

The Cession and Reconstruction of Visual Designers' Color Decision-making Power in Human-AI Co-creation

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Abstract

Generative artificial intelligence (GenAI) has brought a paradigm shift to visual communication design and restructured the epistemology and workflows of color-decision-making. Computational color tools can rapidly generate large-scale optimized color palettes yet trigger concerns over technological deskilling and alienated creative authorship. This paper is based on a four-month qualitative study combining participatory observation and narrative inquiry. Covering brand identity, user interface/user experience (UI/UX), e-commerce visual merchandising and transnational marketing, it investigates the redistribution of color-decision-making power between human designers and generative algorithms. Empirical results indicate that algorithms seize low-level formal execution authority, which may flatten embodied synesthesia and homogenize local cultural metaphors. Nevertheless, experienced designers do not passively surrender creative agency. They elevate their work to higher-order semantic framing and hermeneutic governance, subverting algorithmic optima through counter-prompt engineering, cross-media material translation and negative aesthetic adjudication. Human-AI co-creation constitutes a dialectical negotiation of agency. This paper resolves the superficial conflict between algorithmic deskilling and creative empowerment and provides theoretical frameworks and pedagogical implications for design education in the intelligent age.



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Introduction

Color is both the foundational building block of visual communication and a profound crystallization of human emotional experience, cultural metaphor, and aesthetic

intuition. Within classical visual design methodologies, chromatic decision-making has historically represented an intensely subjective, embodied, and culturally situated

exploratory journey. Designers interrogate design briefs and target audience psychographics. They rely on iterative, trial-and-error mechanisms, including mood boarding, chromatic scale derivation, harmonic calibration, and contextual micro-adjustments. Throughout this traditional craft-based lineage, the designer has occupied an uncontested ontological position as the primary “chromatic author” and sovereign creator of visual meaning.

However, the emergence and rapid maturation of generative artificial intelligence (GenAI) - driven by latent diffusion architectures, generative adversarial networks (GANs), and multimodal foundation models - has disrupted this long-standing equilibrium. Modern computational color engines are capable of interpreting ambiguous text prompts and outputting hundreds of chromatic palettes exhibiting high perceptual balance, contrast compliance, and psychophysical harmony within fractions of a second [1]. This unprecedented computational capacity dramatically compresses the temporal and cognitive costs historically required for intuitive color exploration, transforming human-AI co-creation from an experimental novelty into a ubiquitous industry norm.

Yet, beneath this veneer of hyper-accelerated productivity lies a profound, structural reallocation of creative agency and professional authority. Visual designers are progressively shifting from their historical role as primary originators - conceiving color schemes ex nihilo - to that of evaluative curators who inspect, filter, and validate pre-computed algorithmic outputs. This socio-technical transition provokes critical theoretical questions: Does the delegation of combinatorial color exploration to probabilistic models signify an imperceptible cession of creative sovereignty to algorithmic black boxes? Furthermore, as deep learning models converge upon the statistical means of their massive training datasets, does the resulting chromatic uniformity risk eroding personal emotional projection, flattening embodied synesthesia, and erasing localized

cultural nuances [2]?

Navigating these tensions requires moving beyond binary rhetorical debates that pit technological determinism against romanticized craft nostalgia. While early critical discourse warned of wholesale professional displacement, contemporary design research emphasizes that technology reframes the boundaries of creative identity and co-evolutionary problem formulation [3,4]. To rigorously comprehend how visual designers experience, negotiate, and reconstruct their decision-making sovereignty in practical settings, empirical investigations situated in real-world professional contexts are essential. This paper investigates the nuanced mechanics of color decision-making in human-AI co-creation through an empirical study combining participatory observation and narrative inquiry. It offers theoretical frameworks and actionable insights for design theory and practice.

Research methodology

To pierce through broad speculative claims and directly uncover the nuanced mechanisms through which chromatic decision-making shifts in everyday practice, this study adopts a qualitative research paradigm that synergizes participatory observation with narrative inquiry. Rather than treating design as a sterile laboratory variable, this paper situated the inquiry within authentic commercial design workflows. This approach enabled us to capture real-time cognitive friction, tacit negotiations, and micro-adaptations as practitioners interacted with generative AI tools across extended creative cycles.

