

Balancing Design Intentionality and Serendipitous Emergence: How Visual Designers Navigate Generative AI Co-creation

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Abstract

Generative artificial intelligence (GenAI) tools including Midjourney, Stable Diffusion and Comfy user interface (UI) have evolved from experimental novelties to widely used commercial tools integrated into professional visual design workflows. Yet diffusion models' probabilistic nature creates persistent tension for designers between preserving deliberate design intent and embracing unplanned emergent visuals. Unlike conventional digital tools enabling predictable direct editing, GenAI often yields unforeseen outputs, swinging practitioners between creative frustration and fortuitous inspiration. To explore how designers resolve this conflict, this qualitative empirical study recruited 10 experienced commercial visual, illustration and UI designers. Drawing on dual evidence: Stimulated recall interviews and process records including prompt logs and draft visuals, alongside thematic analysis, it develops a three-stage spiral model: "Loss of Control - Taming - Symbiosis". Results: (1) Designers' cognitive-emotional journey is not a simple linear shift from anxiety to joy, but spiral cognitive reappraisal triggered by chance discoveries. (2) Four operational strategies manage algorithmic variability across a control-divergence spectrum: prompt denoising, regional inpainting, reverse engineering, hybrid collaging. (3) Designer agency persists, shifting from low-level manual manipulation to high-level meta-control over style rules, constraints and selection. This framework explains reshaped human creative agency in human-AI co-creation and informs future AI interface and design education.



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Keywords

Generative artificial intelligence, Visual design, Human-artificial intelligence co-creation, Perceived control, Design intentionality, Serendipitous emergence

Introduction

Transitioning rapidly from technical curiosity to industrial ubiquity, GenAI has fundamentally restructured contemporary paradigms of visual production. Deep learning architectures are capable of

generating high-fidelity, stylistically complex imagery within seconds. The most prominent examples are text-to-image diffusion models including Midjourney and Stable Diffusion, as well as node-based pipeline environments such as ComfyUI. These tools condense tasks that once required hours or days of meticulous manual rendering into short iterative cycles. Consequently, GenAI is widely acknowledged as a foundational infrastructure for creative industries, reshaping creative labor, workflows, and commercial delivery across global markets [1,2].

Nevertheless, the algorithmic opacity and probabilistic foundations of diffusion models introduce a persistent operational conundrum: System outputs cannot be entirely predicted or deterministically steered. Identical textual prompts processed across differing random seed values, checkpoint iterations, or sampler parameters inevitably yield starkly divergent visual outcomes.

For professional visual designers, occupational ethos is fundamentally anchored in the precise articulation of visual intent, brand guidelines, and spatial composition. This group faces an inherent uncontrollability in AI-generated workflows. Such uncertainty becomes an acute source of cognitive friction, professional anxiety, and perceived loss of agency. Simultaneously, however, this very indeterminacy fosters unexpected creative breakthroughs, exposing practitioners to novel compositions, unpredicted chromatic harmonies, and unconventional textures [3].

Under this condition, the daily practice of visual designers is cast into a dynamic tension between two competing imperatives. On one side stands “design intentionality” - the deliberate safeguarding of client specifications, brand tonality, ergonomic usability, aesthetic coherence, and project constraints that define professional design governance [4]. On the other side emerges “serendipitous emergence” - the generative system's stochastic capacity to output unexpected visual anomalies that break conventional design fixation and inspire novel conceptual trajectories. Creativity

scholarship defines creative serendipity as a retrospective phenomenon: Unexpected occurrences become genuinely valuable only when an observant creator identifies their latent utility through active aesthetic reappraisal and deliberate integration [5]. Reconciling this persistent dialectic between intentional rigor and stochastic emergence represents one of the most critical theoretical and empirical challenges in contemporary human-AI co-creation research [6,7].

Research questions (RQ): Despite burgeoning inquiry into generative tools, existing scholarship predominantly concentrates on algorithmic benchmarking, automated generation fidelity, or speculative philosophical inquiries into authorship. Empirical accounts that scrutinize how practicing visual designers subjectively experience, psychologically navigate, and practically resolve this tension in authentic commercial workflows remain notably scarce. To address this empirical and theoretical gap, this study formulates three interrelated research questions:

RQ1: What cognitive and emotional shifts do visual designers experience when confronting unexpected variances and stochastic deviations in generative AI outputs?

RQ2: What specific operational strategies and technical practices do designers employ to tame algorithmic unpredictability while opportunistically capitalizing on serendipitous variations?

RQ3: How does this iterative negotiation between human intent and algorithmic emergence reconfigure the designer's perceived sense of control and decision-making sovereignty?

