

Artificial Intelligence as a New Form of Artistic Literacy: A Conceptual Model of Digital Art Literacy

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Abstract

The rapid development of generative artificial intelligence has radically transformed the ways in which visual images are created, interpreted, and circulated, giving rise to a new cognitive environment in which artistic production unfolds through the interaction of human intention and the latent probabilistic structures of the model. Traditional frameworks of artistic and visual literacy prove insufficient for describing these processes, as they presuppose fixed relationships between the subject, the image, and the cultural code.

In this study, we propose a conceptual model of *digital-art literacy*, interpreting artistic literacy in the age of AI as a hybrid cognitive competence that integrates four levels: semiotic–compositional, prompt-rhetorical, stylistic–generative, and algorithmic–semiotic.

We demonstrate that generative models transform not only the techniques of image production but also the epistemology of visibility, turning the image into a computational object that emerges within latent spaces.

We also discuss practical implications for engineering education, creative industries, professional communication, and critical media literacy.

On the basis of our analysis, we conclude that *digital-art literacy* constitutes a new form of cognitive culture essential for meaningful participation in the algorithmically augmented visual environment of the twenty-first century.

Keywords: digital-art literacy; generative AI; latent space; prompt engineering; algorithmic visibility; computational image; AI literacy; multimodal cognition; digital aesthetics; human–AI cocreativity

1. Introduction

An analysis of the contemporary technological landscape reveals that generative artificial intelligence has, in recent years, evolved from a novel innovation into a foundational mechanism of visual production, profoundly reshaping practices of creating, interpreting, and circulating images. Systems such as DALL·E 2 [1], Midjourney [2], stable diffusion [3], and other diffusion-based models do not merely automate artistic operations; they constitute a new cognitive milieu in which the visual image emerges from the interplay between human intention and the probabilistic structures of the model. As Lev Manovich [4]; [5] argues, the age of AI introduces an entirely new logic of image creation—a logic of automated aesthetics—where latent functions of the model become

more essential than traditional artistic gestures or media techniques.

Traditional frameworks of artistic literacy, visual literacy, digital literacy, or multimodal literacy [6] prove insufficient for analyzing the dynamics of cocreation between humans and machines. These theories assume a fixed relationship between the subject, the visual sign, and the cultural code. Generative AI, however, introduces an intermediate dimension: the *latent space*, where compositional, stylistic, semiotic, and semantic structures are shaped by the “behavior” of neural networks rather than by direct human action. Consequently, researchers increasingly note that contemporary visual images become *computational objects*, emerging not on the plane of representation but within the dynamics of vector fields and probabilistic weights that transform textual intention into visual form [7]; [8].

Simultaneously, new forms of creative practice are emerging that require new types of literacy. For example, *prompt engineering* [9] is not merely a technical skill of constructing queries; it represents a novel rhetorical and semiotic practice. It demands the ability to manipulate latent model states, anticipate generative behaviors, and iteratively steer the production process. Educational research increasingly confirms that working with generative AI requires mastering a fundamentally new competence (AI literacy) which includes the capacity to interpret model behavior, identify latent biases, and understand the computational mechanisms underlying visual generation.

In this context, we argue that a new conceptual category is needed: *digital-art literacy*. This concept refers not only to the ability to use digital tools but also to the ability to operate at the intersection of artistic, cognitive, and machine-computational processes. Such literacy entails not only mastery of traditional visual skills but also an understanding of latent compositional structures, the rhetoric of prompts, the mechanisms of stylistic transformation, and the specific semiotics of neural network models.

Accordingly, this article proposes a compact conceptual model of *digital-art literacy* comprising four interrelated components: latent composition, prompt rhetoric, transformational stylistics, and neural semiotics. Together, these components form an integrated framework that describes how humans and AI jointly participate in the production of visual images. Our model explains why generative AI transforms the structure of artistic literacy

and identifies which cognitive and interpretive competencies become essential in engineering education, digital design, and the creative industries.

1.1. Definition of Digital-Art Literacy

Digital-art literacy is an integrated cognitive–algorithmic competence that enables an individual to produce, interpret, and critically evaluate visual images emerging from the interaction between human intention and generative AI models operating within multidimensional latent spaces.

In the competence we define, we include four structural components:

The semiotic–compositional level refers to the ability to understand and construct visual structures, compositional relations, and cultural codes in contexts where part of these structures is generated algorithmically.

The prompt-rhetorical level denotes the ability to formalize artistic or conceptual intention in the form of textual or parametric instructions interpretable by the model, as well as to guide generative trajectories through rhetorical strategies embedded in prompts.

The stylistic–generative level refers to the ability to anticipate and steer the probabilistic behavior of a model operating in latent space, including the management of styles, variations, and semantic shifts.

