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Integrating Multimodal and Generative AI in Design Research

Enhancing Ethnographic Methods with Data-Driven Analysis

멀티모달 및 생성 AI를 통한 디자인 연구방법

민족지학적 방법론을 데이터 기반 분석으로 강화하기

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Abstract

This research examines the application of Multimodal and Generative AI in analyzing interior design trends within the South Korean market. The objective is to enhance traditional ethnographic research methods with AI's quantitative capabilities, offering a more comprehensive understanding of design preferences. This methodology uses AI tools to systematically analyze and categorize design elements from a large dataset of interior design images sourced from a relevant online platform. This process involves extracting key visual trends and patterns using AI-driven semantic analysis and clustering techniques. The study identifies and classifies four dominant design trends, providing a structured overview of current market preferences. By integrating AI into design trend analysis, the study demonstrates a novel approach to understanding consumer preferences, potentially influencing future design decisions. This use of AI in design research broadens the scope of traditional ethnographic studies in design and provides practical insights for designers and industry practitioners, suggesting a shift towards more data-driven design practice.

Keyword

AI in Design (디자인에서의 AI), Design Research (디자인 연구), Multimodal AI (멀티모달 AI), Trend Analysis (트렌드 분석)

요약

본 연구는 한국의 인테리어 디자인 트렌드를 멀티모달 및 생성 AI를 활용하여 분석합니다. 이 연구의 목적은 AI의 정량적 능력을 활용하여 기존의 민족지학적 연구 방법론을 강화하고 디자인 선호도에 대한 더 깊은 이해를 제공하는 것입니다. 이 방법론으로, 온라인 플랫폼에서 수집된 인테리어 디자인 이미지 데이터를 AI를 통해 분석하고 분류합니다. 이 과정은 AI 기반 의미론적 분석과 클러스터링을 사용하여 주요 시각적 트렌드를 추출합니다. 이 연구를 통해 현재 시장의 선호도를 반영하여 주요 디자인 트렌드 네 가지를 식별했습니다. AI의 통합은 소비자 선호도 이해에 새로운 방향을 제시하며, 미래 디자인 결정에 중요한 영향을 미칠 수 있습니다. AI를 디자인 연구에 적용함으로써, 우리는 기존 방법을 넘어서고 디자인 실천을 데이터 중심으로 전환할 수 있는 가능성을 보여줍니다.

Contents

1. Introduction

1-1. Research Background and Objectives

Many industries are witnessing a significant transformation driven by the rise of data-driven methodologies as the regular utilization of data in many professional practices and workflows is becoming the standard.[1] The field of design, particularly impacted by this shift, is experiencing a redefinition of the designer's role, propelled by the integration of artificial intelligence (AI).

Traditionally grounded in ethnographic methods, design research has predominantly focused on qualitative insights drawn from human experience.[2] However, the influx of Data-Driven Research has initiated a paradigm shift towards a mixed qualitative-quantitative approach, enhancing the empirical rigor of traditional methods. This study aims to demonstrate this shift by exploring the application of Multimodal and Generative AI in design research. These AI systems, with their capacity to process diverse data forms, offer a comprehensive lens to examine and interpret design elements and consumer preferences, particularly in intricate markets like South Korea's interior design sector. By supplementing ethnographic methods with AI's quantitative capabilities, this research enriches traditional approaches with data-driven insights, particularly in visualizing complex design trends.

Emerging platforms that democratize advanced machine learning techniques, such as natural language processing and sentiment analysis, are increasingly accessible to designers, and AI's capability to process and generate visual content (image-to-text, text-to-image) offers unprecedented opportunities for exploring and visualizing design trends. This method, which could be called "AI-enhanced design Ethnography," showcases how AI can revolutionize traditional design research methods, offering richer, data-informed insights that align with the evolving demands of the field.

