

Research on Visual Communication of Intelligent Packaging in the Context of New Media: A Case Study of Cosmetics Packaging

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Abstract. Under the backdrop of the rapid development of new media technologies, intelligent packaging has emerged, driving packaging to evolve from its traditional static form into an intelligent medium that integrates information transmission, emotional interaction, and technological realization. Particularly in the cosmetics industry, renowned brands such as L'Oréal, Gucci Beauty, and Watsons have incorporated technologies like NFC, RFID, AR interaction, and thermochromic color-changing into their packaging designs, which have been well-received by the public. This study takes the cosmetics industry as a core case and employs qualitative research methods, combining text analysis and case studies, to explore the visual communication mechanism of intelligent packaging in the context of new media. The research finds that intelligent packaging mainly reshapes consumers' perception and experience through the reconfiguration of the symbol system, the strengthening of narrative strategies, and the expansion of interactive design, significantly enhancing brand communication effectiveness and user emotional connection. However, it also faces challenges such as high technical costs, content homogenization, and audience stratification. In the future, it is imperative to seek a balance between technological functionality and aesthetic value.

Keywords: new media, intelligent packaging, visual communication, cosmetic design, semiotics

1. Introduction

With the continuous development of technology, in the environment of new media platforms, product packaging is no longer a single “static shell”, but has evolved into a comprehensive medium capable of carrying information, emotions and technology. This transformation is particularly notable in the cosmetics industry, which is highly dependent on visual appeal and emotional marketing. For a long time, the visual design of cosmetic packaging has occupied a core position in both consumer experience and brand communication, thanks to its exquisite patterns, unique shapes and rich colors. However, in the dynamic and interactive communication created by the new media environment, traditional static packaging is facing unprecedented challenges and opportunities. A packaging revolution driven by “intelligence” is quietly emerging.

Against this backdrop, this paper attempts to adopt a qualitative research approach from the cross-disciplinary perspective of new media studies and visual communication studies, combined with text analysis and case studies, to focus on the following three research questions: What is the visual communication mechanism of intelligent packaging in the context of new media? How does it construct consumer experience through symbolism, narrativity and interactivity? Then, how can a balance be struck between technical functionality and aesthetic value? This article will select representative cases of intelligent cosmetic packaging at home and abroad for in-depth analysis. For example, L'Oreal, Gucci Beauty, Watsons, Nivea, etc. have introduced technologies such as NFC, RFID, AR interaction and temperature-sensitive color-changing into packaging design, and deconstruct their technological applications, visual elements and interactive processes. At the same time, a systematic assessment of the advantages and disadvantages of new technologies should be conducted to comprehensively answer the core questions raised in this study.

“The new media era is mainly characterized by digital communication, online communication and global communication.” [1] New media research has introduced key experiences such as interaction, participation and immersion; Visual communication studies provide a classic framework for interpreting the symbols, images and colors of packaging. The combination of the two helps to bring about a brand-new perspective for communication research. This is not only the application and expansion of visual communication theory to new media objects, but also provides innovative models and optimization directions for the practice of cosmetic packaging design, helping brands build differentiated advantages through packaging innovation in fierce competition.

2. Literature review

Traditional visual communication theory holds that packaging is a symbolic system for conveying brand information and building value recognition, communicating with consumers through elements such as color, graphics, and text. “With the rapid economic development and the increasing demands of consumers for product quality and service, traditional packaging design has gradually failed to meet the market's needs for personalization, interactivity and sustainability.” [2] Today's intelligent packaging not only features changes in elemental forms but also integrates digital technologies on this basis, such as AR interaction, big data analysis, and intelligent sensing, transforming packaging from a static visual medium into a dynamic and two-way interactive experience. It not only implements the environmental protection concept of sustainable development, but also offers personalized experiences and practical functions, such as traceability and anti-counterfeiting, as well as preservation monitoring. In consumer psychology, the ultimate goal is to better connect products with consumers. The design of intelligent packaging precisely aligns with this point, enabling enterprises to more effectively meet consumers' demands and allowing consumers to more rationally understand their purchasing behaviors. This greatly extends the connection between brands and consumers.

