

Original Paper

Visual Metonymy in App Icons of Social Media: A Cross-Cultural Analysis

Shiyi Zhou^{1*} & Zixuan Chen¹

¹ Nanjing Audit University, Nanjing, China

* Shiyi Zhou, Nanjing Audit University, Nanjing, China

Received: August 23, 2026 Accepted: September 16, 2026 Online Published: October 5, 2026

doi:10.22158/csm.v9n1p174

URL: <http://dx.doi.org/10.22158/csm.v9n1p174>

Abstract

This study investigates the use of visual metonymy in social app icons within a highly competitive global app market. While previous research has mainly focused on surface-level visual traits such as color, shape, and aesthetics, the cross-cultural symbolic and rhetorical dimensions of app icons remain largely understudied. This study takes metonymy as its central object of analysis and explores how this particular type of visual rhetoric is deployed across diverse cultural settings and how it manifests within various national marketplaces. We conducted a quantitative content analysis on 800 social app icons from four national markets: China, India, Russia, and Saudi Arabia. The findings reveal that visual metonymy is widely used in social app icons. This trend highlights its importance as a visual strategy for conveying broader meanings through concrete elements. Cross-national variation, however, reveals distinct usage patterns across the four markets. This empirical divergence indicates that metonymic design is influenced by the interplay among functional communication, global design conventions, and local cultural contexts. This study deepens our understanding of the semiotic mechanisms in digital visual communication and provides practical insights for cross-cultural app icon design.

Keywords

visual metonymy, app icon, social app, visual communication, cross-cultural design

1. Introduction

Mobile apps have been deeply integrated into daily life and play a central role in communication, information acquisition, business transactions, and social interaction. With the increasingly fierce competition in the digital market, app icons have become the main visual identity of mobile apps and an important interface between users and digital products. They help identify, navigate, and make

decisions, and often provide users with an initial impression of the app. Studies have shown that users evaluate digital products within seconds and are highly dependent on visual cues when judging their credibility, quality, and relevance (Lindgaard et al., 2006; Tuch et al., 2012). Therefore, the effectiveness of app icons depends on their uniqueness, familiarity, semantic meaning, visual complexity, and aesthetic appeal (McDougall et al., 2000; Isherwood et al., 2007; McDougall & Reppa, 2008). Icons with visual appeal and clear semantics can promote recognition, enhance the user experience, and positively affect the user's evaluation of the product before the user actually uses the function (Tractinsky et al., 2000; Tuch et al., 2012). With the continuous dominance of minimalist interface design on mobile platforms, app icons must convey complex meanings through highly restricted visual forms, making them an important field for studying visual communication and meaning construction.

Metonymy plays a particularly important role in realizing the cognitive mechanism of compressed visual communication. Metonymy does not establish correspondences between different conceptual domains, but functions through associations in a single conceptual domain, that is, a prominent element can lead people to associate with a wider range of concepts or experiences (Radden & Kövecses, 1999). Cognitive linguistics has identified metonymy as a fundamental mechanism of thought that underpins communication, categorization, and reasoning, rather than merely rhetorical or linguistic techniques (Lakoff & Johnson, 1980; Panther & Thornburg, 2007). Metonymy can efficiently convey complex meanings and reduce cognitive burden by highlighting the most prominent aspects of concepts (Littlemore, 2015). This cognitive economy is particularly valuable in situations that require rapid information processing, because metonymic representations can provide access to shared knowledge through limited visual cues (Ruiz de Mendoza Ibáñez & Mairal Usón, 2007). Digital communication studies further show that metonymy promotes rapid understanding by drawing on the experience of cultural sharing and conceptual association (Littlemore & Tagg, 2016). These characteristics make metonymy particularly suitable for app icon design. In a highly restricted visual space, a small number of elements with visual salience can effectively convey the function, service and brand identity of the app.

Despite the increasing attention to metonymy as the basic mechanism of meaning construction, the existing research on the app icons mainly focuses on surface-level visual attributes, such as color preference, geometric configuration, visual complexity and aesthetic attraction (Wang & Li, 2017). However, limited attention has been paid to how metonymic structures promote meaning construction and user understanding. This limitation is particularly salient in cross-cultural context, because the effectiveness of metonymic expressions may be highly dependent on shared cultural knowledge, social customs and situational experience. In addition, since most of the existing studies are conducted in the Western digital environment, the role of culture in shaping the design and interpretation of visual

metonymy is still not fully understood. In order to fill this research gap, we turn our attention to the social app icons in the four major app markets in Asia to do a visual metonymy study. We use the analytical framework of cross-cultural comparison to dismantle those metonymic strategies in icon design, and to see how the cultural context affects the selection of strategies and their interpretation process. Through such research, we hope to better grasp the operation mechanism of visual metonymy in the app icon, and also sort out the path of meaning construction and interpretation of cultural context in the digital interface.