The algorithmic–semiotic level captures the ability to interpret the model’s computational patterns and identify biases, latent clusters, artifacts, and generative mechanisms that shape visual meaning.

Thus, the definition of digital-art literacy presented here constitutes a new form of cognitive culture in which visual literacy expands into the capacity to interact meaningfully with the probabilistic, nonlinear, and recursive processes of algorithmic visuality.

2. Theoretical findings

We emphasize that the shift from traditional artistic literacy to forms of visuality shaped by artificial intelligence should not be understood as yet another technological modernization but rather as a profound epistemological and semiotic rupture—one that transforms the very nature of the visual sign, the modes of its production, and the mechanisms of its perception. Historically, the visual culture of both the industrial and digital eras—from photography to computer graphics—was built upon the assumption of a direct relationship among the event, the image, and the agent of production, whether that agent was a human or a machine operating under predefined rules. In the age of generative AI, however, the image ceases to be a reflection of external reality or a direct extension of artisanal skill. It becomes a *computational phenomenon* emerging within the latent space of statistical models—a space with no direct ontological correspondence to material reality. For our purposes, this space is not a metaphor but an actual mathematical structure in which visual elements exist as distributed vector states.

Traditional theories of artistic literacy assume human control over semiotic operations such as composition, style, symbolic charge, and cultural representation. Within these frameworks, the human subject directs the image, whereas the cultural environment provides the interpretive context. However, it is evident that generative models introduce an entirely different regime of visuality. Meaning-making becomes distributed between the human and the algorithm, and significant portions of artistic labor—especially compositional and stylistic labor—are displaced into the neural architecture itself, which operates according to its own statistical and computational laws. As Manovich argues, artificial intelligence “algorithmizes the aesthetic decision,” transforming artistic production from a linear activity into a hybrid process in which authorship belongs not to the human alone but to the *human-in-conjunction-with-machine dynamics*.

One of the fundamental components of this shift is the fact that generative models do not work with the “image” as such but with latent representations—that is, abstract statistical encodings of visual features. The latent space is not a visible structure; it is better understood as a mathematical surface containing millions of potential image configurations. The artist (or engineer, or designer) interacts with this space through textual or visual prompts but cannot directly control the hidden semantic trajectories along which the model “moves” toward a particular output. This leads to a displacement of artistic literacy: the ability to manipulate line, color, or form becomes less important than the ability to understand the model’s behavior, its probabilistic tendencies, its biases, its stylistic predispositions, and its mechanisms of compositional formation.

Consequently, we extend artistic literacy toward algorithmic inspection and cognitive modeling. Research in AI pedagogy demonstrates that individuals who possess advanced AI literacy are better able to predict generative outcomes, adjust model behavior, and adapt their rhetorical prompting strategies. For us, this implies that contemporary visuality requires a more complex literacy model—one that encompasses an understanding of algorithmic structures, the capacity to interpret machine-generated semiotic patterns, the ability to guide stylistic trajectories, and a reflexive awareness of cultural and technical distortions.

Notably, AI-driven visuality transforms the relationships among the subject, the image, and the cultural context. If, in the traditional artistic system, the image functions as an expression of human intention, it becomes an encounter between human conceptualization and machine behavior. Here, it is appropriate to recall Floridi and Chiriatti’s [10] insights into the shifting boundaries of authorship: while AI is not an autonomous creator, it possesses an operational agency that influences the final visual product. This results in a new form of authorship—coauthorship with the algorithm—which demands new interpretive competencies and a reconceptualization of artistic responsibility.

Thus, the transition from traditional artistic literacy to AI-mediated visuality can be characterized as a shift from *representational visuality* to *computational–generative*

visuality. It requires a different epistemology—one in which the image is understood not as the trace of an action but as the product of an interaction with nonlinear, probabilistic yet structurally organized systems. This underscores the necessity of a new literacy model—digital-art literacy—capable of accounting for the computational mechanisms of image generation, the hybridization of authorship, and the transformation of semiotic structures in the era of algorithmic aesthetics.

Contemporary educational research increasingly highlights the multidimensional characteristics of the learning environment, including teacher motivation, institutional quality, and parameters of professional well-being. For example, Zhundibayeva et al. [11] demonstrated that differences in environmental quality (SACERS) are systematically associated with teachers' motivation and job satisfaction, underscoring the sensitivity of pedagogical practice to structural and cognitive shifts.

However, despite the active development of such directions, issues related to the transformation of visual literacy in the context of generative AI models remain virtually absent from the literature. This creates an evident research gap that the present study seeks to address by introducing the concept of digital-art literacy as a new cognitive–algorithmic competence essential for twenty-first-century educational and professional contexts.