Research on intelligent packaging has been gradually improving all along. In terms of technology, the application fields of intelligent packaging technology are constantly expanding, such as the popularization of conductive ink technology. “Meanwhile, the classification and application of intelligent packaging technology have also enhanced the information collection, management, control and processing capabilities of current product packaging, which is of great significance for the optimized management of the transport packaging system.” [3] Secondly, the design of intelligent packaging has also become more systematic, establishing element form processing models and visual communication systems, and emphasizing the intersection of multiple disciplines, mainly including design studies, materials science, computer science, etc. However, although

intelligent packaging has a wide range of market applications, its development is uneven. It is more commonly used in industries such as food and cosmetics, and only high-end brands tend to favor intelligent packaging, while small and medium-sized brands still mainly rely on traditional methods.

As one of the main fields of intelligent packaging applications, the packaging design of cosmetics is also constantly evolving, showing a concentrated development trend. Packaging is no longer merely a protective shell for products. “Packaging also has promotional value, beautifying the goods and conveying information,” [4] serves as a medium for conveying emotions and brand culture, with a particular focus on the emotional needs of women and Generation Z, achieving a development from functionality to emotion. With the development of The Times, people have begun to pursue the experience and emotional value of use. The packaging of cosmetics, while taking into account the visual aspect, has also paid more attention to multi-sensory experiences. The design covers vision, touch, smell and even hearing, emphasizing the comprehensive sensory stimulation such as the unboxing experience, material texture and eco-friendly materials. Pierce believed that a symbol is “something replaced by something in the mind” [5], emphasizing the dynamic connection between the symbol and the object as well as the interpreter. Cosmetic packaging design also shows this dynamic connection, evolving from general and popular to personalized and symbolic. It emphasizes personalized customization, extraction of cultural symbols, and expression of regional characteristics, meeting consumers' demands for uniqueness and identity recognition. Introducing intelligent technologies into cosmetic packaging design, integrating social media dissemination, consumer behavior research, and sustainable development concepts, a cross-disciplinary and multi-dimensional packaging design system is formed. Research has found that “intelligent packaging has expanded new functions on the basis of traditional packaging functions. The realization of these functions at the packaging design level has, on the whole, reduced certain behavioral steps for consumers during the usage process” [6], making packaging serve consumers more conveniently.

To sum up, most of the existing research focuses on the technical implementation of intelligent packaging, but there are certain research gaps at the level of visual communication or cultural significance. Less attention is paid to individual needs, and there is also a lack of systematic exploration of the visual communication mechanism of “interactive packaging”. This study attempts to expand the research boundaries of the discipline of visual communication from the perspective of the intersection of new media research and visual communication studies.

3. Analysis and results

3.1. Case selection

To comprehensively present the visual communication characteristics of intelligent packaging in the cosmetics industry, this study, in terms of case selection, on the one hand, selects cases of high-end cosmetics brands with international representativeness, and on the other hand, incorporates practical cases of domestic emerging brands and retail channels, in order to reveal the differentiated expressions under different cultural backgrounds and market environments. “As the emotional demand for self-pleasure continues to rise, consumers' choices and demands for cosmetics have shifted from the initial 'functional school' to the 'experiential school’” [7]. Currently, both domestic and foreign cosmetic brands are innovating in packaging, striving to offer consumers novel experiences and thereby enhance the core competitiveness of their products.

At the International level, L 'Oreal has collaborated with PCH International to launch the wearable Patch “My UV Skin Patch”, which utilizes NFC technology to help users perceive the intensity of sunlight, thereby enabling better skin management. At the same time, L 'Oreal has also

launched packaging that supports AR technology. Consumers can experience the makeup trial effects of different products through their mobile phones, significantly enhancing the immersion and fun of shopping. Gucci Beauty has introduced AR functionality in its perfume packaging. Users can scan the packaging to unlock virtual try-on filters or short brand story videos, creating an atmosphere of a “dream garden” that echoes the scent of the perfume, enhancing the digital narrative capabilities of luxury brands. In addition, Nivea, a brand under Beiersdorf, has launched temperature-sensitive color-changing ink packaging, which not only enriches visual communication but also offers consumers a unique tactile experience.