By answering these questions through an empirical qualitative investigation of 10 professional designers, this paper makes three core contributions. First, it resolves prior ambiguities regarding professional attitudes toward AI unpredictability by tracing a non-linear, spiral trajectory of psychological adaptation. Second, it establishes an operational taxonomy of algorithmic taming strategies across a control-divergence

continuum. Third, it conceptualizes the ontological migration of design agency from “procedural outcome control” to “curatorial meta-control”, offering concrete design guidelines for human-AI interaction frameworks and design education.

Literature review

Generative AI and the restructuring of design workflows

The integration of artificial intelligence within creative disciplines has been extensively documented as a transformative paradigm shift that augments rather than outright replaces human creative agency [8]. Conceptual frameworks draw a fundamental distinction between two modes of AI application. The first mode treats “AI as an instrumental tool”, which carries out predefined human commands with high fidelity. The second mode frames “AI as an autonomous co-creative partner”.

This type of AI actively takes part in conceptual exploration, introduces generative variability, and challenges user assumptions. In visual and spatial design contexts, empirical inquiries indicate that text-to-image diffusion models exert their primary influence during early ideation phases, fundamentally altering how designers explore conceptual solution spaces [9].

Recent empirical studies observe that GenAI reshapes the cognitive distribution of creative labor. Instead of spending effort on repetitive, low-level technical execution such as vector tracing or perspective rendering, designers shift their cognitive bandwidth toward strategic evaluation, visual synthesis, and emotive resonance [10]. In architectural and industrial ideation, Paananen et al. showed that text-to-image synthesis fosters imaginative mindsets and unexpected discoveries. However, they stressed that the practical value of these serendipitous findings depends heavily on the designer’s capacity to set rigorous programmatic constraints. Without explicit constraint mechanisms, the generative stream rapidly devolves into visual noise.

Prompt engineering, algorithmic agency, and design serendipity

In text-to-image workflows, prompt construction has emerged as a distinct creative discipline and linguistic craft. In their extensive multi-study investigation, Oppenlaender et al. demonstrated that while practitioners can intuitively craft descriptive subject prompts, they frequently struggle to articulate the stylized, technical vocabularies required to exert fine-grained control over algorithmic outputs [11]. This highlights the non-intuitive nature of prompt engineering: interacting with diffusion models is inherently probabilistic rather than deterministic. Designers cannot command outcomes with the pixel-level predictability offered by traditional raster or vector software (e.g., Adobe Photoshop or Illustrator). Instead, they steer probabilistic distributions across high-dimensional latent spaces [12].

Contrasting this quest for precision is the generative value of stochastic randomness. In computational co-creativity frameworks, human-AI interaction dynamics - comprising conversational turn-taking, reciprocal contribution, and mutual adaptation - serve as the foundational engine of novel ideation. Generative models serve as computational “muses” that deliver external stimuli capable of breaking habitual design patterns. However, unconstrained reliance on generative algorithms carries documented cognitive risks: Zhang identified that exposure to algorithmically generated examples can paradoxically induce severe design fixation, constraining conceptual variety when practitioners prematurely anchor onto standardized model outputs [13].

Information science conceptualizes this generative potential through the lens of “designed serendipity” - the intentional engineering of computational environments to support unexpected yet valuable information encounters. Serendipity is not mere blind luck. It demands active human receptivity and reflective interpretation to convert accidental visual deviations into actionable design assets. As Rafner et al. emphasize,

understanding how human creators attribute authorship and distribute agency during these serendipitous human-AI co-creative encounters remains a central imperative for contemporary creativity research.

Theoretical tension: Critical perspectives on design labor and craft

A critical counter-narrative cautions against overly techno-optimistic views of AI automation in design. Hernández-Ramírez and Ferreira provide a vital critique of managerialist narratives that conceptualize design as a series of modular, automatable tasks. They argue that reducing design to prompt-based generation obfuscates its foundational character as embodied knowledge work and material craft [14].

Design “craft” is intrinsically tied to tacit knowledge, intentional decision-making, and critical aesthetic discernment that cannot be fully subsumed by probabilistic pattern recognition. When designers are relegated to passive consumers of automated imagery, their subjective sense of control, professional identity, and creative ownership are profoundly threatened.

Research gaps

In synthesizing the existing literature, three conspicuous theoretical and empirical gaps emerge. First, prior empirical inquiries have mainly relied on short-term experimental lab studies with novice participants or design students. These investigations fail to capture the sustained, high-stakes negotiation of professional designers working under commercial deadlines and client requirements.