1-2. Research Scope and Methodology

This study focuses on the dynamic field of interior design within the South Korean market. South Korea, known for its rapid cyclicality of consumer trends, early adoption of technological innovations, and unique aesthetic sensibility in design, provides a fertile ground for exploring current trends in interior design. Our research specifically targets consumer preferences and prevailing design trends as reflected in popular social platforms/ online markets. This approach not only offers insights into the current market dynamics but also forecasts emerging trends contributing to the discourse on interior design.

This research process starts with the collection of a comprehensive dataset of interior design images from a popular South Korean social media platform and online forum. These images were categorized based on their popularity metrics such as shares, likes, saves, and comments. We then employed widely available Multimodal AI systems to analyze this dataset, extracting key visual elements and design attributes from the images. This step incorporated both image recognition and text generation capabilities of AI, transforming the visual data into descriptive, analyzable text. Subsequently, we applied clustering algorithms to categorize the images into distinct groups based on shared design features and aesthetics, which helped us identify prevailing design trends and patterns within the South Korean interior design landscape. The clustered data was then visualized using prompts created with the most frequent and representative terms from each cluster, effectively translating our data-driven insights into actionable design knowledge. The final stage of our research involved evaluating these findings within the context of current design practices. Through this comprehensive methodological

1) McKinsey Digital, The data-driven enterprise of 2025, January 2022, p.3.

2) Salvador T., Bell G., Anderson K., Design Ethnography, Design Management Journal, 1999

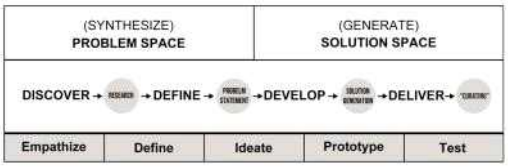
framework, our study explores the intersection of AI and design research, providing a unique perspective on contemporary interior design trends in South Korea.

2. Theoretical Research

The design thinking process is a methodological approach that prioritizes empathetic user-centric problem-solving and is deeply ingrained in modern innovation strategy.[3] Its significance lies in its systematic yet flexible framework for identifying problems and crafting solutions that are both user-relevant and innovative. The stages of Empathize, Define, Ideate, Prototype, and Test serve as guideposts for transforming observations into actionable insights.

Artificial Intelligence (AI) has permeated this process, becoming a collaborative partner rather than just a tool. AI applications within design thinking enhance human capabilities at various stages, particularly where large data sets and pattern recognition are involved. While AI excels at tasks involving computation and pattern identification, human intelligence remains paramount for contextual understanding and creative problem-solving.

Context comprehension is crucial in design. Under System Theory, design is viewed as a complex, problem-solving activity that involves the generation and reconfiguration of systems.[4] As Nobel award winner Herbert Simon declared “Everyone designs who devises courses of action aimed at changing existing situations into preferred ones (…), but those courses of action depend on assumptions about what the world is and how it can be acted upon.”[5] This approach recognizes that systems, defined by their emergent properties and fluid boundaries, engage in intricate interactions within a larger ecosystem. These interactions can lead to new behaviors and properties, highlighting the importance of understanding the interconnected elements within the system. While AI is adept at analyzing data and identifying patterns within these systems, it is human perceptions and intelligence that truly excel in grasping the subtle, contextually rich interdependencies and cultural nuances. The human ability to synthesize empathy, cultural understanding, and intuitive reasoning is vital in navigating and interpreting the complex web of relationships inherent in these systems, making the human contribution still indispensable in understanding, and designing within these interconnected systems that situate humans at its center.



[Fig.1] An integrated overview of the design thinking process, merging the Five-Stage Model from the Hasso-Plattner Institute of Design with the British Design Council's Double Diamond framework

AI's implementation within design thinking is multifaceted,[6] playing a crucial role across various phases. As an example, in the Empathize phase, AI analyzes vast user data through Natural Language Processing and sentiment analysis to understand user emotions and needs. In the Define phase, AI-driven insights assist in

3) Brown, T., Change By Design: How Design Thinking Transforms Organizations And Inspires Innovation, 2009

4) Norman D. A., Stappers, P. J. "DesignX: Complex Sociotechnical Systems." She Ji: The Journal of Design, Economics, and Innovation, vol. 1, no. 2, 2015, pp. 83–106.