3. Methodology

The methodological framework we employ differs fundamentally from classical empirical studies in pedagogy, media education, or computer science. Importantly, the design and structure of our work correspond to a conceptual model–building study, whose aim is not to test predetermined hypotheses on a sample but to develop a new theoretical construct—digital-art literacy—and its cognitive–algorithmic architecture. In this respect, our study continues the tradition of conceptual articles described in methodological guidelines for theoretical and model-building research [12]; [13].

Accordingly, following the logic of conceptual design, our methodological approach is organized around three interconnected layers: a strategy for selecting and synthesizing the literature; an analytical procedure for constructing the model; and an epistemological stance that clarifies the scope and limits of validity of the resulting concept.

Unlike a strictly formalized systematic review, we employ a hybrid design that combines elements of a conceptual literature review and a framework-based synthesis adapted to the needs of theoretical model construction rather than to the production of practical recommendations within a narrowly defined domain [14]; [15]; [16].

Methodologically, the analytical portion of our study relies on abductive reasoning, that is, movement from empirical-theoretical observations toward the development of a new concept capable of explaining the observed shift in the structure of visual activity. In this sense, digital-art

literacy is derived not from a single preexisting theory but from constructing at the intersection of several theoretical traditions, each elucidating only a particular facet of the phenomenon.

The first step of our analysis involved semiotic–cognitive mapping of existing approaches. Drawing on scholarship on multimodal and visual literacies, we identified foundational semiotic operations: composition, style, symbolization, modality, and cultural code. Simultaneously, from the corpus on AI literacy, we extracted elements such as understanding model operations, critical interpretation of data, awareness of algorithmic bias, and the capacity to steer the behavior of AI systems [17]; [18].

We then aligned these two strands of analysis with the literature on algorithmic *visuality* and the theory of computational images, where the visual object is conceptualized as the output of latent-space dynamics and probabilistic diffusion processes. This alignment allowed us to fix a fundamental shift in the analytical unit—from the image as a static artifact to the image as a computational–generative process. In terms borrowed from Kress's multimodal theory, this shift marks a transition from analyzing representational resources to analyzing the modes through which these resources are algorithmically generated.

In the third stage, we developed the four-level architecture of digital-art literacy, presented explicitly in the main body of the article. Methodologically, this architecture results from a dual operation: first, the deconstruction of the traditional field of visual literacy at the level of operative types (composition, interpretation, cultural code); second, the reconfiguration of these operations under conditions of generative modeling, where a substantial portion of artistic and semiotic decisions is relocated into algorithmic structures.

Each of the four levels—the semiotic–compositional, prompt–rhetorical, stylistic–generative, and algorithmic–semiotic—was derived by comparing three dimensions: which elements of artistic work remain under human control; which are delegated to the algorithm; and how this new distribution of agency necessitates a reconfigured form of literacy.

This type of work is methodologically close to what Jaakkola describes as a *conceptual model article*: a study constructing a new model through the synthesis of heterogeneous theoretical fragments, with clear articulation of the roles of each borrowed theoretical element.

Finally, at the fourth stage, we conducted an iterative assessment of the model's internal coherence, comparing our proposed architecture of digital-art literacy with existing AI literacy frameworks.

Overall, the methodological foundation of our study is rooted in interpretivist and constructivist epistemology, which holds that categories such as “literacy,” “visuality,” “authorship,” or “algorithmic bias” are not natural entities but are constituted within specific historical–technological and cultural contexts.

In this sense, we treat digital-art literacy not as an individual psychological trait but as a relational and

distributed construct describing the configuration of human and machine operations within a specific cognitive ecology. This perspective resonates with postdigital and posthumanist research traditions, in which AI agency is understood not as autonomous creativity but as an operational force structuring the field of possible human actions.

4. Results

4.1. Digital Art Literacy as a New Cognitive Competence

We reiterate that the emergence of *digital-art literacy* should be understood as a fundamental cognitive innovation associated with the transition from a static, culturally anchored form of artistic literacy to a dynamic mode of interaction with generative models operating in multidimensional latent spaces. Unlike traditional visual literacy, which is grounded in observation, interpretation, and representation, digital-art literacy develops within *processual visibility*, where the image exists not as a fixed object but as a probability, a computational trajectory, or a statistical configuration. This form of literacy requires the ability to think not only in images but also in algorithms; in tendencies of latent space; in rhetorical structures of prompts; and in the semiotic reactions of the model that emerge in response to human intention.

