Unstuck: Charting the Design Space of Generative AI-based Creativity Interventions

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Myriad generative AI (GenAI) products and research prototypes have demonstrated practical applications for amplifying human creativity in various professional activities that span writing, music composition, graphic and product design. While many applications of GenAI for creativity support focus on augmenting or altering human-generated content, these tools do not directly address the core challenge of "being stuck", a phenomenon that hinders creatives' ability to generate original content. In this position paper, we offer broader perspective on the concept of "being stuck" and insights into how GenAI can be leveraged to overcome barriers in the creative process. More specifically, we draw from the HCI and Cognitive Science literature to provide a nuanced conceptualization of stuckness and use this to propose a design space of GenAI-based interventions toward unleashing the potential of creative professionals.

CCS Concepts: • **Applied computing** → *Media arts*; • **Human-centered computing** → **Interaction paradigms**.

Additional Key Words and Phrases: generative ai, large language models, creativity, intervention

1 INTRODUCTION

While applications of Generative AI (GenAI) have been shown to be useful in supporting everyday creativity such as creating a new recipe, the latest advances in GenAI technologies, combined with growing market demand for AI-infused products [1], are beginning to truly disrupt professional creativity at a rapid pace. A recent report exemplifies this trend, suggesting that GenAI could potentially automate 26% of tasks in the arts, design, and media sectors [2].

GenAI-based creativity support tools allow individuals to guide text and image as well as audio and video generation models with various input modalities and UI components to create various augmentations on their seed ideas. These augmentations offer support for established activities with well-defined success metrics, such as proof editing or text paraphrasing; they can extend to more complex use cases, such as empowering users to engage in novel creative endeavors that would not be possible without such technological interventions, such as sketch-guided image synthesis enabled by diffusion models. This type of support, however, may not be enough to support professional creatives, whose goals are to (1) generate an artifact that is perceived to be novel, appropriate, useful and valuable by their professional community (i.e., creative) and (2) push the boundaries of what is known and possible in their respective fields [14].

Creative individuals share unique characteristics that allow them to excel at creative tasks, but not without moments of decreased performance. While the level of mastery of tools honed over their career often allows them to outperform AI systems on creative tasks [3], even high-performing individuals using the right tools can become stuck and face a period of diminished creativity and inability to make meaningful progress in their work [15]. Designing creativity interventions for professional creatives can be challenging because achieving creative leaps and generating truly creative products often comes at the expense of being 'stuck'—a concept that is not well understood yet prevalent in their lives [8].

To this end, in this paper, we unpack what it means to be stuck, advocate for a greater need toward designing professional creativity interventions focused on helping people overcome stuckness, and chart a design space of GenAI-based creativity interventions aimed at stimulating human cognition and creativity.

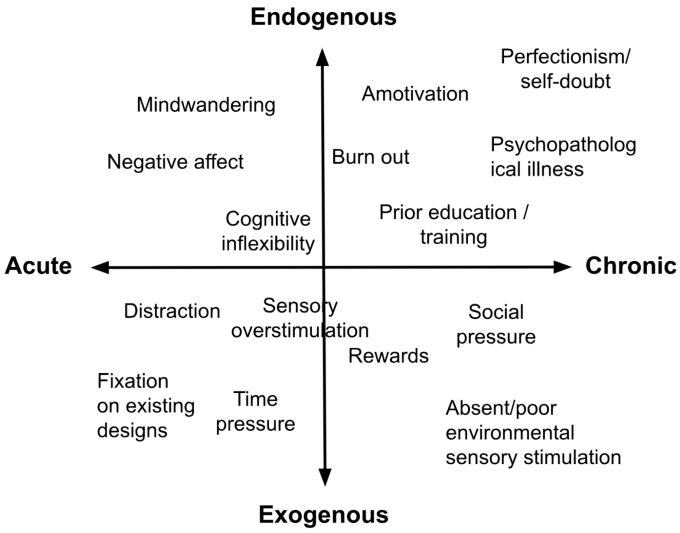

Fig. 1. The mapping space outlines a spectrum of factors contributing to stuckness, organized along two intersecting dimensions: acute to chronic, and endogenous to exogenous.

2 DEFINING AND CONCEPTUALIZING STUCKNESS

There is no single unified definition or consensus on what it means to be 'stuck,' yet it is a common, albeit varied, experience. Colloquially, expressions of stuckness include *creative block*, *being in a rut*, *frozen*, *dried up*, *burnout*, *exhaustion*, *plateau*, and *blank canvas syndrome*. In cognitive psychology, concepts of stuckness are expressed as *inhibition* and *resistance*, to name a few [12, 17]. Stuckness has been studied extensively in creative cognition and design research, leading to a culmination of concepts that include *impasse*, *design fixation*, *functional fixedness*, *mental set*, and *premature conceptualization* [4, 7]. Many of these concepts point to the broad notion of stuckness as a hindrance to mental processes due to self-imposed or unconscious inhibition thereof or depletion of cognitive resources necessary for an individual's creative pursuit.