Second, literature has bifurcated into either celebrating algorithmic serendipity or lamenting loss of control, lacking a nuanced empirical model of how practitioners systematically tame randomness and convert deviations into repeatable workflows.

Third, the ontological transformation of “perceived control” in GenAI co-creation remains undertheorized,

with little qualitative evidence explaining how human agency persists when procedural execution is mediated by black-box algorithms. This study directly addresses these voids.

Methodology

Methodological approach and research design

This study adopts an empirical qualitative research design rooted in phenomenological inquiry and thematic analysis. It aims to capture the nuanced, subjective experiences of professional designers as they navigate the delicate tension between design intentionality and serendipitous discovery within human-AI collaborative workflows. Human-AI co-creation involves rapid, iterative micro-decisions and constantly shifting emotional states that unfold dynamically during generative design sessions. Standardized post-hoc surveys cannot adequately capture these transient, situated phenomena, so an empirical qualitative methodology delivers the required granularity to unpack designers’ tacit practices, affective dilemmas, and ongoing cognitive restructuring in real creative practice.

Participant recruitment and sample characteristics

Through purposive sampling supplemented by snowball sampling, we recruited 10 professional visual designers. To ensure empirical validity and depth, all participants met strict inclusion criteria: (1) A minimum of three years of professional design practice. (2) At least one full year of continuous commercial or major client project experience utilizing text-to-image generative tools (specifically Midjourney, Stable Diffusion, or ComfyUI). (3) Verified professional portfolios demonstrating commercial GenAI application across visual identity, digital illustration, user interface (UI), or concept design. The sample purposefully represented diverse industry verticals, technical specializations, and tooling workflows to maximize thematic saturation and cross-

case transferability.

Detailed participant profiles are outlined in Table 1.

Table 1. Demographic and professional profile of study participants (N=10).

ID	Domain specialization	Years in design	GenAI experience	Primary AI toolchain	Representative projects
P01	Brand visual identity	6 years	1.5 years	Midjourney, photoshop AI	Commercial brand rebranding, key visual systems
P02	Editorial illustration	5 years	2.0 years	Midjourney, stable diffusion	Book cover illustrations, editorial feature art
P03	Game concept design	8 years	2.0 years	Stable diffusion (WebUI), ControlNet	Character conceptualization, environment keyframe
P04	Digital UI/UX design	4 years	1.0 year	Midjourney, Figma plugins	SaaS dashboard assets, visual micro-interactions
P05	Commercial advertising	7 years	1.5 years	Midjourney, ComfyUI, photoshop	Social media ad campaigns, commercial posters
P06	Motion & graphic design	5 years	1.0 year	ComfyUI, stable diffusion	Animated visual sequences, kinetic typography assets
P07	Product & package visuals	9 years	2.0 years	Stable diffusion, ControlNet, Blender	Consumer FMCG packaging, 3D visual mockups
P08	Concept & fantasy art	6 years	1.5 years	Midjourney, stable diffusion	Fantasy game environment, card game illustrations
P09	E-commerce visual strategy	4 years	1.0 year	Midjourney, SD, photoshop AI	Promotional banners, e-commerce landing pages
P10	Creative director / multi-domain	11 years	2.5 years	ComfyUI, Midjourney, SD XL	Integrated advertising campaigns, brand IP creation

Dual-channel evidence chain

A critical methodological challenge in studying generative AI interaction is “retrospective recall bias”. This bias describes a common tendency among designers: They tend to remember only successful final outputs while overlooking intermediate failures, or they post-rationalize accidental results as predetermined plans.

Such recall distortion easily distorts researchers’ understanding of the dynamic, moment-by-moment decision-making process during AI-assisted creative work. To overcome this challenge and ensure empirical fidelity, this study constructed a “Dual-channel Evidence Chain” combining subjective recall with objective trace data (in Figure 1).

Channel 1: Stimulated recall interviews. Each participant engaged in a 45-60 minutes semi-structured stimulated recall interview. Prior to the interview, participants selected 1-2 recently completed commercial or advanced portfolio projects that prominently featured human-AI co-creation. These selected works must contain rich

iterative trials and obvious AI-generated deviations suitable for process reconstruction.

During the interview, participants shared their screens and reconstructed their creative trajectory step-by-step along a chronological process timeline: Initial Intent or Baseline Prompt → Deviant or Failed Drafts → Compromise or Serendipity Trigger Point → Final Production Deliverable. Designers verbalized their real-time cognitive dilemmas, emotional reactions to failed iterations, and decision rationale at each critical junction. Channel 2: Objective process artifacts. Simultaneously, we gathered concrete trace data from participants’ actual generation histories.