Narrative inquiry was deployed concurrently to elicit the rich, reflective autobiographical accounts of designers navigating changing technological regimes. As contemporary research on design methodology illustrates, narrative frameworks work particularly well for examining the reconstruction of professional identity and the perceived loss of agency. They also capture the tacit strategies practitioners use to preserve authorial integrity

in ill-defined problem-solving contexts [5].

Fieldwork settings and participant profiles

The fieldwork was conducted over a four-month period across diverse creative studios and corporate digital departments. To ensure depth, empirical friction, and maximum conceptual variation, four senior practitioners were purposefully selected. The cohort spans distinct

professional domains: brand identity design, digital UI/UX engineering, e-commerce visual merchandising, and transnational marketing strategy. Participants varied widely in career tenure (ranging from 5 to 12 years), reliance on AI toolchains, and philosophical receptivity to algorithmic agency. Table 1 details their professional profiles and characteristic AI color inference workflows.

Table 1. Participant profiles and AI-assisted color workflow characteristics.

Participant ID	Years of experience	Core business domain	Primary AI toolchain	Typical workflow characteristics
P1	12 years	Brand identity visual design	Midjourney/DALL·E 3	Extracts strategic keywords from brand positioning and demographic briefs to generate mood boards; assesses chromatic ambiance through prompt permutation, manually samples hues, and calibrates palettes against brand identity and cross-media packaging rules.
P2	8 years	Digital interface & interaction (UI/UX)	Stable diffusion/colormind	Sets baseline constraints for brand colour, semantic tokens and light/dark modes; uses Colormind and Stable Diffusion for palette exploration, and audits candidate vectors for WCAG contrast, accessibility and state differentiation.
P3	5 years	New retail & e-commerce visual merchandising	E-commerce generative color plugins/stable diffusion	Defines colour themes from product taxonomies and campaign standards; generates background candidates via plugins and verifies colour fidelity across mobile, thumbnail and banner layouts.
P4	10 years	Transnational marketing & campaign strategy	ChatGPT-4/midjourney	Breaks down cross-border briefs by cultural and demographic dimensions; uses ChatGPT for localised colour metaphors, generates visuals in Midjourney, and consults local specialists to eliminate taboo colour connotations.

Immersion protocol and interpretive thematic analysis

The empirical investigation accumulated over 160 hours of direct participatory observation, during which the researchers observed creative ideation, prompt drafting, algorithmic generation runs, post-generation curation, and digital asset finalization. Screen recordings, iterative prompt logs, and intermediate design drafts were systematically archived. Following each major design milestone, semi-structured narrative interviews (lasting 60 to 90 minutes each) were conducted, prompting

participants to reconstruct their internal cognitive deliberations, emotional reactions, and perceived moments of authorial friction.

Data analysis followed an inductive, constant-comparative thematic coding framework [6]. Observational field notes, design artifacts, and verbatim interview transcripts were triangulated and coded using open, axial, and selective coding phases. Primary coding categories centered on epistemological ruptures in color synthesis, perceived loss of intuitive control, tactical resistance strategies, and semantic boundary negotiations. Emerging interpretations were iteratively validated

through member-checking sessions with the four participants to ensure interpretive rigor and ecological validity.

From intuition to algorithm: The technical logic of AI color generation

Computational color research over the past five years has undergone a decisive epistemological shift from heuristic, rule-based systems to end-to-end, data-driven deep generative models. Historically, early computational color tools were predicated on rigid geometric formalizations of color harmony. These included classic mathematical frameworks, such as those developed by Moon and Spencer, or the geometric principles underpinning Itten's color wheel. These systems codified color relationships based on predefined spatial distances within structured color spaces like Munsell or Commission Internationale de l'Éclairage (CIE). While computationally transparent, these deterministic systems were notoriously brittle and unable to capture the nuanced, fluid, and context-dependent aesthetic synergies that human designers command intuitively.