Whereas classical visual literacy [19] presupposes a direct correspondence between the visual sign and its cultural context, our conception of digital-art literacy demands the ability to interpret and manage what Lev Manovich has called *algorithmic* visibility—a process in which cognitive operations are distributed between human consciousness and the computational structures of the model. In this sense, we interpret digital-art literacy not as an extension of digital literacy but rather as its expansion into a domain where artistic practice becomes the coordination of human intent and neural-network behavior.

Research on AI literacy stresses that working with generative models requires a hybrid skill set that includes an understanding of probabilistic models, the ability to design structurally coherent textual prompts, and the reflexive capacity to identify biases and stylistic interference inherent in model architectures. Thus, digital-art literacy becomes a distinctive form of cognitive competence in which artistic skills are intertwined with computational skills and where interpreting an image requires not only cultural awareness but also algorithmic sensitivity.

This new competence manifests primarily in the ability to work with latent structures—the invisible yet determinative spaces of possible configurations that a model may generate. The user must be able to anticipate how the model interprets particular rhetorical constructions of the prompt, which stylistic parameters may activate or suppress certain visual patterns, and how iterative prompts transform the image within the nonlinear dynamics of diffusion-based generation.

Accordingly, digital-art literacy produces a new mode of cognitive interaction. The human becomes a *director of probabilities*, a *navigator of latent spaces*, and a *semiotic*

analyst of computational signs. Artistic intuition is supplemented with an analytic understanding of algorithmic behavior, whereas visual sensitivity is complemented by an awareness of the statistical properties of training corpora and the architectural logic of generative systems.

A defining characteristic of digital-art literacy is its interactivity and recursion—the fact that images emerge through repeated human–model–human cycles, in which each iteration refines not only the visual result but also the user’s understanding of the mechanics of image formation. This aligns with empirical research on generative creativity, which shows that iteration, prompt adjustment, and reflection on model behavior are central to the development of contemporary digital artistic competencies.

Thus, in our interpretation, digital-art literacy is not merely a new cultural phenomenon but a *cognitive–technical literacy*—a competence that enables meaningful interaction with generative neural systems, the ability to manage their visual parameters, and the capacity to interpret their outputs across cultural, algorithmic, and semiotic dimensions.

This competence has no direct analog in earlier forms of artistic knowledge, and we argue that it is becoming a necessary condition for participation in contemporary visual culture, engineering design, communication, and educational practices of the twenty-first century.

The iterative nature of human–model interaction underlying the formation of digital-art literacy is represented in Figure 1.

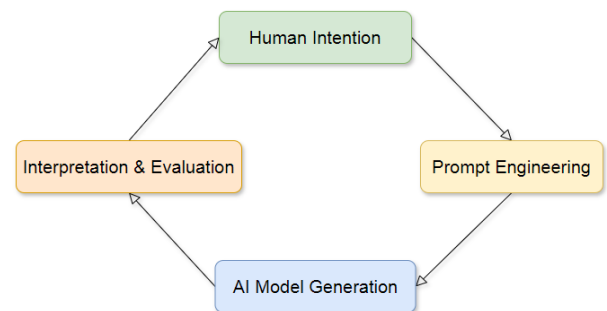


Figure 1. Human–Model Interaction Cycle in Digital-Art Literacy

The diagram visualizes one of the central elements of digital-art literacy: the recursive cycle of interaction between human intention and the algorithmic dynamics of a generative model. Unlike traditional models of artistic activity, which assume a linear progression from idea to image, generative AI transforms the creative process into a nonlinear dialog in which each stage is not a conclusion but the beginning of a new iteration of cognitive–algorithmic cooperation.

At the top of the cycle, we place human intention, comprising compositional decisions, semantic structures, and cultural context. In the age of AI, artistic intent is no longer static: even at the initial stage, it must account for the probabilistic nature of visual output, the characteristics of latent spaces, and the behavioral patterns of the model.

Human intention thus becomes not a preliminary step but a function of future interaction with the system.

The next element, Prompt Engineering, represents the rhetorical and computational translation of intent into a form interpretable by the model. The prompt functions as a mediator between humans and machines: it must be semantically expressive yet parametrically precise. Even minor variations in prompt structure can significantly alter the model's trajectory within latent space, demonstrating that prompt literacy is a new form of artistic technique.

The third block, AI model generation, corresponds to the computational phase, where diffusion or transformer architectures convert linguistic instructions into visual forms. Here, creative action is performed not by the human but by the algorithm, which operates according to its internal statistical logic: selecting paths within a multidimensional latent space, activating stylistic clusters, combining probabilistic features, and shaping the final render. This stage underscores that digital-art literacy requires thinking in terms of algorithmic behavior as much as in artistic procedures.