This included chronological prompt logs, negative prompt strings, seed numbers, sampler settings, control module architectures (e.g., ControlNet openpose or depth maps), intermediate draft renders, and final post-processed layered photoshop document (PSD) files. These physical artifacts served as objective anchors that corroborated or challenged participants’ verbal accounts, enabling rigorous empirical triangulation.

Research Design Framework: Dual-Channel Evidence Chain & Thematic Analysis

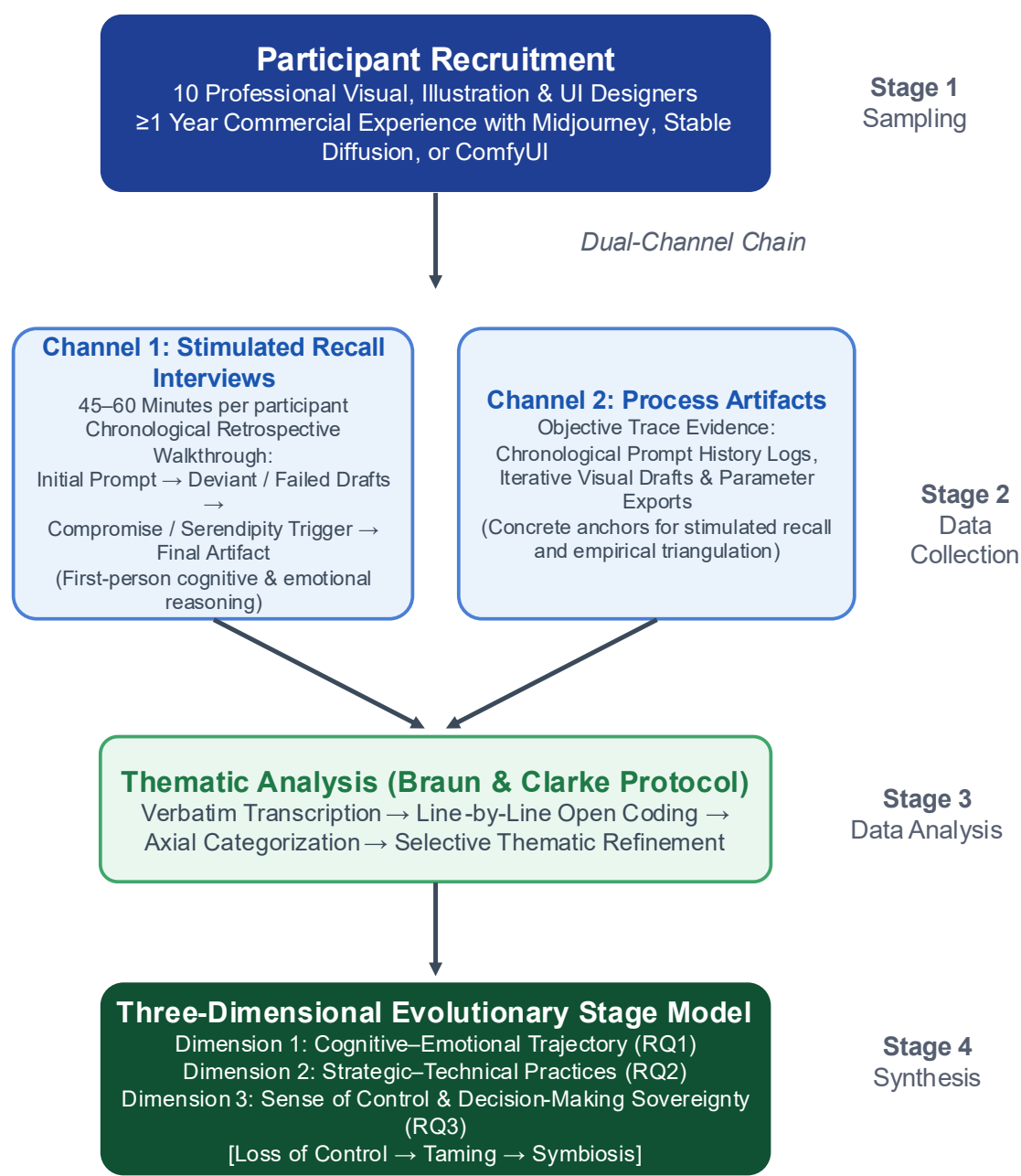


Figure 1. Research design framework: dual-channel evidence chain and thematic analysis workflow.