Computational evolution: From rule-based models to multimodal latent probability spaces

The integration of deep convolutional neural networks and transformer-based vision architectures has revolutionized this landscape by enabling models to learn implicit aesthetic distributions directly from millions of curated visual exemplars. For instance, Yan et al. developed a flexible neural model for color compatibility that can evaluate five-color palettes and extract variable-scale palettes from complex images using convolutional feature representations. This work demonstrates how neural networks can capture subtle color compatibility patterns that are difficult to formalize manually [7]. Building upon these perceptual foundations, contemporary generative systems integrate multimodal large language models with latent diffusion pipelines.

This synthesis creates unified frameworks where conceptual textual prompts directly condition high-dimensional visual synthesis.

Under this paradigm, color generation ceases to be an act of physical pigment mixing or intuitive subjective calibration; instead, it is reframed as an optimization and sampling problem within high-dimensional vector spaces. Multimodal models map textual tokens and visual pixels into shared latent embeddings, where concepts such as “retro cyberpunk” or “minimalist botanical warmth” correspond to specific probabilistic density clusters in latent manifolds. By sampling from these distributions, diffusion models iteratively denoise random Gaussian vectors, reconstructing pixels until they satisfy both chromatic compatibility metrics and semantic prompt alignment.

Consequently, generative algorithms transform color selection from an artisanal tacit craft - requiring years of embodied visual immersion - into an exhaustive, mathematically tractable search operation. The algorithmic engine excels at combinatorial breadth, producing mathematically balanced, aesthetically plausible compositions at speeds that entirely outstrip human biological capacity. However, technical speed does not inherently translate into semiotic depth or contextual appropriateness. Color decision-making entails far more than the production of psychophysically harmonious pigments. It demands the situated attribution of meaning within specific cultural, social, and emotional ecologies - a dimension fundamentally external to statistical loss functions.

The paradigm contrast: Intuitive craft vs. algorithmic search

To systematically map the structural shifts brought about by this technological inflection, Table 2 presents a multidimensional comparative analysis between traditional intuitive color formulation and AI-assisted computational color decision-making across seven foundational operational axes.

Table 2. Comparative analysis of traditional and AI-assisted color decision modes.

Analytical dimension	Traditional color decision-making	AI-assisted color decision-making
Decision-making subject	The individual designer operating through personal aesthetic sensibility, tacit experience, and intuitive trial-and-error.	A hybrid human-AI negotiation system wherein probabilistic models generate candidate sets and human designers exercise critical curation and governance.
Epistemological basis	Embodied perceptual intuition, affective projection, visceral memories, and deeply situated cultural metaphors.	Data-driven statistical harmony metrics, multi-objective chromatic contrast algorithms, and pixel co-occurrence likelihoods.
Exploratory solution space	Relatively constrained by cognitive fatigue, biological bandwidth, and temporal budget limitations.	Virtually infinite and exhaustive, capable of traversing vast combinatorial coordinate spaces across continuous latent dimensions.
Temporal and resource costs	High temporal expenditure characterized by manual swatch testing, mood board iteration, and micro-calibrations.	Near-instantaneous output generation operating within sub-second or seconds-long inference cycles.
Locus of emotional projection	Intrinsically woven into the generative process; emotion directly guides the physical acts of selection, mixing, and layering.	Displaced downstream to post-hoc evaluative selection, semantic contextualization, and corrective micro-adjustment phases.
Cultural metaphor formation	Established directly through the designer's conscious immersion in community symbols, vernacular idioms, and historical codes.	Approximated through statistical correlation across global training corpora; requires active human grounding to avoid generic stereotype convergence.
Primary systemic vulnerabilities	High subjectivity, cognitive bias, vulnerability to personal exhaustion, and limited empirical replicability.	Aesthetic homogenization, loss of vernacular identity, cultural misattribution, and depersonalized corporate uniformity.

Algorithmic rationality versus humanistic perception: The crisis of displaced emotional projection and cultural metaphor

As the visual designer's primary operational focus shifts decisively toward downstream curation, evaluation, and algorithmic filtering, the metaphysical essence of color design - encompassing individualized emotional projection and shared cultural metaphors - faces a profound existential crisis. When algorithmic rationalism dominates the creative process, the rich phenomenological depth of color is perpetually at risk of being reduced to mere statistical averages.