The cycle concludes with Interpretation & Evaluation, where semiotic analysis takes place: identifying semantic shifts, stylistic mismatches, visual artifacts, and algorithmic biases. Interpretation becomes an act of critical analytics directed not only toward the image but also toward the model itself. It determines which aspects require refinement and initiates the next iteration—returning to an adjusted intention, a revised prompt, and a new generative cycle.

Thus, the diagram demonstrates that digital-art literacy is an iterative, recursive, and distributed competence in which human and machine cognitive actions are mutually constitutive. Unlike the classical artistic process, creativity here does not end at execution; it continues as many times as necessary to stabilize the dialog between humans and models.

Overall, the cycle illustrates the following:

- creativity in the AI era is the tuning of dialogic parameters,
- the image is the outcome of a series of human-machine agreements,
- Literacy is the ability to manage and interpret this process.

In the context of engineering education, the presented cycle highlights that interaction with AI requires mastery of both technical and cognitive-analytic skills, thereby forming a new culture of visual reasoning and design.

4.2. Conceptual Model of Digital Art Literacy

From a practical perspective, developing a conceptual model of *digital-art literacy* requires a shift from describing isolated skills (prompt construction, stylistic adjustment, or visual pattern analysis) to understanding how a unified cognitive system emerges—one that links human intention, algorithmic behavior, and cultural interpretation. This model must consider not only the technical specificity of generative architectures but also the

deeper epistemological transformations that AI introduces into the production of artistic meaning.

In our proposed framework, digital-art literacy is conceived as a four-component system comprising the following:

1. The semiotic-compositional level, which encompasses an understanding of visual structure, compositional principles, and the cultural codes embedded in images,
2. The prompt-rhetorical level, where artistic intention is transformed into algorithmically interpretable instructions,
3. The stylistic-generative level, associated with steering the model's trajectories within latent space,
4. The algorithmic-semiotic level enables the interpretation of model behavior, biases, probabilistic decisions, and the specific characteristics of artistic output.

These levels do not function in isolation. Instead, they form a dynamic loop of interaction, *i.e.*, *intention-parameterization-generation-interpretation*, analogous to what Luciano Floridi describes as an “aesthetics of distributed agentive action.”

In the first stage, the subject formulates a visual intention grounded in cultural knowledge and compositional experience. In the second stage, this intention is translated into a prompt structure that is both linguistic and computational: it must be semantically cohesive while remaining compatible with the probabilistic logic of the model. The third stage is executed by the generative system itself, which performs a nonlinear transformation from textual description to visual representation by traversing latent-space pathways that cannot be fully controlled, although they can be guided through precise parameterization. In the fourth stage, the user interprets the result, comparing the model's output with the original intention, cultural codes, and semiotic structures of the image. This cycle then repeats recursively, forming an evolving cognitive competence.

A central element of our model is the understanding of latent space as a new artistic medium. In traditional art, the medium—canvas, photographic film, or a digital display—possesses a material or visual structure governed by physical laws. The latent space, however, is statistical and multidimensional. It possesses its own topology in which visual features are distributed across probabilistic clusters and vectors. Developing a conceptual sensitivity to the dynamics of this space—without necessarily mastering the engineering details—becomes a key component of digital-art literacy. The user must be able to anticipate which stylistic specifications, refinements, or iterations may shift the model toward a desired cluster or away from zones of bias.

Thus, our conceptual model of digital-art literacy constitutes a hybrid system in which artistic reasoning is integrated with algorithmic intuition and interpretation is complemented by an understanding of the probabilistic nature of visual output. This system does not replace traditional artistic literacy; rather, it transforms it into a more complex and adaptive competence that reflects new relationships among human agents, machine processes, and

visual artifacts. In an era in which visibility becomes a distributed process, digital-art literacy emerges not as a technical skill but as a *new form of cognitive culture*—the capacity to think within the framework of joint artistic action between humans and neural-network models.

The structural organization of the model, including the distribution of cognitive functions across the four levels and their recursive interconnections, is illustrated in Figure 2.

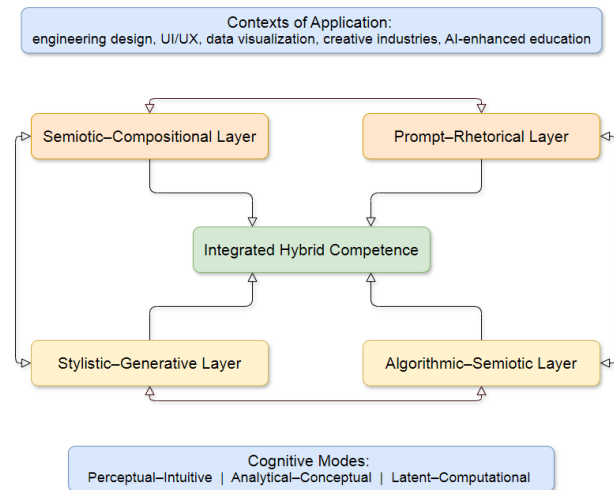


Figure 2. Architecture of digital-art literacy (four-layer hybrid competence model)

The presented diagram conceptualizes digital-art literacy as a hybrid cognitive system emerging at the intersection of artistic practice, algorithmic reasoning, and interaction with generative AI models. Unlike traditional artistic literacy, which assumes a linear path from concept to finished image, digital-art literacy operates as a dynamic network of interdependent cognitive operations.