Data analysis: Rigorous thematic coding protocol

All interview recordings were transcribed verbatim, yielding over 110,000 words of textual transcript, which were paired with 142 visual artifact screenshots and prompt logs. Data analysis adopted the reflexive thematic

analysis protocol proposed by Braun and Clarke. The analysis proceeds through six sequential phases: data familiarization, initial code generation, searching for candidate themes, reviewing themes against the raw evidence chain, defining and naming themes, and producing the synthesized report. Two researchers independently coded an initial subset of

three transcripts and artifact sets using line-by-line open coding. Conceptual discrepancies were discussed until reaching a high inter-coder consensus (Cohen’s Kappa=0.88).

The team then conducted axial coding to cluster initial codes into overarching thematic dimensions aligned with the three research questions: Cognitive-emotional trajectory, strategic-technical practices and sense of Control and Decision Sovereignty. Analysis continued until theoretical saturation was verified across all 10 participant datasets.

Research ethics and rigor

All participants provided written informed consent prior to data collection. To safeguard proprietary commercial assets and professional confidentiality, all client names, proprietary brand assets, and participant identifiers were

anonymized. Member checking was conducted by returning synthesized thematic summaries to four participants, all of whom validated that the findings faithfully reflected their authentic lived experiences.

Findings

Through thematic analysis of the dual-channel evidence chain, this study induced a comprehensive “Loss of Control - Taming - Symbiosis”. As shown in Table 2, the progression through these stages is not a rigid linear chronology.

Rather, designers oscillate dynamically across stages depending on task novelty, client rigidity, and toolchain complexity, though their overarching trajectory exhibits a clear maturation from friction to collaborative symbiosis.

Table 2. The Three-dimensional evolutionary stage model of designer-AI co-creation.

Thematic dimension	Stage 1: Loss of Control (Alienation)	Stage 2: Taming (Negotiation)	Stage 3: Symbiosis (Integration)
Cognitive-emotional dimension (RQ1: psychological experience)	Deviation as pure error: Severe frustration, feeling hijacked by algorithmic opacity; profound anxiety over professional obsolescence and loss of craft identity.	Deviation as heuristic hint: Cognitive reframing; reinterpreting rogue visual outputs as alternative conceptual prompts, unexpected lighting schemes, or novel textures.	Deviation as creative resource: Aesthetic discernment and calm appreciation; proactive expectation of stochastic emergence; emotional resonance and co-creative delight.
Strategic-technical dimension (RQ2: operational practices)	Brute-force trial and error: Chaotic re-rolling of seeds, minor prompt guessing, rapid generation flooding without structured parameter modulation.	Methodological taming practices: Systematic mastery of prompt denoising, negative prompting, regional inpainting, reverse engineering, and hybrid compositional collaging.	Integrated hybrid workflows: Seamless pipeline convergence; fluidly combining node-based AI generation (ComfyUI/SD) with manual raster/vector craft in Photoshop/Illustrator.
Control and sovereignty dimension (RQ3: agency reconfiguration)	Direct procedural control: attempting to enforce pixel-by-pixel “what-you-see-is-what-you-get” certainty; repeated failure leads to perceived total powerlessness.	Boundary constraint control: Establishing deterministic envelopes; locking stylistic parameters, seeds, ControlNet poses, and negative constraints to restrict output space.	Meta-control sovereignty: High-level curatorial governance; directing conceptual trajectory, orchestrating constraints, and exercising decisive editorial selection.

Cognitive and emotional dimension: From frustration to serendipitous reappraisal (RQ1)

In Stage 1 (Loss of Control), participants universally recalled severe emotional turbulence and cognitive frustration upon their initial professional encounters with text-to-image AI. Accustomed to the deterministic control of standard software where inputs produce exact, predictable visual transformations, designers found diffusion models fundamentally disorienting. They could no longer reliably forecast visual outputs even with carefully refined prompts and repeated parameter adjustments. Structural anomalies - such as deformed anatomical features, scrambled typography, or random stylistic drift - were viewed as aggravating bugs that undermined their planned creative direction. This unpredictability triggered deep anxieties regarding their professional competence and the degradation of artisanal skill. Many worried that inconsistent AI outputs would weaken their capacity to deliver stable, high-quality visual results to clients:

(P01, Brand Visual Identity) “In the beginning, I felt completely hijacked. I would enter a prompt expecting a delicate minimalist poster, and it would return a hyper-rendered, chaotic baroque nightmare. I hit generate fifty times in an hour, tweaking one adjective at a time, and got fifty completely unrelated things. I felt I had lost my hands, like an art director yelling at a manic, erratic intern who refuses to listen. It made me question whether all my years of compositional training meant anything anymore”.