Statistical harmony vs. embodied synesthesia: The flattening of affective nuance

Human color perception is inherently embodied, cross-modal, and deeply synesthetic. As early as Goethe's

classical treatise on color, it was recognized that color is not merely an objective radiometric wavelength, but an experiential dynamic intimately bound to somatic equilibrium, moral sentiment, and physiological sensation. Modern empirical psychology corroborates this phenomenological view. In a study spanning over 30 countries, Jonauskaitė et al. demonstrated that certain color-emotion associations exhibit universal psychological tendencies. However, they also found that these associations remain exquisitely sensitive to idiosyncratic lived experience, bodily interactions, and linguistic nuances [8,9]. When human designers assign chromatic values to evoke somber grief, sacred reverence, or tranquil solitude, they draw upon an embodied memory bank - memories of physical thermal warmth, textural tactile contact, climatic rhythms, and existential vulnerability.

In stark ontological contrast, generative artificial

intelligence processes chromatic phenomena through purely mathematical representations. In machine learning architectures, emotional descriptors such as “serene” or “melancholy” are encoded as vector coordinates in multidimensional latent feature spaces. These descriptors are mapped to clusters of Red Green Blue (RGB) or Commission Internationale de l’Eclairage Lab* (CIELAB) pixel values through statistical correlation.

Generative models do not possess phenomenological consciousness. They do not experience the sensory chill of a winter dawn or the oppressive heat of midsummer noon. Instead, they approximate human sentiment through the statistical co-occurrence of image pixels and descriptive text captions harvested across the open web. This fundamental ontological chasm between embodied human feeling and statistical aggregation was vividly observed during fieldwork with participant P2, who was developing an interactive “anxiety-relief mode” for an intelligent automotive digital cockpit. Participant 2 (P2) aimed to construct a highly specific, breathing chromatic atmosphere: “the luminous, dewy green of a dense mountain forest filtering the first morning light through cold mist”. When P2 prompted multiple state-of-the-art generative tools using variations of “anxiety-relieving green”, the algorithms repeatedly converged upon a standardized spectrum of desaturated mint greens, muted sage, and sterile Morandi celadons. While these generated palettes scored near-perfect ratings on objective chromatic balance and legibility metrics, they utterly eliminated the organic irregularity, luminous atmospheric depth, and raw atmospheric moisture that P2 sought to evoke in the driver’s sensorium.

P2 (senior UI/UX interaction designer) articulated this frustrating encounter during a post-session interview, capturing the subtle violence that statistical smoothing inflicts upon affective design.

“AI-calculated colors are excessively ‘correct’ - smooth, uniform, and technically unimpeachable, yet this correctness feels profoundly sterile. They entirely lack

the subtle imperfections born from human emotional trembling - the idiosyncratic chromatic deviations that an artist mixes only while experiencing real joy or grief. In the algorithm’s aggressive denoising and optimization passes, those vital, expressive micro-deviations are systematically discarded as meaningless noise.”

Cultural stereotyping and the erosion of vernacular metaphor

An even more pervasive crisis unfolds at the level of cultural semiotics. Within human societies, color functions as an elaborate semiotic code, inextricably interwoven with collective mythology, historical memory, and indigenous cosmology. Cross-cultural linguistic research by Uusküla et al. and Epicoco et al. demonstrates that color terms and their affective connotations suffer substantial semantic loss when translated across languages and cultural topographies. The affective resonance of color is never universally interchangeable, it is deeply situated within localized semiotic ecosystems [10,11].

However, foundational generative AI models are overwhelmingly trained on indiscriminate web-scraped visual corpora, predominantly reflective of Western-centric, commercialized, and mainstream corporate imagery. Guided by the mathematical logic of empirical risk minimization, generative networks naturally gravitate toward the statistical mode - the central limit tendencies of global visual culture. As a consequence, localized cultural metaphors are systematically smoothed away or caricatured into crude cultural stereotypes.