Defining stuckness is challenging, but we can broaden our understanding by looking at underlying factors and conditions that accompany stuckness in professional creativity. For example, looking at the intersection of chronicity and endo-/exogenous factors, we can construct a 2-dimensional mapping space as seen above (Fig 1). Acute factors are immediate and short-term, often situational, such as fixation on existing designs and time pressure. These are contrasted with chronic factors, which are persistent and long-standing, including the effects of prior education and psychopathological illness. The vertical axis represents the origin of these factors, with endogenous on top and exogenous at the bottom. Endogenous factors stem from within the individual, such as mindwandering, negative affect, amotivation, and burnout. Exogenous factors, on the other hand, arise from external circumstances, including rewards, distraction, and the quality of environmental sensory stimulation.

While not exhaustive, this map provides a framework for understanding the multifaceted nature of stuckness. Factors that influence one's ability to become stuck can be grouped into different mental—emotional (e.g, negative affect), attentional (e.g., distraction), and motivational (e.g., burnout)—states that are internally and externally triggered, as

well as varying in duration and intensity. Understanding such complex relationships is key to designing effective interventions for creativity support.

3 GENAI INTERVENTIONS FOR BUILDING CREATIVE CAPACITY WITHIN

As described above, professional creatives often face more challenges than their non-professional counterparts when they are stuck, primarily due to high expectations set within their industries. Part of this expectation involves exercising mastery over self-regulation techniques to manage various mental states. At the heart of these challenges is the amalgamation of an intense aversion to stuckness and suboptimal coping strategies that, while intended to mitigate creativity-induced distress, can paradoxically exacerbate the issues at hand.

For instance, the ironic processing theory posits that deliberate efforts to suppress or avoid specific thoughts and emotions can backfire and lead to an increased focus and rumination about them [16]. In the context of creativity, attempts to avoid certain thoughts (e.g., distraction) and emotions (e.g., anger)—examples of *acute, endo-/exogenous factors*—about one's work or creative capabilities may amplify the frequency and intensity of these undesired mental states, leading to a counterproductive cycle that stifles creativity. Procrastination is another common manifestation of a maladpative coping mechanism that is often rooted in perfectionism (*chronic, endogenous factor*) [6]. Creative individuals, aiming for flawless execution, may delay tasks due to a fear of falling short of their own high standards. This delay not only impacts their creative processes but also contributes to chronic stress and anxiety, further complicating the ability to self-regulate.

Addressing these challenges require new approaches to creativity support that focus on strengthening individual's capacity for self-regulation, in addition to directly contributing to the generation of creative products. Interventions in this realm could include mindfulness training, cognitive-behavioral strategies to tackle perfectionism, and techniques to enhance emotional resilience. Below we discuss how GenAI might support the design of these interventions.

3.1 Affordances of GenAI for Intervention Design

With its ability to recognize patterns in existing data and generate new data, GenAI offers a unique set of affordances [11] that, when combined with other technologies, has the potential to maximize the effectiveness of interventions aimed at helping professional creatives combat stuckness. In this paper, we discuss three such affordances that could lead to improved engagement with the interventions.

Reducing Boredom and Habituation. Habituation refers to a reduction in physiological and behavioral responses toward certain stimulus after prolonged and repeated exposure to it. In the context of intervention design, boredom and habituation are primary drivers of reduced effectiveness in long term deployments. Changing the form, presentation, and timing of content delivery with GenAI can be an effective strategy for increasing or sustaining user engagement [10]. For example, instead of cycling through a bank of media content, GenAI can help produce unexpected patterns within distinct families of stimuli and content to reduce habituation and boredom. Adjusting the temperature parameter would allow for greater control over when to reduce or increase predictability in the presented content.

Personalization. Another way to improve the effectiveness of interventions is to improve the contextual relevance of the presented content. Research in HCI has shown that personalization can be a helpful strategy to increase the efficacy of interventions [13]. Drawing on contextual data about the individual such as demographic attributes, preferences, behavioral and mental states, GenAI can dynamically produce tailored messages, recommendations, or other content that resonate with the individual's current context. This can enhance engagement and the relevance of interventions, ultimately increasing their effectiveness in the long run.

