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STRUCTURED PATHWAY FOR KEY VISUAL DESIGN: INTEGRATING CLA AND EXTENICS

The escalating demands of public aesthetic evolution have positioned key visual design as a critical medium for cultural dissemination and identity construction, yet conceptual development in this field continues to rely heavily on subjective intuition and fragmented inspiration, lacking systematic methodological support. To address this gap, this research constructs a structured, hybrid creative pathway for key visual design that integrates vertical semantic depth with horizontal quantitative evaluation. The proposed framework synergistically combines Causal Layered Analysis (CLA) from futures thinking – which deconstructs design propositions across four levels (litany, systemic causes, worldview/discourse, and myth/metaphor) to uncover layered cultural meanings – with the formalized, quantifiable modeling capabilities of Extenics Semantics, which translates abstract cultural and semantic factors into evaluable matter-element structures for objective comparison and selection. In the implementation phase, generative artificial intelligence (AIGC) is further incorporated to efficiently transform the selected high-value semantic concepts into diverse visual forms, thereby accelerating graphic realization. Applied to the key visual design task for the "Hiii Illustration International Illustration Award", this integrated methodology demonstrated its practical efficacy: through layered problem analysis, semantic factor extraction, quantitative evaluation via custom metrics (cultural relevance tx and cultural value weight ty), and AI-assisted visual generation, the framework systematically guided the development of a culturally resonant visual identity – centered on the metaphor of "stone" to symbolize resilience and uniqueness – while reducing arbitrary reliance on designer intuition. The study concludes that the combined application of CLA and Extenics Semantics not only enhances the logical coherence, evaluative transparency, and cultural depth of the design process but also establishes a replicable, structured pathway that balances creative inspiration with methodological rigor, offering a scientifically-grounded and operationally viable model for key visual design in complex cultural contexts.

Key words: *Key visual design; Creative association; Causal layered analysis; Extenics Semantics; Generative artificial intelligence.*

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СТРУКТУРОВАНІЙ ШЛЯХ ПРОЄКТУВАННЯ KEY VISUAL: ІНТЕГРАЦІЯ СЛА ТА ЕКСТЕНІКИ

Зростання вимог до суспільної естетики перетворило ключовий візуальний дизайн на важливий засіб культурної комунікації та формування ідентичності. Однак концептуальне проектування в цій галузі досі значною мірою спирається на суб'єктивну інтуїцію та фрагментарне натхнення, бракуючи системної методологіч-

ної підтримки. Для подолання цього розриву в дослідженні запропоновано структурований гібридний творчий шлях, що поєднує вертикальну семантичну глибину з горизонтальною кількісною оцінкою. Запропонована модель синергетично інтегрує причинно-наслідковий багаторівневий аналіз (CLA) з інструментарію футурологічного мислення, який деконструє дизайнерські концепції на чотирьох рівнях (літання, системні причини, світогляд/дискурс та міт/метафора) для розкриття багатопланових культурних значень. Цей метод поєднується з формалізованими можливостями екстенсійної семантики, що трансформує абстрактні культурні та семантичні чинники в оцінювані структури предметно-елементного типу для об'єктивного порівняння та відбору. На етапі впровадження залучено генеративний штучний інтелект (AIGC) для ефективного перетворення обраних високоцінних семантичних концепцій у різноманітні візуальні форми, що прискорює графічну реалізацію. Практична ефективність інтегрованої методології була апробована під час розробки візуального рішення для міжнародної премії ілюстрації «Niii Illustration International Illustration Award». Завдяки багаторівневому аналізу проблем, екстракції семантичних чинників, кількісній оцінці за допомогою спеціальних метрик (культурна релевантність t_x та вага культурної цінності t_y) та AI-асоційованій візуальній генерації, запропонована структура забезпечила системну розробку культурно-резонансної візуальної ідентичності. Центральним образом стала метафора «камня» як символу стійкості та унікальності, що дозволило мінімізувати довільну залежність від інтуїції дизайнера. У висновках зазначено, що поєднання CLA та екстенсійної семантики не лише підвищує логічну послідовність, прозорість оцінювання та культурну глибину дизайну, а й формує відтворюваний структурований шлях, який балансує творче натхнення з методологічною строгістю. Це пропонує науково обґрунтовану та операційно спроможну модель для ключового візуального дизайну в складних культурних контекстах.