This algorithmic reductionism manifested prominently during the observation of participant 4 (P4), who was tasked with designing a cross-border visual identity for an East Asian traditional mid-autumn cultural festival. When P4 input prompts that included conceptual terms like “traditional East Asian festive celebration” or “oriental Zen poetic aesthetics”, the generative engines consistently produced hyper-clichéd visual outputs. These included aggressively saturated crimson reds

accented with gilded yellow, or stark, monochromatic ink-wash grays paired with generic bleached wood tones. The algorithmic outputs entirely failed to register the delicate, multi-layered nuances of East Asian historical mineral palettes - such as the iridescent coolness of “mother-of-pearl purple” (luodian zi), the restrained dignity of “ancient cinnabar” (zhusha), or the deep mineral tranquility of “cold malachite green” (shilu) (see Table 3). These ancient chromatic signifiers embody complex philosophical negotiations between Daoist naturalism and imperial court rituals, which cannot be

compressed into generic commercial red-and-gold stereotypes.

Multidimensional divergence: Embodied human perception vs. algorithmic inference

To synthesize these profound epistemological and semiotic tensions, Table 3 establishes a rigorous comparative framework contrasting the embodied perceptual mechanisms of human designers against the computational inferential logic of generative AI.

Table 3. Multidimensional comparison of human embodied color representation and generative AI color inference.

Theoretical dimension	Human embodied color perception and decision	Generative AI algorithmic inference	Systemic conflicts and alienation risks
Epistemological foundation	Somatic lived experience, visceral synesthesia, emotional memory, and tacit, non-codifiable craftsmanship.	High-dimensional probability distributions, cross-modal latent embeddings, and mathematical co-occurrence correlations.	Affective expression is reduced to statistical classification tags, stripping design of phenomenological depth and visceral resonance.
Cultural signification mechanism	Dynamic semiotic encoding deeply rooted in specific historical, geographic, linguistic, and communal ritual contexts.	Weighted statistical averaging across web-scale image-text datasets governed by central tendency convergence.	Vernacular chromatic metaphors are flattened into generic global commercial aesthetics and cultural stereotypes.
Aesthetic evaluation criteria	Seeks contextual tension, poetic friction, dramatic narrative contrast, deliberate flaws, and conceptual disruption.	Optimizes for perceptual loss minimization, Euclidean distance balancing, and universal hedonic smoothness.	Proliferation of “hyper-polished mediocrity” that systematically suppresses radical, non-normative aesthetic experimentation.
Moral and creative accountability	The designer serves as an accountable moral agent responsible for aesthetic intent, cultural representation, and semiotic ethics.	Opaque algorithmic black box lacking consciousness, moral agency, or comprehension of historical consequences.	Diffusion and vacancy of ethical authorship, lulling commercial design into passive compliance with algorithmic monoculture.

Reconstructing agency: Critical negotiation and methodological breakthroughs

Confronted with risks of creative alienation and cognitive deskilling from generative AI, fieldwork practitioners rejected passive technological compliance. Rather than yielding to algorithmic hegemony prioritising computational efficiency over human judgment, they deployed resistance and dialectical negotiation within AI design workflows. Through iterative experimentation and tactical interventions, they

developed approaches to reclaim authorial agency amid shifting creator-system power dynamics.

Cognitive elevation: Upgrading from formal execution to meaning construction

To understand this reclaiming of agency, it is essential to resolve a fundamental conceptual tension: Does the delegation of color generation to AI represent an absolute loss of design sovereignty, or does it represent an evolutionary transformation of creative practice? The findings reveal a bifurcation of color decision-making

authority into two interdependent tiers. The first is lower-order “formal execution authority”: It covers procedural synthesis of specific hex codes, tonal blending, and contrast calculation. The second is higher-order “meaning construction authority”. This tier encompasses philosophical justification, semiotic contextualization, and ethical intent, which together govern why a particular chromatic harmony is adopted within a specific cultural context.

Generative AI undeniably expropriates formal execution authority, automating the artisanal mechanics of palette generation. While this expropriation may trigger initial anxiety among practitioners, it also frees designers to shift their creative agency toward higher-order conceptual framing and sensemaking. This transition closely aligns with the framework proposed by Vergantie et al. concerning design evolution in the age of artificial intelligence [12]. Moreover, as Crilly notes in his work on the co-evolution of design problem-solving and problem-finding, true creative breakthroughs do not stem from hyper-efficient optimization confined within predefined solution spaces. Instead, they arise from radical restructuring of the problem space itself.