2. Literature Review

2.1 Studies on the Design of App Icons

Mobile apps have now become an indispensable part of daily life. The app icon is no longer just a simple graphic logo. It has gradually evolved into a very important visual interface, which will have an impact on the user's initial impression, subsequent decision-making process, and long-term use experience. Now researchers are increasingly aware that icons occupy a key position in UI design. After all, it is the first major contact between users and apps. Previous study mainly focused on the basic features of color, shape, symmetry, and visual complexity to see how they affect icon recognition and visual attention (McDougall et al., 2000; Shen et al., 2020). The visual cognition research shows that when users face a large number of options, icons with obvious visual differences can improve the efficiency of search, and help users find the app they want more quickly (Wolfe, 2021). Also, interface design research shows that icons with clear contours, balanced composition, and low visual complexity can help information processing, and this can improve their attractiveness and usability (Schrepp et al., 2021; McDougall et al., 2016; Lidwell et al., 2010). These findings are consistent with the processing fluency theory, which holds that visual stimuli requiring less cognitive effort tend to produce more positive aesthetic evaluation and facilitate decision-making (Reber et al., 2004). In general, this series of studies establishes visual conciseness and perceptual clarity as the basic principles of effective app icon design.

Recent studies have further expanded this perspective by examining how app icon design affects user behavior, especially in the increasingly competitive digital markets. Apart from attracting attention, icons can also influence installation decision-making and continuous use behavior (Moshagen & Thielsch, 2010; Jylhä & Hamari, 2019). Empirical research shows that subtle differences such as color saturation, geometry, border style, and visual consistency can significantly affect the click rate and download behavior (Liu et al., 2021). Eye tracking research further confirms that in crowded smartphone interfaces, visually prominent icons can reduce visual search time and improve search efficiency (Trapp & Wienrich, 2018). In addition, easy-to-recognize visual structure is closely related to faster information processing speed, lower cognitive load and more efficient user interaction (Liu &

Li, 2023). These findings show that effective app icon design not only transcends aesthetic preferences, but also has a measurable impact on user behavior and app performance.

In recent years, people have gradually realized that the app icon is not only a navigation tool, but also a concise embodiment of brand identity and strategic communication objectives. Through visual symbols, app icons convey the personality, values, and functional characteristics of the app (Baharom & Zolkifly, 2025; Johansen & Gregersen, 2024; Henderson & Cote, 1998). A consistent visual image in app icons, interfaces and brand materials can enhance brand awareness and enhance users' trust in the brand (Wheeler, 2017). In addition, the design consistency between the app icon and the overall brand image is also closely related to the enhancement of users' emotional attachment and continuous utilization (Norman, 2013). More importantly, effective app icons can simplify complex brand identities into visual symbols that are easy to remember, and achieve fast brand recognition with limited attention (Liu et al., 2021; Stocchi et al., 2020). These findings highlight the strategic role of app icons in integrating functional usability with symbolic brand communication.

Although significant progress has been made in understanding the perception, behavior and brand function of app icon design, the cognitive mechanism behind visual meaning construction has not been fully studied. Most of the existing research focuses on visual aesthetics, usability evaluation and brand effect, while less attention is paid to how app icons convey abstract concepts through rhetorical strategies in a highly restricted visual space. The research on visual rhetoric mainly focuses on the visual metaphor in advertising and media communication (Forceville, 1996; Burgers et al., 2016). Although visual metonymy is widely used in logo design, interface design and digital communication, it has received little academic attention. In addition, although cultural background has been proved to affect the interpretation of visual symbols and interface elements (Sun, 2012), systematic research on the differences in metonymic performance from a cross-cultural perspective in the mobile app market is still scarce. Filling this gap will contribute to a deeper understanding of how metonymic strategies in cultural contexts promote the spread of app functions and brand identity through app icons in different cultural contexts.

2.2 Visual Metonymy in Advertising and Communication

Visual rhetoric has long provided an important theoretical framework for explaining how images construct and convey meaning in advertising and digital media. Under this framework, visual metonymy, as a basic cognitive mechanism, is attracting more and more scholars' attention. It leads to another concept in the same conceptual field through a visual element (Littlemore, 2015). Unlike visual metaphors that build mappings between different conceptual domains based on similarity, visual metonymy relies on pre-existing conceptual relations, such as part-whole, producer-product, and object-user associations (Lakoff & Johnson, 1980). These associations are rooted in human experience, allowing viewers to quickly infer complex meanings with relatively little cognitive effort (Panther &

Thornburg, 2007). Therefore, it is now widely recognized that visual metonymy is an independent cognitive mechanism that can play a unique communication function in both linguistic and visual modes, not just as a subordinate form of metaphor (Barcelona, 2011).