Ключові слова: ключовий візуальний дизайн; творча асоціація; причинно-наслідковий багаторівневий аналіз (CLA); екстенсійна семантика; генеративний штучний інтелект.

Problem Statement. Elevated aesthetic standards demand advanced key visual design, yet creative generation often relies on subjective inspiration without systematic methods. Limited time and resources hinder deep cultural interpretation.

This study integrates CLA and Extenics semantics to create a structured pathway, combining vertical analytical depth with horizontal quantitative support. Generative AI is further employed for efficient and diverse visual translation.

Analysis of research. Challenges and Requirements of Main Visual Design. Creating quality key visuals under tight deadlines is increasingly difficult. Relying solely on designer intuition is insufficient for complex demands (Zhou, J et al., 2024: 3). While intuition may yield immediate results, it often lacks lasting impact (Fu Zhiyong, Zhou Yuyao, 2017: 58). The absence of objective methodology leads to superficial replication (Gao Peng, 2024: 123). Systematic methods integrating semantic refinement and structural validation are needed to enhance coherence and depth, as individual inspiration is limited, especially in resolving brand-society semantic conflicts (Belfield, Petrescu, 2024: 8). Conceptual creation must engage cultural issues to endow designs with greater social value.

The Inspiration of Causal Analytic Hierarchy Process in Design. Causal Layered Analysis (CLA) (Inayatullah, 2008: 12) examines issues through litany, systemic causes, worldviews/discourse, and myths/metaphors, fostering cultural depth (Inayatullah, 2009: 25). Unlike trend-focused research, CLA critically reshapes social assumptions and structures (Slaughter, 1997: 15), distinguishing futures studies and activating designers' pluralistic cognition and imagination.

CLA enhances design education by improving spatial awareness (Haigh, 2016: 170). Futures-infused methods help designers consolidate perspectives and bridge feasibility with foresight (Xu, Lü, 2023: 30). CLA's layered framework guides from surface to deep dimensions, enabling engagement with complex challenges and exploration of philosophical, long-term impacts (Zhao, Zhang, 2023: 10).

CLA focuses on analysis over concrete solutions (MacGill, 2015: 60). Its metaphors often remain theoretical, resisting actionable translation (Riedy, 2008: 150). Despite design use, a clear path from insight to tangible expression is elusive (Lederwasch et al., 2011: 210). Integrating complementary methods is therefore essential to implement CLA insights.

The quantitative evaluation capabilities of Extenics semantics. Extenics semantics addresses the need for evaluable yet creative systems by formalizing abstract semantics into matter-element structures (Yang et al., 2016: 1510). Its application spans from translating regional symbols (Feng, Wu, 2024:228) to innovating cultural imagery (Han et al., 2024: 225), confirming its viability in quantifying cultural elements for objective decision-making. Semantic quantification enhances transparency and reliability over expert judgment alone (Liu et al., 2022: 265), proving crucial for efficient evaluation and selection in time-constrained key visual design.

Extenics semantics' initial modeling lacks critical support in feature and criteria definition, requiring integration with cognitive methods to avoid formal detachment.

Integrating vertical semantic insight with horizontal quantitative evaluation. Key visual design necessitates a hybrid approach that transcends mere

subjectivity or rationality (Zheng, Fu, 2015: 82). Research demonstrates its practical potential by integrating Extenics semantics with methods such as eye-tracking (Hu et al., 2021: 90), user perception studies (Li et al., 2024: 218), and cultural abstraction (Liu et al., 2024: 1100). This study positions cultural semantics at the core, supported by quantitative tools and AI. CLA provides semantic depth, Extenics enables structured evaluation, and AI facilitates visual translation, collectively balancing creative insight with logical efficiency (Sanders, Shen, 2025: 6).