Shared autonomy **Interruptions**	**Assistive** *Increasingly human-led, with data presentation*	**Negotiated** *Mixed or conditional autonomy, with decision support*	**Autonomous** *Increasinglya machine-led*
Peripheral *No workflow interruption*	Slow breathing while working. *GenAI provides minimal assistance with varying forms of data presentation*	Slow breathing while working with sensory stimuli. *GenAI generates pleasant haptic/ audio/ visual displays synced with breathing, offering personalization on the go.*	Slow breathing while working, with adjustments to sensory stimuli. *GenAI initiates BR adjustment via gradual modulation of music volume or BPM.*
Just-in-time (JIT) *Minimal workflow interruption*	Small break to breathe fresh air. *If requested, GenAI can propose a new breathing pattern or voice-guided breathing activity.*	Small break to breathe fresh air. *GenAI proposes and modifies the breathing metaphor, e.g., "Aye, mate, let's breathe like a pirate!"*	The system interrupts work and overlays a short breathing guidance video. *GenAI creates a tailor-made guided breathing video.*
Offline *Complete workflow interruption*	Deep breathing exercises in a mindfulness class. *If requested, GenAI acts as a DJ and generates background accompanying music.*	Immersive "awe" room with multimodal stimuli to modify BR and inspire. *GenAI generates personalized and inspirational multimedia "awe" content that changes invariably.*	The system changes the workplace environment (desk height, temperature, lights, music), to change tonic BR. *GenAI chooses the mix of environmental parameters.*

Table 1. Example of a GenAI delivery method for **negative affect regulation** modulated by **slow breathing**

Interactive and Immersive experiences. Chronic manifestations of stuckness (e.g., perfectionism) may require prolonged exposure to a rich set of experiences that can be difficult to design, scale, and maintain. Given the rapid emergence of multimodal generative models (e.g., Google Gemini[1], Open AI Sora[2]), we can expect GenAI to create rich digital experiences that provide proxy simulations of the physical world tailored to the user's preference, state and other context. This can include partial to fully immersive environments, or other interactive content, which can increase motivation and intervention efficacy over static content [5]. On the other hand, GenAI can also alter our perceptions of reality by introducing subtle changes to the individual's surrounding environment [9]. Adding subtle animations to the periphery of a computer screen, or changing the volume, pitch, bpm of music that is being played are examples in which GenAI can offer subtle changes without introducing huge disruptions to ongoing creative activities.

3.2 Morphology and Delivery of GenAI Interventions

To deliver GenAI interventions with different intensity, frequency, and duration levels, they should be designed taking into consideration at least two elements: level of interruption and shared autonomy. Interruption levels can vary from none (peripheral), minimal (just-in-time), to complete (taking the user offline) interruption. On the spectrum of shared autonomy, interventions can be assistive (increasingly human-led), negotiated (either low autonomy or conditionally autonomous depending on the situation), or autonomous (increasingly machine-led). A potential third element, the

[1] https://gemini.google.com/
[2] https://openai.com/sora

Shared autonomy **Interruptions**	**Assistive** *Increasingly human-led, with data presentation*	**Negotiated** *Mixed or conditional autonomy, with decision support*	**Autonomous** *Increasinglya machine-led*
Peripheral *No workflow interruption*	Remind user of the current role they are playing (e.g., detective). *System displays assumed role*	Suggest different roles users can play (e.g., space detective, archeologist, etc.). *GenAI proposes and generates soundtracks or character themes that reinforce the alternative role that the user chooses to play (e.g., Noir music for a detective role).*	Eliminate distracting elements and make the work environment linked to a role-playing character. *GenAI changes the work space to resemble the world of the role-playing character and modifies the focus of the task (blurs in/out).*
Just-in-time (JIT) *Minimal workflow interruption*	Small break to practice adopting a new role. *Display and project assumed role onto live video feed (e.g., instagram detective filter).*	Small break to iterate on various ways to assume the new role. *GenAI proposes and generates a few speech dialogues of the user demonstrating the role in different ways.*	The system interrupts distracted work and takes user through a guided, immersive role play scenario. *GenAI scaffolds social interactions that allow the user to play the role in different scenarios (e.g., GenAI plays an assistant detective asking the user about the case, such as a Watson to the user's Sherlock).*
Offline *Complete workflow interruption*	Practice adopting new role in fully immersive environment (e.g., VR) away from any workspaces. *User selects from pre-generated avatars, objects, scenery, music that complements the assumed role.*	Enacting role in a partially or fully immersive environment with multimodal stimuli. *GenAI proposes and generates different role-play scenarios for users to experience that becomes more challenging as the user grows into their role (e.g., more complicated cases as the user learns how to be a detective).*	The system interrupts distracted work with a countdown and primes the person to engage in a fully immersive experience. *GenAI chooses the best combination of environmental parameters and the role-playing metaphor.*

Table 2. Example of a GenAI delivery method for regulating **perfectionism** modulated by **role-playing** exercises

level of immersion (uni- to multi-modal), usually depends on the limitations imposed by the prior two. Tables 1 and 2 illustrate examples of different intervention morphologies and delivery mechanisms to manage *negative affect* and *perfectionism*.