Under the global development trend of intelligent packaging, domestic brands are also actively conducting relevant explorations. As a highly representative domestic brand, Hua Xi Zi combines traditional Eastern symbols with intelligent packaging, creating new visual and cultural sparks. Watsons has established a more humanized and personalized close connection with consumers through multi-dimensional upgrades of the “O+O” experience, and has collaborated with brand owners to promote sustainable growth. These “original functional packages not only enable consumers to purchase practical products but also allow people to enjoy the joy and surprise of interaction, enriching People's Daily lives.” [8]

3.2. Analysis of visual communication elements for intelligent cosmetic packaging

3.2.1. Symbolic system

From a semiotic perspective, packaging is a symbolic system. “The primary purpose and function of symbols is to convey information. Therefore, packaging design can also be understood as a form of communication, which is a message (designed product) formed by designers to convey specific cultural values.” [9] In intelligent cosmetic packaging, traditional visual symbols such as patterns, colors, fonts, and materials have been endowed with new connotations of dynamism and interactivity, and their functions have shifted from merely conveying information to guiding experiences.

Patterns and colors are the most fundamental elements in packaging design, mainly serving the functions of “enhancing visual perception and attracting consumers” [10], as well as improving aesthetics and bringing a sense of pleasure. In smart packaging, patterns often serve as the entry point for AR triggers, while colors are not only used for brand recognition but also play a guiding role in interaction. For instance, fluorescent colors or high-contrast colors are used to highlight the NFC touch area or the position of the QR code, thereby guiding users to complete the interaction.

The role of fonts in packaging is equally crucial, and they need to be consistent and coordinated in both physical packaging and digital interfaces. The text on physical packaging is mostly guiding short sentences, such as “discover more” on Gucci Beauty perfume; In the activated AR interface, the font is transformed into dynamic text, taking on functions such as telling brand stories and demonstrating ingredient science, thereby enhancing the layers and depth of information transmission.

Materials have become an important bridge connecting the physical and digital worlds. The combination of frosted glass bottle body and cold metallic texture can enhance the “technology” and “efficiency” attributes of the product. Ceramics or renewable wood, on the other hand, are more in line with the brand narrative of “nature” and “sustainability”. With the application of smart labels, the material itself has also become a medium for conveying product status and usage information, endowing packaging with more dynamic communication functions.

3.2.2. Narrative strategy

Packaging, as a “medium for storytelling”, has further strengthened the narrative expression of brands with the support of intelligence. Intelligent packaging not only tells the brand story but also creates a unique sense of ceremony through diverse interaction methods. It combines brand narrative, technological narrative and consumer narrative to build a new communication field.

Thanks to intelligent packaging, brand narratives are no longer confined to founding stories or ingredient sources, but have evolved into immersive “narrative universes” for users to explore. For instance, the AR experience of Gucci Bloom series of perfumes allows users to feel as if they are in a garden, where they can slide the screen to search for hidden perfumes in the garden maze and unlock special effects like “petal rain”. L'Oréal has also incorporated AR makeup try-on modules in some of its cosmetics, materializing its brand philosophy of “creating beauty that moves the world” into an immersive visual experience. Packaging has thus become a trigger for carrying brand value narratives, transforming consumers from passive “receivers” to active “explorers”.

Intelligent technology has also greatly enhanced the sense of ritual during the unboxing and usage process. Some cosmetic gift boxes trigger internal sensors upon opening, lighting up soft LED effects and playing exclusive music, transforming the unpacking experience into a sensory feast full of anticipation and a sense of indulgence. More importantly, this sense of ritual is often amplified through users' sharing on social media, further enhancing the brand's dissemination effect. According to data from Xiaohongshu, topics such as “#AI Makeup Try-On”, “#Beauty Tech”, “#Virtual Makeup Try-On”, “#Ingredient Visualization”, and “#AR Black Technology” have garnered over ten million views.

3.2.3. Interaction design

The core of intelligent packaging lies in interactivity, covering multiple levels from sensory stimulation to cultural expression. The core of interaction design lies in transforming “functional experience” into “communication experience”, enabling consumers to form emotional memories during the interaction process and thereby achieving a deeper brand connection.

In terms of the sensory dimension, traditional packaging mainly remains at the level of vision and touch, while smart packaging expands to the multi-sensory integration of temperature, light effects and even sound. Visually, dynamic superimposition is achieved through AR. In terms of touch, with the help of differentiated materials and precise opening and closing structures, such as magnetic covers and damping pump heads, it brings a pleasant hand feel. In terms of sound, the video or AR experience after scanning the code is accompanied by carefully designed sound effects and background music. Cutting-edge exploration has even begun to introduce temperature sensing and light effects, all of which enable consumers to obtain additional information through non-visual senses, creating a “multi-sensory resonance”.