In the fieldwork, senior brand visual director participant 1 (P1) exemplified this cognitive elevation. P1 deliberately refrained from using generative AI as an automated palette vending machine. Instead, P1 reconceptualized the model as a “provocative, slightly unhinged thinking partner” - a computational lens to disrupt human cognitive fixation. While developing the visual brand identity for an avant-garde lifestyle client, P1 deliberately engineered prompts containing sharply oxymoronic, conceptually discordant linguistic pairs, such as “dopamine energy bursting through industrial ruins” or “haute-couture silk velvet sheen blooming across decomposing woodland fungi”. By intentionally driving the diffusion model’s latent cross-attention mechanisms toward the extreme boundaries of its manifold, P1 induced productive generative glitches, uncovering bizarre, unprecedented chromatic transitions

that defied classical human convention.

P1 (senior brand identity visual director) articulated this sophisticated posture of critical reclamation during an in-depth debriefing session.

“If you treat AI merely as an accelerated paintbrush, you will inevitably be enslaved by the brush. You must treat it as an eccentric, volatile external collaborator. I delegate all the tedious combinatorial trial-and-error to its neural network, but I fiercely retain sovereign control over interpretation and curation. What I extract from its output is never what the algorithm considers its ‘statistically optimal’ solution; rather, I hunt for the magnificent, expressive accidents that spill out when its computational logic fractures.”

Tactical resistance: Deliberate interventions against algorithmic defaults

Beyond conceptual reframing, the participatory observation documented three concrete tactical interventions through which practitioners actively subvert the algorithmic default states of generative systems.

(1) Counter-prompt engineering

Experienced designers systematically eschew generic, high-frequency aesthetic modifiers (e.g., “trending on Behance”, “beautiful color palette”, “stunning contrast”) because such tokens inevitably trigger the model’s most homogenized, commercialized latent weights. Instead, designers inject highly specific physical, chemical, and historical referents - such as “naturally oxidized copper verdigris on Venetian masonry”, “19th-century Prussian blue wet-plate collodion degradation”, or “mineral azurite pigment layered on unprimed mulberry paper”. This tactical friction forces the latent diffusion process to sample from peripheral, historically grounded feature clusters, bypassing bland statistical averages.

(2) Cross-media material translation

Recognizing that digital screens and generative algorithms exist within a closed RGB /standard Red Green Blue (sRGB) mathematiccal feedback loop, practitioners routinely disrupt purely computational

workflows through physical prototyping. Designers extract digital hex values and immediately translate them onto tangible physical substrates, including unbleached Belgian linen, tactile handmade washi papers, raw architectural concrete, and metallic foil stampings. By subjecting colors to the complex, non-linear scattering of ambient physical light, designers restore tactile, embodied reality to algorithmic abstractions, ensuring that chromatic choices are grounded in phenomenological materiality rather than digital-pixel smoothness.

(3) Negative aesthetic adjudication and parameter defiance

In digital interface design, participant P2 instituted a deliberate protocol of “negative selection”. When generating candidate UI color states with algorithmic engines, P2 routinely discarded the top three highest-confidence recommendation vectors. Instead, P2 selected lower-ranked, slightly discordant candidate palettes and introduced intentional manual parameter offsets. For example, subtly breaking mathematically calculated complementary hues to insert a sharp, slightly dissonant chromatic accent. This deliberate subversion injects critical visual friction and brand differentiation into an otherwise blandly optimized digital landscape.

Dialectical co-creation: Establishing symmetrical human-AI collaboration

These empirical practices demonstrate that human-AI co-creation in visual design is neither a narrative of catastrophic technological disempowerment nor one of frictionless computational utopia. Rather, it constitutes an ongoing, dialectical power struggle - a dynamic negotiation of agency between human aesthetic intentionality and algorithmic generative capacity [13]. By confronting algorithmic smoothing with critical friction, designers transform automated tools into collaborative partners within wicked-design-problem ecologies. In doing so, the visual designer’s sovereignty is dialectically reconstructed: Formal execution is ceded

to computational efficiency, while the ultimate authority over aesthetic significance, cultural resonance, and ethical value remains firmly anchored in human creative consciousness.