The central core of the diagram denotes the integrated competence through which human intention and model behavior form a unified creative circuit.

The four surrounding components represent the primary levels of this new literacy. Bidirectional connections among these components emphasize the nonlinear nature of the process: generation is always recursive, and each stage modifies those that came before. This interdependence illustrates a key feature of digital-art literacy, namely, the transition from “creating an image” to *navigating probabilistic spaces of visibility*.

The upper segment of the diagram highlights the multidisciplinary context of application (engineering design, data visualization, UI/UX, education), demonstrating that this new literacy extends far beyond artistic disciplines. The lower segment identifies three cognitive modes—perceptual, analytical, and computational—latent—that operate jointly and shape the specific ways in which users engage with AI-mediated visibility.

In this sense, the block scheme demonstrates that digital-art literacy is not a technical skill but a new cognitive culture that enables meaningful and critical engagement with algorithmic image production and

integrates these processes into contemporary engineering and educational modes of thinking.

4.3. Practical Implications

We argue that the practical implications of digital-art literacy extend far beyond artistic production, encompassing engineering education, the design of complex visual systems, human-machine interfaces, and emerging professional competencies of the digital age. Above all, the ability to work with generative models transforms the very character of creative and engineering practice. Instead of producing images entirely “by hand,” the specialist becomes a conductor of probabilistic processes—steering the model’s latent trajectories and interpreting visual outcomes with attention to their algorithmic and cultural layers. This shift from singular authorship to hybrid coagency opens the door to new forms of visual prototyping, accelerated ideation, and multivariate exploration of aesthetic solutions.

In engineering education, digital-art literacy acquires instrumental competence. Contemporary generative architectures enable the rapid creation of visualizations of engineering objects, interfaces, and system designs, making the ability to direct their behavior essential for future professionals. Research in technological pedagogy shows that AI-based tools foster a deeper understanding of complex structures through visual modeling, multi-iterative analysis, and adaptation of images to diverse application scenarios. Integrating digital-art literacy into engineering curricula therefore cultivates skills that blend analytical rigor with visual intuition, positioning future engineers as competent participants in an algorithmically expanded visual environment.

Digital-art literacy also significantly affects professional communication. In architecture, industrial design, medicine, urban planning, and other fields where visual models facilitate dialog and decision-making, generative systems can accelerate collective visualization, lower the barrier to creative collaboration, and support multiperspectival analysis of concepts. Such visual scenarios can be used in “rapid design sessions,” in remote or hybrid educational studios, and in public project presentations, contexts in which the quality of visual material directly influences communicative efficiency.

Furthermore, digital-art literacy establishes foundations for new ethical and critical competencies. Understanding model biases, generative dynamics, and the cultural codes embedded in training data enables users to recognize the limitations of AI visual systems and assess risks associated with misrepresentation, stereotyping, or data-driven distortions. This is particularly crucial in contexts where visual information shapes social judgments, for example, in media, education, urban studies, and political communication. As Manovich emphasized, algorithmic visibility is not neutral: it inherits and amplifies existing cultural structures, requiring users to exercise heightened critical sensitivity.

Finally, our model of digital-art literacy opens pathways to innovative practices in which generative

models become integral to production and scientific workflows. In biomedical imaging, materials science, and robotics, AI is increasingly used to generate preliminary models and hypotheses, which are then refined through traditional methods. This suggests that digital-art literacy can broaden the horizons of research by employing visual structures as instruments of thought and scientific modeling.

Thus, the practical implications of digital-art literacy lie not only in extending creative possibilities but also in forming a new professional ecology—an environment in which visual, algorithmic, and cognitive processes converge into a unified mode of action. Digital-art literacy has emerged as a key competence of the twenty-first century and is capable of transforming artistic and engineering practices alike by establishing new standards of visual reasoning and interdisciplinary communication.

4.4. Limitations and Future Research

Despite the conceptual model of digital-art literacy developed in this study and the cognitive–algorithmic architecture we have proposed, it is important to acknowledge that our work has several limitations shaped both by the nature of theoretical reconstruction and by the very dynamics of human interaction with generative AI models. These limitations do not diminish the value of the framework presented here; rather, they delineate the boundaries of its interpretation and point toward directions for further scholarly development.

