edit the outputs. This compresses what was previously a multi-day cycle of brief reading, tonal exploration, draft writing, peer critique, and

revision into a single afternoon. The displaced labour is real, but so is the displaced cognition. The work of finding the brand voice — listening to draft after draft, recognising why one phrasing lands and another does not, articulating that recognition into a working principle, applying it forward — is precisely the work that crosses the three intersections of the framework. It is also the work that builds copywriting skill. When the LLM produces a competent draft on the first prompt, the practitioner does not have the occasion to do that work and over time, and with the next generations, they might lose the capacity to do it at all. So, one might argue that what the industry currently celebrates as productivity gain is an accelerated obsolescence of its own workforce.

4.2 Architecture.

Architectural ideation has historically been one of the most cognitively layered creative practices in the professional world. The architect moves between site analysis (deterministic constraints), conceptual sketching (improvised exploration), parametric modelling (system-driven generation), and intuitive judgement against programme and context — a near-perfect example of fluid movement between the modes the framework describes. The recent rapid adoption of text-to-image tools and AI-assisted design platforms in architectural studios is therefore not a marginal change. It is a substitution of a single-mode interaction for a multi-mode practice. Junior architects increasingly produce concept renderings by prompting before sketching, and the practice tradition that distinguished architecture from technical drafting — the cognitive architecture of architecture, so to speak — is at structural risk. The discipline has resources to recognise this: architectural pedagogy and theory have long argued that drawing-as-thinking is constitutive of architectural skill. The framework I have proposed offers a vocabulary for naming what specifically is lost when that thinking is displaced into prompts.

These two examples are not exhaustive. The same analysis applies, with local variation, to music as well as game and narrative design, fashion, film pre-production, journalism, music production, and the visual arts — the creative industry. What unites them is that all are creative practices whose value lies in the cognitive work between modes, and all are being structurally remade by an interaction paradigm that eliminates exactly that work. The provocation is therefore not directed at AI tools as such, but at the creative industry's failure to interrogate the paradigm. The question is whether the current use of AI, but whether the way it is currently being used is compatible with the long-term survival of creative practice as a human centered knowledge-bearing profession.

5 Discussion

If the preceding analysis is accurate, an immediate question arises regarding what creative practitioners and the institutions that educate them can do without awaiting a potential redesign of AI tools. The framework outlined here serves both as a methodological approach and as a critical lens. Practitioners engaging with prompt-based AI can intentionally reintroduce the intersections: formalising their intuitive material prior to system input, re-entering system output as a substrate for further intuitive development rather than treating it as a final product, and regarding the generative rules as objects for revision rather than as fixed constraints. None of these strategies require alternative tools; rather, they necessitate a revised approach to tool usage and a redefined vocabulary for creative practice. I have implemented this method with creative business students at Inholland University of Applied Sciences, and initial observations indicate that mode-switching is perceived as the point of greatest cognitive friction, precisely because it demands the highest cognitive engagement. In this context, friction should not be interpreted as evidence of inefficient tooling, but rather as an indicator of ongoing skill formation.

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