5) Simon H. A., The Sciences of the Artificial, The MIT Press, 1969, p.130.

6) Paxinos, G., "How Will AI Impact the Design Thinking Framework?" [Website]. (2023.11.20). URL: https://builtin.com/design-ux/ai-design-thinking

synthesizing information and clarifying the problem statement. During the ideation phase, generative AI enhances creativity by suggesting new ideas and concepts, drawing on patterns from successful designs. In the Prototype phase, AI automates repetitive tasks and provides real-time feedback, facilitating rapid iteration. Finally, in the Test phase, AI efficiently analyzes user interactions, enabling designers to refine solutions based on AI-driven A/B testing tools and behavioral data analysis. This comprehensive application of AI throughout the design thinking process significantly enriches each stage with data-driven insights and efficiency.

The subsequent “curation” of these AI-generated solutions is inherently human. Designers must recontextualize solutions, refining and aligning them with user needs and testing their validity within the real-world context. This “curation” process ensures that the outcomes are not just data-driven but also meaningful and applicable.

This synergy is especially potent in the Research phase leading up to the Problem Definition. This study focuses on how, by combining qualitative observational techniques, common to traditional Ethnographic Research, with quantitative AI-assisted analysis, the resulting methodology is particularly beneficial. It leverages the observational strengths of humans and the analytical prowess of AI to create a rich, nuanced understanding of the problem space, setting a solid foundation for the subsequent stages of the design thinking process.

3. Methods and Procedures

Since the objective of this research is to obtain a comprehensive understanding of design trends and user preferences within the South Korean interior design market, we employed a multifaceted methodology integrating Multimodal AI tools and data analysis techniques.

3-1. Data Collection

Our initial step was to compile a substantial dataset of interior design images from a widely-used South Korean social media platform. We specifically selected images based on their popularity metrics, including likes, shares, and comments. This approach was chosen to ensure that our dataset accurately represents[7] the most engaging and preferred interior design trends among the platform's users, reflecting the trends that have generated the most user interaction and approval on this specific platform.

3-2. Image Analysis

The common image analysis method Feature Extraction, involves using Convolutional Neural Networks (CNNs) to identify key visual elements in each image, such as color schemes and layout patterns.[8] The second process would be semantic interpretation, where Natural Language Processing (NLP) models translate these visual elements into descriptive text, capturing the design's contextual and stylistic nuances.[9] Tools like TensorFlow and OpenCV libraries, and cloud services like Google Cloud Vision API are commonly used in this kind of analysis and they require significant expertise in machine learning model development and training. The key difference between these tools/services and a true multimodal AI is in the integration and

7) Krippendorff, K., "Content Analysis: An Introduction to Its Methodology." Thousand Oaks, CA: Sage Publications, 2018

8) Jogin M., Mohana, Madhulika M. S., Divya G. D., Meghana R. K., Apoorva S., Feature extraction using Convolution Neural Networks (CNN) and Deep Learning, 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2018

9) Medium, "Natural language processing: Advance techniques ~ in-depth analysis" [Website]. (2021. 12. 11). URL: https://medium.com/analytics-vidhya/natural-language-processing-advance-techniques-in-depth-analysis-b67bca5db432

simultaneous processing of multiple types of data to gain a comprehensive understanding or perform complex tasks.