The purpose of the paper is to develop and validate a structured, hybrid methodological framework for key visual design by integrating Causal Layered Analysis (CLA) with Extenics. The study aims to bridge the gap between intuitive creative processes and systematic analytical methods, providing a pathway to deconstruct deep cultural meanings and transform them into quantifiable, objective design elements.

Presentation of the main material. The proposed key visual design solution, illustrated in Figure 1, comprises three principal phases with the following core components:

(1) Semantic Layering employs CLA to conduct four-level Problem Analysis and Semantic Extraction of the design theme;

(2) Semantic Modelling utilizes Extenics Semantics to quantify associative concepts generated across these layers, evaluating and identifying optimal creative directions;

(3) Collaborative Generation uses semantic factors as generative AI prompts, with outputs refined digitally to accomplish key visual design tasks.

This methodology establishes an integrated pathway from problem analysis to creative output, directly addressing over-reliance on intuition in conceptual development.

Phased Implementation Procedures and Concrete Execution

(1) Semantic Layering encompasses both Problem Analysis and Semantic Extraction. Problem Analysis collects and analyzes data to build a framework. Semantic Extraction applies CLA across four levels (Inayatullah, 2009: 12): Semantic Extraction applies CLA across Surface, Historical, Assumption, and Symbolic levels.

(2) Semantic Modelling includes Factor Extraction, structuring “problem-method-characteristic” insights, and Factor Evaluation, which quantifies and selects optimal concepts. Using Likert scales and the Extenics Semantics model, keywords are refined into factors and assessed along two dimensions: cultural relevance ($t_x, 0-1$) and cultural value weight ($t_y, >1$).

Following established methods (Li et al., 2024: 218), the T-value is derived from $t_x \times t_y$ (Eq. 1). Comparison of T-values identifies the highest-scoring factor across levels as the definitive creative solution.

$$T = t_x \cdot t_y$$

CLA provides a critical framework; Extenics Semantics enables quantitative comparability. Their integration shifts decision-making from intuition to logic and evidence.

(3) Collaborative Generation uses generative AI (AIGC) to train models with solution keywords, iteratively generating semantic-aligned image assets for a smart database. Digital software then refines graphics, color, and layout to realize the key visual identity.

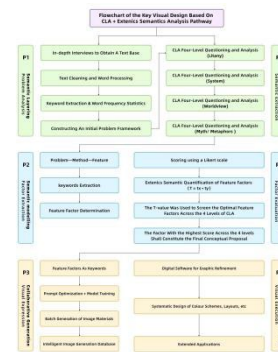


Fig. 1. Schematic Diagram of the key Visual Design Process Based on CLA+ Extensional Semantics

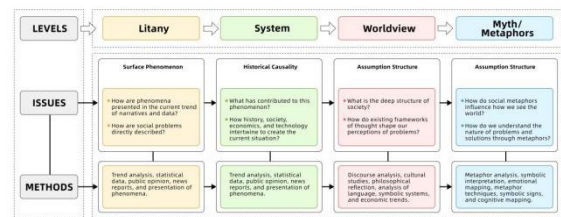


Fig. 2. Schematic Diagram of The Four Levels of Causal Layered Analysis (CLA)

Applied Practice of Key visual Design Integrating CLA and Extenics Semantics The "Hiii Illustration Award" case validated the "CLA+ Extenics Semantics" method, defining its core task through interviews as visually expressing "discovering illustrators". CLA structured analysis across four levels to guide conceptual development.