First, the model we propose is conceptual rather than empirically verified. Unlike studies grounded in experimental data, behavioral metrics, or pedagogical interventions, our work seeks primarily to describe the epistemic transformation of visibility and the cognitive operations that arise from users’ engagement with generative AI. Consequently, the architecture of digital-art literacy has not yet been tested on representative samples, in K–12 or higher education contexts, within professional design and engineering communities, or in cross-cultural comparative settings. In this context, the empirical operationalization of digital-art literacy—ranging from prompt rhetoric to algorithmic–semiotic analysis—remains a promising task for future research.

Second, our model is formulated within a rapidly changing technological environment, where generative architectures (diffusion, transformer-based, multimodal) evolve at high velocity. This poses a methodological challenge: any theoretical construction risks becoming provisional if it is tied too closely to specific generative mechanisms. We have attempted to avoid this technological determinism by articulating digital-art literacy through basic cognitive–semiotic processes. Nevertheless, future research must further evaluate the stability of the proposed literacy levels in the face of emerging models, new forms of interactivity, and evolving generative regimes.

The third limitation concerns the cultural and sociosemiotic variability of visual interpretation. Because generative models are trained on datasets saturated with

cultural, political, and aesthetic asymmetries, they inevitably reproduce—and at times amplify—preexisting biases contained within those data. Algorithmic visibility is not neutral. Accordingly, digital-art literacy presupposes a user’s capacity to detect and interpret such embedded distortions. Our study identifies this direction only in broad terms. A systematic examination of culture-specific and cross-cultural differences requires a dedicated empirical agenda encompassing bias analysis, ethnocultural layers of training data, and the mechanisms through which these layers manifest in the visual outputs of AI models.

A fourth limitation arises from the recursive character of the “human–model” cycle described in this study. This cycle implies that digital artistic activity is processual, interactive, and probabilistic. However, a fine-grained mapping of this recursion—from microiterations of prompts to the transformation of user intention under the influence of generative suggestions—remains beyond the scope of our work. Longitudinal research is needed to understand how digital-art competence is formed: how users internalize AI tools, how their interaction strategies evolve, and how their cognitive patterns shift over time.

Finally, the proposed architecture of digital-art literacy can be further extended toward pedagogical, engineering, and cognitive operationalization. Promising directions for future inquiry include developing assessment instruments for measuring levels of digital-art literacy (from tasks involving the interpretation of latent trajectories to metrics evaluating prompt quality), designing curricula adapted to generative AI, and constructing learning models for designers and engineers working within algorithmic visual environments. Additional opportunities lie in examining the application of digital-art literacy across professional domains—from visual communication to biomedical imaging and robotics.

Thus, the limitations of this study should not be understood as deficiencies but as generative points of departure. They outline the conceptual space within which the theory of digital-art literacy may be refined, specified, and empirically validated. Our model proposes not a final system but a conceptual scaffolding for ongoing scholarly, educational, and interdisciplinary research in the field of algorithmic visibility and the cognitive culture of the generative AI era.

5. Conclusion

The transition from traditional artistic literacy to emergent AI-driven visibility represents not localized technological mutation but rather a profound cultural and cognitive shift. It reshapes the foundations of visual experience, the nature of artistic creation, and the mechanisms through which meaning is produced in a distributed interplay between humans and algorithms. In this new environment, the image no longer results from a craft or from an individual expressive act; it becomes the outcome of the complex dynamics of latent spaces, statistical transformations, and parameterized human intentions. For this reason, it becomes necessary to conceptualize digital-art literacy as a comprehensive

cognitive competence that integrates artistic, algorithmic, and semiotic modes of reasoning.

The model of digital-art literacy proposed here demonstrates that this new literacy emerges not through the adoption of a new toolset but through a shift in the epistemological horizon. Creativity becomes cooperative; the image becomes computational. Under this logic, generative models function not as instruments but as coagents in the production of visibility, prompting new forms of responsibility, critical analysis, and awareness of model limitations. Moreover, the applicability of digital-art literacy in engineering, design, and research contexts underscores its transdisciplinary significance. It enables visual thinking under conditions of uncertainty, facilitates engagement with complex probabilistic structures, and creates new channels of communication between humans and machines.

As contemporary scholarship—from Manovich to Floridi—shows, the central challenge of the digital era is not only learning new tools but also learning to think within an altered cognitive ecology in which AI becomes part of the very structure of the visual world [5]; [10]. Thus, digital-art literacy can be understood as such an ecology—a new infrastructure for perception, interpretation, and creative practice.