For our analysis, we used a Multimodal AI instead of the previously mentioned methods, specifically ChatGPT4. It is considered a multimodal AI because it has the capability to understand and generate content in multiple modes of communication beyond just text. Multimodal AI systems are characterized by their ability to process and interpret multiple data types[10] (such as text, images, and sometimes even audio) can be operated using natural language and excel in contextual understanding, allowing them to generate contextually appropriate responses or descriptions. Some models, like Google's Pix2Struct, can even interpret visually situated language[11] (text that is integrated with or appears within images). This makes them highly effective in tasks that require a nuanced understanding of both visual and textual content. In creative industries, they are bringing an innovative edge, generating novel content by synthesizing insights from different data types. The multimodal AI model employed in our study (ChatGPT4), particularly for the task where images are analyzed and descriptive words are extracted, works on a different principle compared to traditional image analysis techniques. The key difference lies in the AI's ability to seamlessly integrate image analysis with linguistic articulation, offering a richer and more comprehensive understanding of visual data. This is particularly beneficial in the realm of design research, where the nuances of style, aesthetics, and user preferences are as crucial as the physical attributes of the design elements. Through this process, we obtained a highly accurate semantic description of all the images in the dataset.

3-3. Clustering

With the AI-processed text data, we applied a clustering K-means algorithm[12] to the text data to obtain distinctive design trend categories. Clustering can be briefly defined as the grouping of unlabeled data, a case of unsupervised learning in machine learning. In this process, we provide the model with input data without any labeling (the text data with the definitions generated from the image by the multimodal AI) and ask it to categorize the data into different groups, even though we don't predefine these categories. The model discerns differences and similarities in the data, drawing conclusions and organizing the data accordingly.

In K-Means Clustering, used in high-dimensional semantic spaces[13] (with 'dimensions' referring to the number of data attributes), the first step involves deciding the number of clusters. This is done using the Elbow Method, which involves examining the within-cluster sum of squares (WCSS) - the squared distance between each data point and its cluster's centroid. The more clusters there are, the smaller the WCSS becomes. If the WCSS is zero, it implies one centroid per data point. The Elbow Method utilizes a graph plotting WCSS against the number of clusters. We look for the 'elbow' in this graph, a point where the rate of decrease in WCSS sharply changes, indicating the optimal number of clusters. This is becsue we try to find a balance between minimizing the

10) Rouse M., "Multimodal AI (Multimodal Artificial Intelligence)" [Website]. (2023.07.26). URL: https://www.techopedia.com/definition/multimodal-ai-multimodal-artificial-intelligence

11) Khadke C., "Document information extraction using Pix2Struct" [Website]. (2023. 04. 26). URL: https://www.analyticsvidhya.com/blog/2023/04/document-information-extraction-using-pix2struct/

12) Babitz, K., "K-Means Clustering with Scikit-Learn in Python" [Website]. (2023.03.10). URL: www.datacamp.com/tutorial/k-means-clustering-python

13) Cao G., Song D., Bruza P., Fuzzy K-Means Clustering on a High Dimensional Semantic Space, Lecture Notes in Computer Science Book Series (LNCS, volume 3007), Springer, 2004, p. 907 - 911.

within-cluster sum of squares (WCSS) and avoiding overfitting with too many clusters. At the elbow point, adding more clusters does not provide significant improvement in the variance explained. This determination is somewhat subjective[14] , and as we'll see, in the Study Case we had to try various numbers of clusters until we got the best results.

K-Means then assigns each data point to the nearest centroid. The centroid's position is recalculated as the 'central mass' of each cluster, and this reassignment and recalculating process are repeated until the centroids' positions stabilize, indicating the final clusters. Utilizing K-means clustering, we analyzed the AI-generated feature sets to identify patterns and group similar designs together. This method allowed us to discern prevailing design trends within the dataset, based on similar semantic terms.

Clustering is crucial in understanding large datasets as it reveals underlying structures and commonalities that might not be apparent immediately. In the context of interior design, this means uncovering prevalent trends and styles that resonate with users, and providing valuable insights for designers and industry stakeholders.

4. Case Study: Trend Research

4-1. Experimental design

When we looked for images that accurately represent interior design trends in South Korea, we used “오늘의집” (Today's House). It is a prominent interior platform based in South Korea, offering a comprehensive range of services related to interior design. The platform features online housewarming content, a store, and professional construction services, making it a one-stop solution for all interior design needs. Launched as an app in February 2014, it has significantly impacted South Korea's interior industry. By 2020, it had achieved over 14 million cumulative downloads and monthly transactions amounting to 70 billion won. "오늘의집" appeals to a broad range of users, from digitally savvy younger generations to older age groups.