In terms of interaction dimensions, scanning codes, touching, and sensing have become the main forms of interaction in smart packaging. The differences in interaction methods directly affect the smoothness of user experience. Qr code scanning has the lowest threshold and the widest application. NFC technology is more convenient and high-end, allowing you to jump with just a light touch. Sensing interactions such as gravity sensing, light sensing, and temperature sensing create a “contactless” magical experience, for instance, automatically displaying information when the product is picked up. Interaction design transforms the unboxing process into an immersive digital experience, instantly capturing users' attention. In addition, “the interactive interface should be not only intuitive and user-friendly but also aesthetically pleasing and attractive. At the same

time, the design concept and the experience brought by the operation process should be able to provide people with a pleasant operation experience.” [11] This novel interaction not only stands out at the first moment but also creates unique memory points, enhances user participation, and prompts consumers to establish an emotional connection with the brand.

In terms of cultural dimensions, the differences in wisdom between the East and the West have led to significant disparities in the intelligent expression of brands between the two regions. Eastern brands such as those from China, Japan and South Korea place greater emphasis on the sense of ceremony, emotional connection and the digital translation of traditional cultural elements. For instance, the Chinese brand Hua Xi Zi incorporates traditional patterns and carvings into its packaging, embodying the philosophy of “Oriental skin care”. Japanese brands often showcase the process of ingredient extraction through fine animations, highlighting naturalness, craftsmanship and precision. Western brands, on the other hand, tend to focus more on a sense of technology, functionality and futurism. Their interactive content often directly showcases laboratory data and efficacy comparisons, with a simple and abstract style that emphasizes the empirical effects and cutting-edge technological attributes of the products. Of course, “The complementarity between Eastern and Western wisdom is the foundation for the further development of human wisdom” [12]. The sixteen-character maxim proposed by Mr. Fei Xiaotong, “Let each be beautiful in its own way, appreciate the beauty of others, and share beauty together for a world of great harmony,” is also applicable to the exchange and integration of different regions and cultural identities in the context of globalization.

4. Discussion

4.1. New technologies drive the transformation of visual communication from “static” to “interactive narrative”

The communication logic of traditional packaging is based on “one-way transmission”, that is, information communication is achieved through static symbols such as color, pattern and material. However, in the context of new media, intelligent packaging, by leveraging technologies such as NFC, RFID, AR, and temperature-sensing color-changing, has broken through the previous communication model and represents a brand-new form of visual communication. Packaging is no longer merely a visual surface but has gradually evolved into an intelligent medium that integrates information transmission, emotional interaction and technological realization.

This transformation indicates that visual communication is moving from “expressiveness” to “narrative”, especially in the cosmetics field. For instance, L 'Oreal's NFC packaging enables consumers to enter an AR makeup try-on scenario through a simple touch, and the packaging becomes the “starting point” of the narrative. Nivea's temperature-sensitive color-changing design transforms the skincare process into a visual story, endowing daily use with ritualized scenarios. The emergence of intelligent packaging marks a fundamental shift in the visual communication paradigm of cosmetics, transforming from a “static rhetoric” to a “dynamic interface”. In the new media environment, intelligent packaging reshapes the relationship between brands and consumers through the three-dimensional integration of symbol construction, cultural narrative and interactive experience. Packaging is no longer the “terminal” of information but the “starting point” of relationships. Its value does not lie in the end of communication, but in the interaction, sharing and re-creation it inspires. This transformation has shifted the core of visual communication from “shaping a perfect image” to “designing an engaging experience process”.

Therefore, it can be considered that intelligent packaging is an important extension of visual communication theory in the new media environment. It promotes packaging to shift from static physical symbols to dynamic media narratives, presenting a new form of communication.