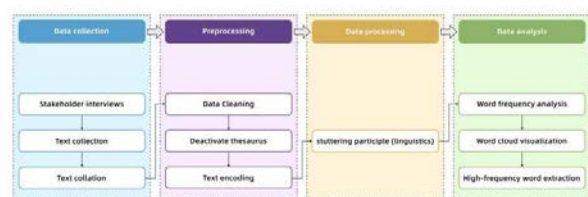


Fig. 3. Word Frequency Analysis and Flowchart

Table 1

Cultural Relevance Score Results for The Litany Layer

Feature Factor	Number of People							t _x
	1 Point	2 Point	3 Point	4 Point	5 Point	6 Point	7 Point	
Creative Journey	0	0	1	2	3	1	1	0.95
Expressiveness	0	1	1	2	2	2	0	0.94
Personal Style	0	1	2	3	2	0	0	0.79
Process Documentation	1	2	2	2	1	0	0	0.73
Influence	2	2	2	1	1	0	0	0.65
Multidimensional Eval	2	2	2	2	0	0	0	0.59
AI Assistance	2	3	1	1	1	0	0	0.52
Subjectivity	3	2	1	1	1	0	0	0.46

Table 2

Cultural Value Weighting Score Results for The Litany Layer

Feature Factor	Score					t _y
	D ₁	D ₂	D ₃	D ₄	D ₅	
Creative Journey	3.00	3.85	3.00	3.00	4.00	3.37
Expressiveness	2.35	3.00	3.00	3.00	3.00	2.87
Personal Style	3.00	3.10	3.00	3.00	3.00	3.02
Process Documentation	3.00	2.00	2.00	3.00	3.00	2.60
Influence	2.00	2.00	2.00	3.00	2.00	2.20
Multidimensional Eval	1.50	2.00	2.00	2.00	2.00	1.90
AI Assistance	1.50	2.00	1.00	2.00	2.00	1.70
Subjectivity	1.00	2.00	1.50	1.00	2.00	1.50

Table 3

Problem, Methodology and Feature Factor Data for The Litany Layer

Problem (Design Question)	Proposed Method (Design Strategy)	Feature Keyword	T
How can the competition select <i>resilient</i> and <i>courageous</i> illustrators and works?	Optimize selection criteria, focusing on the creative journey behind the work.	Creative Journey	3.20
Should the competition emphasize the contestants' <i>artistic expressiveness</i> ?	Establish clear evaluation standards for expressiveness.	Expressiveness	2.70
How can contestants' <i>personal style</i> be reflected in the judging process?	Add personalized dimensions to the evaluation criteria.	Personal Style	2.38
Is it necessary to implement a mechanism for <i>recording the creative process</i> ?	Build an archival database of creation process videos.	Process Documentation	1.90
Should the illustrator's <i>social influence</i> be considered in judging?	Define influence metrics and guidelines to ensure fairness.	Influence	1.43
Must the judging criteria account for <i>multi-dimensional factors</i> ?	Construct a multi-faceted set of evaluation factors.	Multidimensional Evaluation	1.12
Should the judging process incorporate <i>AI-assisted scoring</i> ?	Develop an auxiliary scoring model trained by experts.	AI Assistance	0.88
How to reduce judging <i>subjectivity</i> and improve objective evaluation standards?	Increase quantitative methods and evidence-based scoring for objectivity.	Subjectivity	0.69

Table 4

Assessment Results for the Four-Level Final Feature Factors in CLA

CLA Layer	Selected Concept Description	t _x	t _y	Final Score T
Litany	Highlight illustrators' creative journeys	0.95	3.37	3.20
System	Emphasize creation process and personal motivation	0.98	3.49	3.42
Worldview / Discourse	Analyze symbolic meanings of resilience across cultures	0.92	3.51	3.23
Myth / Metaphor	Use "stone" as a metaphor for resilience and uniqueness	0.96	3.96	3.80

Layered Semantic Ideation and Conceptual Evaluation. Factor evaluation assigned cultural relevance (tx) and value weight (ty) scores, with “creative journey” (T = 3.20) ranking highest in the litany layer. Across all layers, the “stone” concept achieved the top T-value (3.80), selected as the final solution for symbolizing resilience and uniqueness—inspired by “collecting stones by the seashore.”