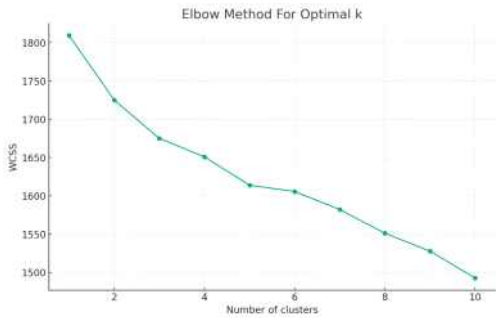
“오늘의집” is not only an interior design platform, it also incorporates a robust social networking aspect. Users frequently upload photos showcasing their home renovations and decorations. These images foster community engagement through interactions such as sharing, commenting, saving, and liking. Our dataset was formed from the top 100 images with the highest number of interactions in the ‘housewarming’ section.

The next step was to request ChatGPT-4, using natural language, to 'Analyze the interior design in this photo, including materials, types of furniture, and other design elements, and summarize them in a list of 35 elements.' This prompt is designed to gather enough text data from individual and general design elements on the images while avoiding redundancies. We repeated the same process with the 100 images in the dataset. Not all images allowed for the generation of 35 terms without creating redundancies, so not every image was described with 35 items. The result is a database of 3416 rows with unique definitions, in natural language, of the design elements in all those photos [Table 1].

Subsequently, we applied the K-means algorithm. First, we undertook some Data Cleaning and Preparation, harmonizing data types, eliminating filler words to focus on meaningful terms in the design features, etc. The cleaned features were transformed into a binary

14) Saji, B., "Elbow method for finding the optimal number of clusters in K-means" [Website]. (2023, 09,20). URL: www.analyticsvidhya.com/blog/2021/01/in-depth-intuition-of-k-means-clustering-algorithm-in-machine-learning/

format using a Count Vectorizer. This vectorizer converted the text data into a binary matrix, indicating the presence or absence of a feature in each image. Then, the K-means clustering algorithm was applied to the binary matrix.



[Fig. 3] Elbow Method Graph

At this point, we applied the previously mentioned "Elbow method" to select the number of clusters in the K-Means algorithm. We ran the algorithm with 5, 6, and 4 clusters. Although the generated graph suggested that 5 clusters were the most obvious choice, we found that dividing the data into 4 clusters provided the most distinctive results with four clearly differentiated interior design trends. The result was a database with all 3416 terms sorted into four clusters. We then arranged the terms of each cluster by frequency. The 35 most frequent terms (excluding stop words) were identified to understand the key themes and characteristics of each cluster, and we named them based on these terms. The results were four clearly differentiated groups representing the general trends present in the most popular images on the '오늘의 집' platform.

Finally, these terms, ordered by frequency, were used to generate prompts for a Text-to-Image Generative AI (DALL·E 3). The prompts were created using the 20 most frequent terms in each cluster. This AI produced visualizations that capture the essence of each trend. To name and describe the four clusters, we considered the most prominent and defining features observed in the analysis.

[Fig. 2] Example Image Fom the Dataset

[Table 1] Examples of the Text Generated From the Dataset Images by the Multimodal AI System

1. Plush moss green sofa, adding a rich, earthy tone to the space.
2. Contemporary artwork featuring a landscape, introducing color and visual interest.
3. White modern lounge chair, offering an alternative seating option.
4. Sleek, wooden pendant light, providing focused illumination over the dining area.
5. Dining table with a minimalist white surface, blending with the room's color scheme.
6. A set of chrome and leather dining chairs, complementing the table's simplicity.
7. Floor-to-ceiling sheer curtains, softening the daylight and enhancing privacy.