The pivotal transition from Stage 1 to Stage 2 occurred through a process of cognitive reframing (reappraisal). As designers deepened their mental models of latent space mechanics, they ceased treating unexpected variations as errors and began reinterpreting them as informative “hints” embedded within the generative outputs.

They gradually learned to separate model artefacts from genuinely novel visual possibilities hidden within each

unstable generation. An unintentional chromatic clash or an anatomically aberrant silhouette was suddenly recognized as an unconventional spatial composition or an avant-garde textural language that the designer’s conscious cognition would have never generated.

This shift required deliberate mental effort to suspend pre-existing design rules and release rigid expectations for fully controllable results. Several designers vividly described certain failed outputs as “free composition mentors”:

(P02, Editorial Illustration) “The turning point arrived during an editorial project. The model hallucinated a weird, skewed perspective with floating atmospheric dust that broke all my original grid plans. My first instinct was to delete it. But when I zoomed out, that aberrant perspective had an uncanny emotional tension that solved my concept block. That was the moment I realized: the model is not broken; it is offering an unsolicited visual counter-proposal”.

By Stage 3 (Symbiosis), designers exhibited a calm, proactive aesthetic posture toward algorithmic emergence. Emotional reactions evolved from reactive anxiety into anticipated curiosity.

Crucially, empirical evidence indicated that this psychological transition was non-linear. Instead of unfolding as a smooth progression, designers experienced a spiral dynamic. Every major model update or unfamiliar project domain first triggered renewed loss of control, which was then followed by rapid tactical adaptation and elevated synthesis.

Strategic and technical dimension: A spectrum of four taming practices (RQ2)

Triangulation of process artifact logs with interview protocols revealed that designers rarely accept raw, one-shot algorithmic outputs for commercial client delivery. Instead, they developed a sophisticated operational spectrum of four taming strategies (in Figure 2 and Table 3).

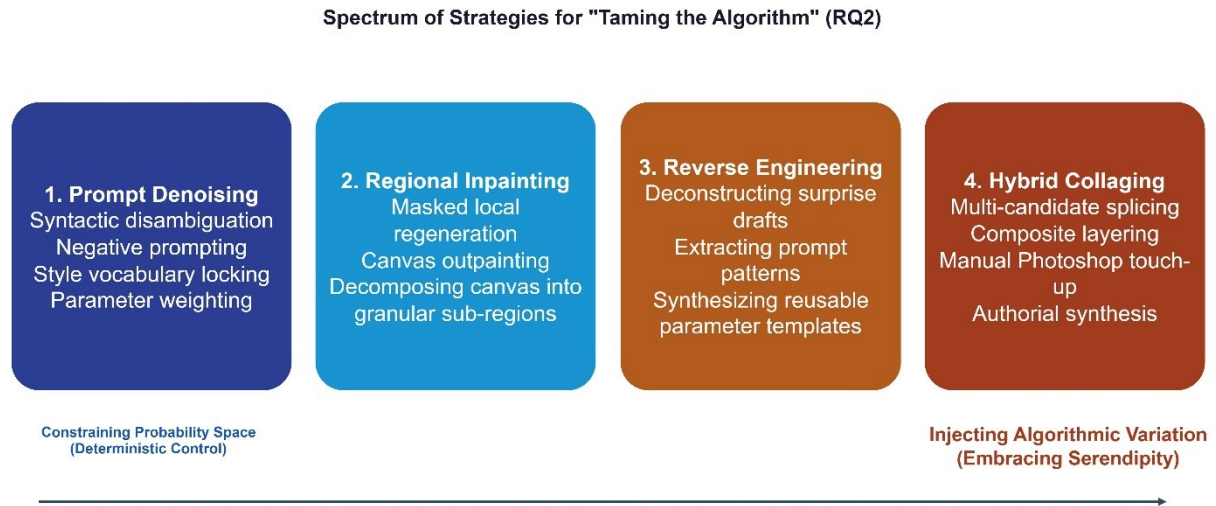


Figure 2. Operational spectrum of algorithmic taming strategies across the control-divergence continuum.

Note: Rather than isolated silos, designers fluidly combine these practices along a dynamic control-divergence continuum. Early ideation prioritizes variance injection, while late production converges toward strict constraint locking.

(1) Prompt denoising (syntactic and lexical pruning)

When seeking to constrain output variability, designers eliminate ambiguous natural language prose in favor of modular, weighted tokens. They prune subjective adjectives (beautiful, epic) that trigger erratic associations and establish structured syntactic hierarchies (Subject + Lighting + Rendering Engine + Perspective). Concurrently, they employ aggressive negative prompting to eliminate undesirable archetypes (e.g., “no 3d render, plastic, oversaturated”), mathematically pruning unwanted regions of the latent probability distribution.