An essential intervention design consideration is how to maximize long-term adherence. Combining GenAI with other mechanisms, such as reinforcement learning, allows for automatic personal and contextual dynamics segmentation to improve long-term adherence. For example, a multi-armed bandit algorithm could explore a suite of just-in-time interventions (e.g., breathing, stretching, cognitive re-framing, etc.). As it converges and exploits successful interventions (e.g., breathing), GenAI could modify the intervention metaphor to make them more appealing (e.g., breath as if you are under water, or like a sailor against the wind).

Finally, as mentioned earlier, our aim is to support individuals build capacity for self-regulation by gradually and adaptively tapering off system autonomy toward restoring control back to human-led levels.

4 CONCLUSION

In this paper, we describe an early foray into mapping the design space of GenAI-based creativity interventions to support creative professionals overcome stuckness. For future work, we aim to develop a suite of interventions that build upon this design space.

REFERENCES

[1] 2023. *Generative AI to Become a $1.3 Trillion Market by 2032, Research Finds.* https://www.bloomberg.com/company/press/generative-ai-to-become-a-1-3-trillion-market-by-2032-research-finds/

[2] 2023. *The Potentially Large Effects of Artificial Intelligence on Economic Growth.* https://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.html

[3] Andres Campero, Michelle Vaccaro, Jaeyoon Song, Haoran Wen, Abdullah Almaatouq, and Thomas W Malone. 2022. A test for evaluating performance in human-computer systems. *arXiv preprint arXiv:2206.12390* (2022).

[4] Joel Chan, Pao Siangliulue, Denisa Qori McDonald, Ruixue Liu, Reza Moradinezhad, Safa Aman, Erin T Solovey, Krzysztof Z Gajos, and Steven P Dow. 2017. Semantically far inspirations considered harmful? accounting for cognitive states in collaborative ideation. In *Proceedings of the 2017 ACM SIGCHI Conference on Creativity and Cognition*. 93–105.

[5] Alice Chirico, Francesco Ferrise, Lorenzo Cordella, and Andrea Gaggioli. 2018. Designing awe in virtual reality: An experimental study. *Frontiers in psychology* 8 (2018), 2351.

[6] Sarah J Egan, Tracey D Wade, Roz Shafran, and Martin M Antony. 2016. *Cognitive-behavioral treatment of perfectionism.* Guilford Publications.

[7] Milene Guerreiro Goncalves. 2016. Decoding designers' inspiration process. (2016).

[8] Wayne D Gray and John K Lindstedt. 2017. Plateaus, dips, and leaps: Where to look for inventions and discoveries during skilled performance. *Cognitive science* 41, 7 (2017), 1838–1870.

[9] Sangwon Jung, Oğuz'Oz Buruk, and Juho Hamari. 2022. Altered States of Consciousness in Human-Computer Interaction: A Review. In *Nordic Human-Computer Interaction Conference*. 1–13.

[10] Inbal Nahum-Shani, Shawna N Smith, Bonnie J Spring, Linda M Collins, Katie Witkiewitz, Ambuj Tewari, and Susan A Murphy. 2018. Just-in-time adaptive interventions (JITAIs) in mobile health: key components and design principles for ongoing health behavior support. *Annals of Behavioral Medicine* (2018), 1–17.

[11] Don Norman. 2013. *The design of everyday things: Revised and expanded edition.* Basic books.

[12] Rémi Radel, Karen Davranche, Marion Fournier, and Arne Dietrich. 2015. The role of (dis) inhibition in creativity: Decreased inhibition improves idea generation. *Cognition* 134 (2015), 110–120.

[13] Julian Andres Ramos Rojas. 2021. Exploring AI-based personalization of a mobile health intervention and its effects on behavior change, motivation, and adherence. (2021).

[14] R Keith Sawyer and Danah Henriksen. 2024. *Explaining creativity: The science of human innovation.* Oxford university press.

[15] Steven M Smith and Steven E Blankenship. 1989. Incubation effects. *Bulletin of the Psychonomic Society* 27, 4 (1989), 311–314.

[16] Daniel M Wegner. 1994. Ironic processes of mental control. *Psychological review* 101, 1 (1994), 34.

[17] Darya L Zabelina and Michael D Robinson. 2010. Creativity as flexible cognitive control. *Psychology of Aesthetics, Creativity, and the Arts* 4, 3 (2010), 136.