4-2. Summary of Findings

4-2-1. Group 1 "Serene Modernity"

The interior design trends we could infer from our research are here divided in four groups. This first group is characterized by a preference for neutral color palettes, creating a calm and serene atmosphere. The living spaces often feature textured or geometric patterned area rugs. The use of low-maintenance materials suggests a practical approach, while modernity is reflected in the furniture styles and layout. There's an emphasis on open-plan living and dining areas, with strategic use of space.

This cluster's focus on neutral colors, clean lines, and a minimalist approach aligns closely with Scandinavian and Minimalist design philosophies. The emphasis on functionality and simplicity, along with a contemporary feel, also ties it to modern contemporary styles.

[Fig. 4] AI Generated Visualization of Group 1 "Serene Modernity"

[Table 2] Most Frequent Terms in the Group 1

Sofas	Low-profile, modular, in neutral colors like light gray, made of leather or fabric.
Dining Tables	Scandinavian style, light wood, with simple chairs.
Coffee Tables	Minimalist, modern, with glass tops or metal frames.
Flooring	Light hardwood or laminate, practical and low-maintenance
Walls	Painted in soft, neutral tones like off-white or light gray.
Area Rugs	Textured or geometric, in neutral colors.
Lighting	Natural light complemented by minimalist modern fixtures.
Storage	Built-in cabinets or floating shelves in white or light wood.
Decorative Accents	Monochromatic art, simple vases, statement indoor plants.
Window Treatments	Sheer curtains or minimalist blinds in light colors.

4-2-2. Group 2 "Natural Elegance"

This group focuses on the use of natural materials like wood and stone, with an emphasis on organic shapes in furniture and decor. The color scheme lean towards earthy and warm tones, creating an inviting and elegant ambiance. Presence of indoor plants and natural light, enhancing the connection to nature.

[Fig. 5] AI Generated Visualization of Group 2 "Natural Elegance"

[Table 3] Most Frequent Terms in the Group 2

Natural Materials	Preference for organic textures like wood and stone
Earthy Colors	Tendency towards earthy, warm color palettes.
Organic Shapes	Furniture and decor with rounded edges and natural forms.
Indoor Plants and Light	Emphasis on indoor plants and natural light.
Comfortable Elegance	Spaces that are stylish yet comfortable
Traditional-Modern Mix	Fusion of traditional and contemporary elements.
Textural Variety	Use of varied textures like woven fabrics and plush upholstery.
Detailed Craftsmanship	Focus on quality and intricate design details
Cohesive Design	Consistent use of natural materials and colors
Personal Touches	Unique art pieces and family heirlooms for individuality.

The use of natural materials and earthy tones connects this cluster to Rustic and Japandi (a blend of Japanese and Scandinavian) styles. Japandi emphasizes simplicity and natural elements, like this group. The emphasis on plants and natural textures ties it to Biophilic design and the human connection to nature.

4-2-3. Group 3 "Minimalist Chic"

[Fig. 6] AI Generated Visualization of Group 3 "Minimalist Chic"

[Table 4] Most Frequent Terms in the Group 3

Monochromatic Palette	Preference for cohesive, calm monochromatic colors.
Clean Furniture Lines	Sleek, modern furniture with simple lines.
Functional Decor	Minimalist decor focusing on purpose over ornamentation.
Uncluttered Spaces	Carefully curated spaces with essential items only.
Metal and Glass	Frequent use of sleek, modern metal and glass.
Strategic Textures	Thoughtful use of textures like leather and wood.
Geometric Symmetry	Emphasis on geometric shapes and symmetrical arrangements.
Open, Airy Spaces	Minimal furniture and ample natural light for openness.
Impactful Artwork	Subtle yet significant artwork, often monochromatic or abstract.
Comfortable Style	Balance between aesthetic appeal and livability.

The "Minimalist Chic" cluster embodies a design ethos that combines sleek minimalism with sophisticated style. This cluster is characterized by its streamlined, uncluttered, and elegant approach to living spaces, as revealed through the analysis of living room designs. The monochromatic color scheme and functional decor of this cluster are hallmarks of Modern Minimalism. The Bauhaus movement, with its principle of form following function and use of materials like metal and glass, is also reflected here. Elements of Industrial style, such as metal fixtures and a focus on geometry and sleek lines, are present as well.