(2) Regional inpainting (granular decomposition)

To resolve the dilemma where a generation exhibits exceptional overall composition but flawed local details (such as facial features, hands, or typography), designers abandon whole-canvas regeneration. Instead, they partition the canvas into discrete sub-problems using masked inpainting, regional prompts, or canvas outpainting. This effectively transforms an intractable global probabilistic puzzle into manageable, localized iterations.

(3) Reverse engineering (template extraction)

When an unexpected generation produces a stunning

serendipitous breakthrough, advanced designers do not simply take the raster image and move on.

Instead, they interrogate the generation metadata - extracting the exact prompt hierarchy, seed number, classifier-free guidance (CFG) scale, and model checkpoint. They isolate which specific token combinations or model weights caused the happy accident, packaging the underlying logic into a reusable commercial workflow template:

(P10, Creative Director) “Whenever ComfyUI spits out an accidental masterpiece, I immediately freeze the workflow, isolate the seed, and run ablation tests. I strip tokens one by one to find the exact catalyst of that surprise. Once I identify the mechanism, that accident becomes my proprietary methodology”.

(4) Hybrid collaging (multi-output synthesis and manual craft)

In professional commercial delivery, final deliverables are almost never monolithic single-seed outputs. Instead, designers carry out a hybrid collaging process. They generate multiple candidate images that highlight different strengths. For instance, they extract lighting from Seed A, spatial anatomy from Seed B, and textural details from Seed C. Designers import these outputs into Adobe Photoshop, then manually slice, mask, color-

grade, and retouch them to form a unified, authorial composition.

Table 3. Operational taxonomy of algorithmic taming strategies.

Strategy name	Core mechanism	Primary tools applied	Position along spectrum
Prompt denoising	Eliminating linguistic ambiguity, applying negative prompts, locking style parameters	Midjourney, SD WebUI, Prompt Bookmarks	Extreme left: deterministic constraint locking
Regional inpainting	Masking flawed sub-regions, localized re-rendering, expanding borders	Stable Diffusion Inpaint, Photoshop Generative Fill	Moderate left: localized bounded regeneration
Reverse engineering	Deconstructing accidental outputs, token ablation, building prompt templates	ComfyUI, SD Info Extractor, Notion Databases	Moderate right: capturing and formalizing emergence
Hybrid collaging	Multi-pass generation splicing, manual vector/raster post-processing, color matching	Photoshop, Illustrator, Blender + SD	Extreme right: authorial synthesis and craft integration

Sense of control and decision-making dimension: The shift to meta-control (RQ3)

The most profound theoretical insight illuminated by this study concerns the fundamental ontological transformation of perceived control. In traditional manual design, control is procedural and direct: the designer experiences agency through the somatic act of placing Bezier curves, brushing pixels, and tuning layer blend modes - a direct causal link between motor action and visual output. When designers initially entered GenAI co-creation, they attempted to impose this direct procedural control onto diffusion models, inevitably resulting in frustration and alienation.

As designers progressed into Stage 3 (Symbiosis), their sense of control did not diminish; rather, it migrated to a higher ontological tier, which we conceptualize as “Meta-control”. In meta-control, the designer no longer seeks to govern every individual pixel or stroke directly. Instead, they govern the higher-order parameters of the creative system: Establishing conceptual boundaries, defining programmatic constraints, modulating prompt weights, and, above all, exercising decisive aesthetic curation:

(P05, Commercial Advertising) “I used to believe that if I wasn’t drawing every line myself, I was not in control. Now I understand that my control exists in the curation

and the constraint framing. The AI can generate ten thousand dazzling images, but it doesn't know which one embodies the melancholic brand essence my client needs. It has no taste, no intentionality, and no cultural context. I provide the compass, the boundaries, and the final verdict. That is meta-control”.

Consequently, the concept of “design intentionality” itself underwent an evolutionary shift. Instead of acting as a rigid, immutable blueprint that designers defend stubbornly against machine divergence, intentionality evolves into a negotiable, dynamic compass. The initial intent sets the general direction and evaluation criteria, but deliberately permits algorithmic surprises to refine, expand, and elevate the final creative destination.

Discussion

Reconceptualizing control: From procedural execution to meta-curation

The central finding of this investigation - that professional designers’ sense of agency migrates from low-level procedural execution to high-level meta-control - substantively advances contemporary human-AI co-creation discourse. Prior human-computer interaction models include the co-creative framework for interaction (COFI). These frameworks emphasize that

interaction patterns shape co-creative outcomes. Our findings expand this premise to the psychological and operational realities of professional practice. Effective human-AI collaboration does not require eliminating algorithmic uncertainty. Rather, it requires that practitioners accept stochastic divergence as a generative partner within bounded constraints.