Advertising and brand building provide important contexts for the application of visual metonymy, because complex conceptual information can be conveyed through simple visual expression. Advertisements usually do not depict complete products or services, but through representative objects or attributes, with the help of familiar conceptual associations to evoke a broader meaning. This kind of visual expression plays a role of cognitive shortcuts, which not only improves communication efficiency, but also maintains persuasion (Pérez-Sobrino, 2017). Empirical research further shows that combining concrete visual cues with situational and cultural knowledge can help to improve information understanding and enhance the audience's sense of participation (Urios-Aparisi, 2009). In addition, visual metonymy and visual metaphor often coexist in multimodal advertisements, and the metonymic relationship often lays a conceptual foundation for metaphorical interpretation (Kashanizadeh & Forceville, 2020). Therefore, visual metonymy has become an important rhetorical strategy in sign, packaging and brand recognition systems, which rely on concise but meaningful visual symbols.

Recent studies have extended the application of visual metonymy from traditional advertising to digital and multimodal communication. Since the digital interface requires efficient communication in a limited visual space, compact visual symbols are becoming more and more important in interface design, emoticons and mobile apps. Representative visual elements enable users to quickly identify features and services by activating familiar conceptual relationships derived from everyday experience (Littlemore, 2015). Cultural conventions and shared social knowledge also play a key role in metonymic interpretation, which explains why the same visual symbol may convey different meanings in different cultural contexts (Pérez-Sobrino, 2017; Forceville, 1996). These findings show that visual metonymy provides a particularly appropriate theoretical perspective for the study of app icons, because the communication function of app icons depends on the highly condensed visual expression in a culturally diverse digital environment.

In order to establish a systematic framework for the analysis of visual metonymy, this study adopts the conceptual metonymy classification method proposed by Lakoff and Johnson (1980). Although the classification was originally proposed to explain conceptual metonymy in language, subsequent studies have shown that the same conceptual mapping is also applicable to visual communication because images, like language, activate conceptual associations through representative elements (Littlemore, 2015; Pérez-Sobrino, 2017). The framework identifies seven recurring metonymic patterns:

PART FOR WHOLE, in which a salient part represents an entire entity, such as a steering wheel representing an automobile.

PRODUCER FOR PRODUCT, in which a producer refers to its products, such as a bitten apple representing Apple products.

OBJECT USED FOR USER, in which an object evokes the person who commonly uses it, such as a shopping bag representing shoppers.

CONTROLLER FOR CONTROLLED, in which a person or object with authority represents those under its control, such as a crown representing a monarch.

INSTITUTION FOR PEOPLE, in which an institution represents the people associated with it, such as Parliament representing its members.

PLACE FOR INSTITUTION, in which a location refers to an institution or organisation, such as the White House representing the U.S. administration.

PLACE FOR EVENT, in which a place name refers to an important event associated with that location, such as Waterloo referring to the Battle of Waterloo.

These categories do not depend on the surface similarity between irrelevant concepts, but through a stable experiential relationship, explain how representative elements provide a conceptual cognitive path for a broader meaning. Therefore, Lakoff and Johnson's classification system has become an important analytical framework for analyzing the construction of visual meaning in language and multimodal communication (Barcelona, 2011; Panther & Thornburg, 2007).

The classification proposed by Lakoff and Johnson (1980) provides a useful starting point for analyzing visual metonymy in app icon design. Although the framework was originally designed to explain conceptual metonymy in language, its theory can be extended to the field of visual communication. In this situation, due to strict spatial restrictions, it is necessary to convey complex app identities and functions through highly condensed visual expressions. App icons usually do not depict the complete service content, but use representative visual elements such as cameras, shopping bags, dialogue bubbles or location pins to evoke broader meanings through established conceptual relationships. Because these relationships are influenced by cultural conventions and users' previous experiences, metonymic strategies may differ in different cultural contexts (Littlemore, 2015). Therefore, we use the classification of Lakoff and Johnson as reference to identify and compare visual metonymy in different countries' app markets. Also, we remain open to metonymic models that can go beyond the original classification.

3. Methods

This study explores the differences in the use of visual metonymy in mobile app icons in different cultural contexts. Through systematic content analysis of app icons collected from selected national markets, we investigate how metonymic representations are constructed and distributed across different cultural contexts. Through this research, we hope to provide an empirical perspective on how visual

elements can act as meaningful hints to convey the function, identity and relationship with users of the app.

3.1 Research Questions

The study addresses the following research questions:

- (1) How is visual metonymy represented in app icons across the selected national markets?
- (2) How are different types of visual metonymy distributed and employed across these markets?