Accordingly, the development of digital-art literacy is not simply an educational or professional task but a key component of societal adaptation to the age of algorithmic visibility. It is a competence that enables individuals to maintain creative agency amid intensified machine participation, sustaining the capacity for cultural reflection, aesthetic judgment, and ethical evaluation.

Ultimately, we contend that this form of literacy defines the conditions under which humans will engage with the visual systems of the future—shaping new standards of perception, creativity, and scientific reasoning in the digital epoch.

References

- [1] OpenAI. (2025). DALL·E 2. Retrieved from <https://openai.com/index/dall-e-2/>
- [2] Yang, H. (2025). Midjourney. In *The Palgrave Encyclopedia of Computer-Assisted Language Learning* (pp. 1–5). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-51447-0_105-1
- [3] Moreno, H., Gómez, A., Altares-López, S., Ribeiro, A., & Andújar, D. (2023). Analysis of Stable Diffusion-derived fake weeds performance for training Convolutional Neural Networks. *Computers and*

- Electronics* *in* *Agriculture*, 214. <https://doi.org/10.1016/j.compag.2023.108324>
- [4] Manovich, L. (2017). Automating aesthetics: Artificial intelligence and image culture. *Flash Art International*, (316), 1–10.
- [5] Manovich, L., & Arielli, E. (2022). AI Aesthetics and the Anthropocentric Myth of Creativity. *Nodes Journal of Art and Neuroscience*, XI(19–20), 91–97. Retrieved from <https://philpapers.org/rec/ARIAAT-6>
- [6] Kress, G., & Leeuwen, T.V. (2020). Reading Images: The Grammar of Visual Design (3rd ed.). Routledge. <https://doi.org/10.4324/9781003099857>
- [7] Ramesh, A., Dhariwal, P., Nichol, A., Chu, C., & Chen, M. (2022). Hierarchical text-conditional image generation with clip latents. *arXiv preprint arXiv:2204.06125*, 1(2), 3.
- [8] Ho, J., Jain, A., & Abbeel, P. (2020). Denoising diffusion probabilistic models. *Advances in neural information processing systems*, 33, 6840–6851.
- [9] Lund, B. (2023). The prompt engineering librarian. Library Hi Tech News. Emerald Publishing. <https://doi.org/10.1108/LHTN-10-2023-018>
- [10] Floridi, L., & Chiriatti, M. (2020, December 1). GPT-3: Its Nature, Scope, Limits, and Consequences. *Minds and Machines*. Springer Science and Business Media B.V. <https://doi.org/10.1007/s11023-020-09548-1>
- [11] Zhundybayeva, T., Nametkulova, F., Sugirbekova, A., & Orakova, A. (2024). Comparison of Motivation and Job Satisfaction of Teachers Working in Schools with Low and High International SACERS Scale Scores. *Journal of Curriculum Studies Research*, 6(2), 177–195. <https://doi.org/10.46303/jcsr.2024.17>
- [12] Jaakkola, E. (2020). Designing conceptual articles: four approaches. *AMS Review*, 10(1–2), 18–26. <https://doi.org/10.1007/s13162-020-00161-0>
- [13] Lindgreen, A., Di Benedetto, C. A., Brodie, R. J., & Jaakkola, E. (2021). How to develop great conceptual frameworks for business-to-business marketing. *Industrial Marketing Management*. Elsevier Inc. <https://doi.org/10.1016/j.indmarman.2020.04.005>
- [14] Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- [15] Dixon-Woods, M. (2011). Using framework-based synthesis for conducting reviews of qualitative studies. *BMC Medicine*, 9. <https://doi.org/10.1186/1741-7015-9-39>
- [16] Shaw, L., Nunns, M., Briscoe, S., Anderson, R., & Thompson Coon, J. (2021). A “Rapid Best-Fit” model for framework synthesis: Using research objectives to structure analysis within a rapid review of qualitative evidence. *Research Synthesis Methods*, 12(3), 368–383. <https://doi.org/10.1002/jrsm.1462>
- [17] Mertala, P., Fagerlund, J., & Calderon, O. (2022). Finnish 5th and 6th grade students’ pre-instructional conceptions of artificial intelligence (AI) and their implications for AI literacy education. *Computers and Education: Artificial Intelligence*, 3. <https://doi.org/10.1016/j.caeai.2022.100095>
- [18] Yim, I. H. Y., & Su, J. (2025). Artificial intelligence literacy education in primary schools: a review. *International Journal of Technology and Design Education*. <https://doi.org/10.1007/s10798-025-09979-w>
- [19] Messaris, P. (1996). Visual “Literacy”: Image, Minds, and Reality. *Canadian Journal of Communication*, 21(2). <https://doi.org/10.22230/cjc.1996v21n2a947>