4-2-4. Group 4 "Eclectic Vibrancy"

[Fig. 6] AI Generated Visualization of Group 4 "Eclectic Vibrancy"

The "Eclectic Vibrancy" cluster is characterized by a bold and dynamic approach to interior design. This group stands out for its adventurous use of colors, patterns, and a mix of various styles, reflecting a spirited and personalized interior design approach.

The bold use of color and unique decorative items is characteristic of Bohemian and Maximalist styles, which embrace vibrancy and eclectic mixes. The lively nature of this cluster, along with its embrace of diverse influences, aligns with Retro styles, particularly from the colorful and expressive eras of the 70s and 80s.

[Table 5] Most Frequent Terms in the Group 4

Vibrant Colors	Preference for lively interiors with vibrant colors.
Diverse Furniture	Mix of vintage and contemporary furniture styles.
Unique Decor	Quirky decorative items and

	unconventional art.
Dynamic Atmosphere	Energetic, expressive interior environments.
Textures and Patterns	Bold mixing of various textures and patterns.
Personal Touches	Prominent personal collections and memorabilia.
Traditional-Modern Fusion	Harmonious blend of traditional and modern elements.
Creative Layouts	Unconventional, personalized spatial arrangements.
Artistic Flair	Whimsical, imaginative design elements.
Layered Visuals	Rich, eclectic visual experience in each space.

5. Conclusions

Avi Goldfarb, a Professor at the Rotman School of Management, University of Toronto, states that from an economic perspective, every technological revolution can be characterized as 'the drop in the cost of something.'[15] The semiconductor revolution, for instance, saw a decrease in the cost of computation and arithmetic capabilities. The Internet revolution was marked by reduced costs in search and communication capabilities. As the cost of these technologies fell, their usage increased, leading to the development of new, unforeseen applications.

Similarly, the current AI Revolution is defined by a significant reduction in the cost of prediction technology. This decrease is prompting widespread adoption of AI across various disciplines and industries, leading to innovative applications in fields where it was previously underutilized, such as design. This study can be seen as part of this trend, where advanced predictive capabilities are being increasingly employed in areas like design practice, opening up new possibilities that were previously unimaginable.

Our research emphasizes the transformative potential of AI in design ethnography, particularly through tools that utilize image recognition and natural language processing. Points towards how advanced research techniques are now accessible to a wide range of designers and stakeholders, potentially revolutionizing the design process. By democratizing trend research and visualization, these tools can significantly enhance established design methodologies like Design Thinking. All signs indicate that the industry is on the verge of a substantial shift, with AI-driven methods promoting a more data-informed, responsive, and innovative design process. This evolution is reshaping both the practice of design and market strategies.

Practically, our study offers a roadmap for designers and educators to integrate AI into their research workflows. However, it's important to recognize the limitations of this study. The accuracy and comprehensiveness of our findings depend heavily on the quality and volume of the data used. Incomplete or biased data sets can skew AI analysis, potentially leading to inaccurate conclusions about design trends. For future applications of this methodology, expanding the range of data sources will be crucial for achieving more reliable results. Additionally, while AI, particularly in multimodal forms, excels at pattern recognition, it still lacks a nuanced understanding of cultural and contextual significance in design trends and can sometimes produce repetitive responses, especially during the image-to-text phase.

A key aspect of our research is its integration with traditional ethnographic methods in design. By incorporating AI, we enhance the researcher's ability to observe and interpret vast quantities of visual data generated online. This AI-assisted approach significantly broadens the scope and depth of insights that can be derived from such data. The fusion of traditional methods with advanced technology facilitates a more comprehensive understanding of complex design issues, paving the way for solutions that are not only innovative but also deeply connected to

15) Agrawal A., Gans J., Goldfarb A., Prediction Machines Updated and Expanded, Harvard Business Press, 2022

human experiences and perspectives.

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