Core Graphic Creation and Key Visual Construction. AIGC generated “stone” images following myth/metaphor analysis (Figure 4). An “Alphabet Letter-texture Stone Library” was built (Figure 5), and selected “stones” were refined into the key visual (Figure 6). The system was finalized with adjustments (Figure 7).

Feedback confirmed the design as fresh and brand-aligned, demonstrating how human–AI collaboration enhances key visual design through structured evaluation.

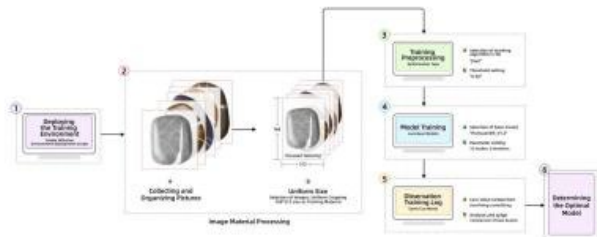


Fig. 4. Generative AI Design Process for "Stone" Images



Fig. 5. AIGC-Assisted "Alphabet Letter-texture Stone Library"



Fig. 6. Digital Design Process Based on Image Library Resources

Integrating CLA and Extenics Semantics enhances design clarity, addresses constraints, and provides a replicable model beyond intuition-based methods.

(1) Structured orientation: CLA links surface narratives to deep metaphors for traceable, logical concept generation.

(2) Evaluative transparency: Extenics Semantics quantifies creative factors for transparent, objective evaluation.

(3) Collaborative efficiency: Generative AI boosts creative speed and output diversity.

Despite structural and AI support, designers remain essential for problem definition, cultural interpretation, and refinement, ensuring balance and depth.



Fig. 7. Key Visual Poster and Extended Applications

Conclusions. This research synthesizes a multifaceted methodological framework that redefines the conceptual boundaries of key visual design by integrating Causal Layered Analysis (CLA), Extenics Semantics, and Generative AI (AIGC). The study advances the field from a paradigm of heuristic, intuition-based creation toward a systematic, evidence-based design epistemology.

Theoretical Integration and Methodological Synergy. The primary contribution of this work lies in the successful orchestration of vertical semantic deconstruction (CLA) and horizontal formal modeling (Extenics). By applying CLA, the design process transcends the superficial "litany" of visual trends, anchoring design solutions in deep-seated cultural myths and worldviews. The subsequent transition to Extenics provides a rigorous mathematical-logical structure, enabling the transformation of qualitative cultural metaphors into quantifiable matter-element models. This synergy ensures that the final visual output is not merely aesthetically coherent but is functionally aligned with complex socio-cultural narratives.

Objectification of the Creative Process. The proposed "Structured Pathway" significantly mitigates the volatility of "designer's block" and subjective bias. Through the formalization of design attributes into extenics-based elements, the methodology introduces a level of transparency and reproducibility previously absent in traditional creative workflows. The integration of AIGC within this controlled semantic environment demonstrates that generative technologies, when guided by structured human-derived logic, can serve as precision tools for high-fidelity conceptual visualization rather than unpredictable engines of random variation.

Practical Implication and Cultural Sustainability. The empirical application of the framework proves its efficacy in preserving cultural authenticity within contemporary visual communication. In an era of rapid digital globalization, this model offers a robust

mechanism for "cultural coding," ensuring that key visuals function as sophisticated carriers of identity rather than fragmented decorative assets.

Limitations and Future Horizons. Despite the enhanced objectivity provided by Extenics, the initial selection of core semantic primitives still retains a degree of dependence on the designer's interpretive expertise. To further advance this field, future research should explore the integration of Natural Language Processing (NLP) and Big Data analytics to automate the extraction of "litany" and "systemic causes" within the CLA phase. Additionally, expanding the applicability of this hybrid framework to multi-dimensional domains – such as interactive environment design and industrial product morphology – will be essential to validating its universality as a foundational design methodology.

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