4.2. Smart cosmetic packaging demonstrates the advantages of interactivity and immersion in visual communication

Intelligent packaging demonstrates advantages that traditional packaging cannot match. The first level is the “deep communication advantage”, which breaks through the limitations of physical space and expands the limited bottle body into an infinite digital content library. Designs such as AR makeup try-on, color-changing ink, and light effect interaction place consumers in a contextualized consumption environment, creating an immersive aesthetic experience and enabling brands to convey complex concepts and information more comprehensively and deeply. The second aspect is the “emotional connection advantage”, which creates a profound sense of participation and memorable points through high interactivity and personalized content feedback, thereby establishing an emotional bond with users that transcends functional levels. For instance, the tips of temperature-sensing ink convey “care”, strengthening users' emotional identification and significantly enhancing brand loyalty. The third level is the “advantage of data-driven marketing”. Every interaction is accompanied by data collection, enabling brands to precisely understand user preferences and behavioral paths, build a unique visual narrative logic, and provide valuable support for subsequent product development, content optimization, and precise marketing, thereby establishing a unique competitive edge in the global market.

4.3. Double-edged sword: market challenges faced by intelligent cosmetic packaging

Although intelligent packaging has demonstrated advantages in terms of communication and experience, its development is also accompanied by complex challenges, presenting a typical “double-edged sword” effect. As mentioned earlier, its value in enhancing brand narrative, improving user experience, creating social opportunities, and achieving precise data feedback has been verified by the market. At the same time, it can also reduce the number of counterfeit and shoddy products, “further stabilizing the normal market order on the basis of protecting the positive rights and interests of consumers.” [13] This is the positive effect it brings.

However, at the same time, both technology development and content production require high investment. High-end brands can undertake the research and application of intelligent technologies, but for small and medium-sized enterprises, NFC chips, temperature-sensitive inks, and AR program development all mean high costs and technical barriers. This has to some extent led to “brand stratification”, making smart packaging more concentrated in the high-end market. With the gradual popularization of intelligent packaging, if numerous brands adopt similar models and lack cultural narrative and aesthetic support in packaging design, the packaging is likely to degenerate into “formalism”, leading to consumer aesthetic fatigue and the risk of brand homogenization. In addition, the main audience of intelligent cosmetic packaging at present are young people who are willing to try new technologies and enjoy participating in interactions. However, some older or less tech-savvy consumers may experience “technology anxiety”, showing a sense of rejection when facing complex steps such as scanning codes and sensing. As a result, the dissemination effect of intelligent packaging varies among different consumer groups. What is even more alarming is that in some cases, it has been confirmed that packaging has been overly designed for entertainment and interaction. If the interaction design is not strongly related to the brand's core or product efficacy, it

may degenerate into a flashy but impractical technical display. In the long run, this may instead undermine the brand's professional image.

Therefore, intelligent packaging must strike a balance between technical functionality and aesthetic value. "The artistic treatment of packaging under the constraints of intelligent technology" [6] is a key link. From an industry perspective, intelligent packaging needs to further enhance the sense of immersion and combine multiple technologies to create a more seamless experience. At the same time, a balance should be struck between "aesthetics" and "ease of use", adhering to the principle of "aesthetics first", integrating technology into design and simplifying operation processes to ensure a good user experience. In addition, cost control and practical application are also of vital importance. Standardized solutions help reduce technical costs and ensure that each function can effectively enhance brand recognition or conversion rates. It is worth looking forward to that if intelligent packaging can be deeply integrated with green packaging and digital marketing, it will be more conducive to achieving the unification of future commercial value and social value.

5. Conclusion

Through the reengineering of the symbol system, the strengthening of narrative strategies and the extension of interaction design, packaging design has formed a brand-new visual communication logic. In the cosmetics industry, this logic is particularly prominent, directly influencing consumers' perception and emotional experience, and on this basis, building a deeper brand emotional connection and user loyalty.

Of course, this study still has limitations. Firstly, the sample cases are limited and mainly focus on the high-end product lines of leading domestic and foreign brands. Future research can be expanded to more diverse mass brands and different categories. Secondly, intelligent technologies are developing rapidly. This study only presents an analysis of a certain stage, and continuous follow-up and updates are needed in the future. Based on research findings and deficiencies, future exploration can further focus on cross-cultural comparisons, differences in consumers' aesthetic preferences and acceptance, packaging design of local regional cultural symbols, as well as the integration of environmental protection and intelligence.

Looking ahead, with the in-depth application of artificial intelligence and virtual reality technologies, intelligent packaging is expected to present more diversified media forms and become an important frontier in visual communication research.

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