Conclusion

Through an in-depth empirical inquiry blending participatory observation and narrative analysis across four commercial visual design sectors, this study investigates how generative artificial intelligence reshapes the mechanics and meaning of chromatic decision-making. The overarching findings of this research culminate in three fundamental structural insights.

First, generative AI decisively transforms color matching from an artisanal tacit craft - historically contingent on slow, biological trial-and-error - into a computationally exhaustive combinatorial optimization problem. The core comparative advantage of machine learning architectures resides in generative volume and speed, drastically lowering the cognitive search costs associated with preliminary palette ideation.

Second, the evolution of the designer’s role must not be oversimplified as a degenerative descent from “autonomous creator” to “passive curator”. Rather, it represents an ontological reallocation of decision-making authority between formal generation and semantic sensemaking. While algorithms assume operational control over combinatorial synthesis, human designers retain absolute sovereignty over aesthetic arbitration, cultural contextualization, and ethical intent.

Third, human emotional projection and cultural metaphors have not been extinguished by algorithmic rationalism; rather, they have been structurally relocated downstream within the design workflow. Confronted with a plethora of computationally flawless candidate palettes, designers draw on their personal embodied memories, somatic sensitivities, and communal semiotic knowledge. They select, interrogate, and modify

algorithmic outputs, establishing a new foundation for professional authorship in the intelligent era.

Resolving the theoretical paradox:

Harmonizing alienation and empowerment

A crucial theoretical contribution of this study lies in reconciling the apparent contradiction within contemporary design discourse between technological deskilling on the one hand and creative augmentation on the other. Uncritical, technologically determinist accounts frequently depict generative AI as an all-powerful apparatus that reduces designers to passive consumers of algorithmic taste, resulting in the vacancy of creative responsibility. Conversely, naive techno-optimism celebrates AI as an unproblematic multiplier of human genius that effortlessly eradicates routine labor.

The empirical evidence demonstrates that both extremes fail to capture the dialectical reality of everyday practice. Creative alienation and homogenization are indeed real, imminent hazards - particularly when practitioners uncritically adopt default algorithmic outputs. However, this deskilling is not an inevitable technological destiny. When designers cultivate critical algorithmic literacy, generative AI ceases to be a monolithic replacement and becomes a dialectical catalyst. The friction between algorithmic statistical smoothing and human embodied intentionality compels designers to sharpen their conceptual clarity, forcing them to articulate and defend their aesthetic rationales with greater rigor. Agency is neither completely retained in its legacy craft form nor entirely surrendered to the machine, it is dynamically renegotiated and reconstructed at a higher cognitive plane.

Pedagogical implications for design education and future practice

These findings offer urgent, actionable implications for design education and professional training institutions. For decades, visual design pedagogy has heavily prioritized formal software execution - training students

in color theory mechanics, swatch manipulation, and software interface mastery. In an era where generative algorithms execute formal tasks with superhuman velocity, this traditional curriculum risks irrelevance. Design educators must fundamentally pivot toward cultivating high-level competencies that algorithms cannot replicate.

(1) Deepening visual semiotics and cultural hermeneutics
Curricula must move beyond color wheel geometry to emphasize cultural anthropology, semiotics, and social history, equipping designers to understand how color operates as a living, situated cultural symbol.

(2) Developing critical algorithmic literacy
Future designers must be taught how deep neural networks process visual information, enabling them to identify the statistical biases, dataset omissions, and central-tendency traps inherent in commercial models.

(3) Fostering tactile and cross-media materiality
Design programs should reinforce physical prototyping, material experimentation, and phenomenological observation, ensuring that students develop an embodied relationship with color that resists purely digital abstraction.

In conclusion, the intelligent era does not herald the death of the visual designer, but rather marks the rebirth of design as a profoundly intellectual, culturally anchored, and critically reflective discipline. By consciously relinquishing routine formal execution to computational tools while fiercely mastering the domain of cultural meaning, human designers will continue to breathe vitality, nuance, and soul into our shared visual world.

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The authors declare no conflict of interest.

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