This dynamic directly echoes Kim and Maher's empirical observation that AI-based visual stimuli restructure the depth of design ideation. When liberated from repetitive manual rendering, designers reallocate their cognitive resources toward strategic conceptual evaluation, semiotic translation, and emotive resonance. Agency is not surrendered to the machine. It is elevated to a curatorial sovereignty where the human practitioner acts as an authorial editor and conceptual orchestrator.

Intentionality and emergence: The dynamics of computational craft

The creative friction between design intentionality and serendipitous emergence mirrors the philosophical debate regarding human intentionality in creative acts. While generative algorithms generate vast quantities of aesthetically polished artifacts, they lack intentionality, subjective experience, and socio-cultural understanding. True creativity requires recognizing unexpected connections in retrospective contemplation.

Furthermore, our empirical documentation of the four taming practices provides an operational answer to the critique posed by Hernández-Ramírez and Ferreira, who warned that managerialist AI adoption risks annihilating design "craft".

It argues that these taming practices constitute an emergent paradigm of "computational craft": a hybrid mastery that integrates algorithmic literacy, prompt syntax modulation, parameter tuning, and traditional aesthetic judgment. Craft has not vanished; it has reconstituted itself within the dialectic between deterministic constraint and probabilistic emergence.

Mitigating design fixation and visual homogenization

A critical caveat highlighted by our participants is the ever-present danger of visual homogenization and design fixation. As documented by Zhang, exposure to generative outputs may unintentionally limit designer exploration. This constraint emerges when practitioners yield to the algorithmic default aesthetics of popular foundation models. A typical example is Midjourney's signature cinematic lighting and glossy textures. Our findings demonstrate that Stage 3 designers actively guard against this trap. They use "hybrid collaging" and explicit negative prompting to de-homogenize outputs, and forcefully reintroduce idiosyncratic human authorship and client-specific distinctiveness into the final artifact.

Practical implications for tool design and design pedagogy

These empirical insights yield direct, actionable implications for both software developers and design educators:

(1) Implications for AI interface design

System architects must transition away from simplistic, single-box text prompts toward modular, transparent interfaces that support explicit intent-constraint workflows. GenAI software should integrate native parameter-locking, non-destructive branching history trees, spatial canvas manipulation (e.g., ComfyUI graph workflows), and fine-grained regional control layers. Providing clear feedback on why output deviated will dramatically reduce cognitive alienation during Stage 1.

(2) Implications for design pedagogy

Design academies must fundamentally update curricula. Rather than merely teaching software-specific keystrokes or prompt "recipes" (which rapidly become obsolete across model releases), educational programs must cultivate "meta-curatorial competencies". Students should be trained in intentionality framing, critical aesthetic evaluation, prompt syntax logic, and

serendipity management - learning how to discipline algorithmic randomness into coherent, purposeful visual arguments.

Limitations and future research

Several methodological limitations must be acknowledged. First, the sample size (N=10), while yielding robust thematic saturation for in-depth qualitative inquiry, is geographically concentrated and specialized within commercial visual and concept design. Future research should deploy larger-scale mixed-method surveys across broader international contexts. Second, because GenAI model architectures and user interfaces are evolving at an extraordinary pace, longitudinal studies tracking commercial creative teams over multi-year product lifecycles will be essential to evaluate the long-term sustainability of the Symbiosis stage.

C Conclusion

This empirical qualitative study investigates how professional visual designers balance deterministic design intentionality with stochastic algorithmic serendipity in generative AI co-creation. By analyzing a dual-channel evidence chain comprising stimulated recall interviews and authentic process artifacts, we establishes the “Loss of Control - Taming - Symbiosis” three-dimensional evolutionary stage model.

Our findings elucidate a form of cognitive reappraisal. This reframing turns algorithmic deviations from aggravating errors into inspiring heuristics. The results also categorize four practical taming practices spanning a control-divergence continuum and demonstrate the ontological elevation of designer agency from procedural execution to meta-control.

Ultimately, generative artificial intelligence does not extinguish the designer’s subjective agency. Rather, it elevates it to an unprecedented level of curatorial, strategic, and aesthetic responsibility. In the emerging

paradigm of human-AI co-creation, the defining mark of the designer is no longer the rote mechanical ability to execute visual form, but the intentional wisdom to guide, interpret, and orchestrate algorithmic emergence into meaningful cultural expression.

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Conflicts of Interest

The authors declare no conflict of interest.

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