3.2 App Selection

The corpus was completely collected from the Apple App Store. We choose this platform because it has a mature ecosystem and standardized display environment. Also it can be used for design-oriented analysis. The app store is a digital distribution channel. Also it acts as regulatory environment and can affect app development through platform-specific requirements and quality control mechanisms (Zhu et al., 2024). In the existing mobile app ecosystem, Apple App Store provides consistent visual background and app icons are presented based on design principles from Apple's Human Interface Guidelines (Apple, 2024). This consistency is especially valuable for cross-cultural comparison, because we can examine the differences in visual meaning construction without considering changes from platform interface or technical conditions.

To make sure data is reliable and can be compared, we collect all app icons and ranking information from the platform app.diandian.com from July to August 2024. We examine apps from China, Russia, Saudi Arabia, and India, which represent four culturally different markets. The app selection is completely based on the official classification criteria of Apple App Store, and the top 100 free apps and top 100 paid apps in each country's social network category are collected. Finally, a total of 800 app icons are obtained as the research corpus.

3.3 Coding Procedure

The study employed a double-coding procedure to improve the consistency of the analysis (Spooren & Degand, 2010). Two coders check all app icons and encode them based on whether visual metonymy exists and its category. Any disagreement is resolved by consensus. This can ensure consistency and reliability of coding process.

To make the interpretation more accurate, we check the app description in Apple App Store. It can help us understand the functions and target users, and the service characteristics of each app. For apps from China, Chinese descriptions were used; for Russia, Saudi Arabia, and India, English descriptions were used. We use this method so that coding decision can consider the visual characteristics and contextual information of each app at the same time.

In visual metonymy analysis, we first check whether an icon contains a metonymic expression. Icons not found to contain recognizable metonymic expressions are coded as "0", while icons containing metonymy are coded as "1". These identified metonymies are then classified based on the conceptual

metonymic framework by Lakoff and Johnson (1980). Considering the app icon is highly condensed visual interface, so we adjust framework to examine how a single visual element represents a wider range of services, users, activities, and experiences.

We use six categories in coding scheme: action-related metonymy, brand-for-service metonymy, object-used-for-user metonymy, part-for-whole metonymy, place-for-event metonymy, and compound metonymy. Action-related metonymy means a behavior can represent the app's functions. Brand-for-service metonymy is when a brand element represents complete service. Object-used-for-user metonymy involves objects that symbolize a specific user group, lifestyle, or community. Part-for-whole metonymy means prominent components represent the whole service. Place-for-event metonymy refers to place that evokes activity. Compound metonymy applies when an icon contains two or more metonymic relationships at the same time and icons that did not fit any category were coded as "Other".

The application of the framework is illustrated through representative examples (Figure 1). WeChat's icon embodies the metonymy of part-for-whole, because as a representative element of communication, the meaning of dialogue bubbles extends to the broader concept of social interaction and information transmission services. The icon of QianShou shows action-related metonymy, in which the image of holding hands represents the broader activity of interpersonal connection and relationship building, which corresponds to the social matching function of the app. The Skype icon embodies the brand-for-service metonymy, because the recognizable "S" symbol not only refers to the graphic element itself, but also serves as a condensed symbol of the entire communication service. The icon of TeamSpeak 3 shows the object-used-for-user metonymy, in which the visual elements related to headphones represent the user group for voice communication and game interaction. The icon of the bell reflects the metonymy of the location of the event, and the visual image of the floating bottle evokes the traditional activities of people to transmit information through the ocean, thus representing the anonymous social communication experience in a broader sense. Finally, the icon of Zhihu demonstrates a compound metonymy. A variety of associative relationships jointly build its meaning, combining brand logos, platform characteristics and representative visual elements, pointing to a wider range of knowledge sharing communities and services.



Figure 1. Examples of Six Types of Visual Metonymies

3.4 Data Analysis

After completing the coding process, a quantitative analysis was carried out to summarize and compare the distribution of visual metonymy in the selected markets. The frequency of various types of metonymy are calculated for each country, and the results are compared to identify the cross-cultural patterns used by visual metonymy strategies in mobile app icon design.

4. Results

The dataset contains 800 social media app icons collected from China, India, Russia and Saudi Arabia, with 200 icons selected for each national market. Visual metonymy is found in a large number of samples, and a total of 538 icons are classified as containing metonymic elements, accounting for 67.3% of the whole sample. The high proportion of metonymic icons indicates that metonymy is a major visual strategy in social media app icon design. Many apps rely on a single prominent element to convey a broader meaning related to services, functions, or user identity.

Figure 2 shows the distribution of metonymic usage in four countries. Saudi Arabia has the highest proportion, with 144 icons containing metonymic elements (72.0%). Russia was followed by 140 icons (70.0%). India's level is similar, with 137 icons (68.5%). China has the lowest proportion, with only 117 metonymic icons identified in the sample, accounting for 58.5% of the national data set. The gap between Saudi Arabia and China is 13.5 percentage points, indicating that there are differences in the degree of metonymy dependence in the app icon design in various countries.

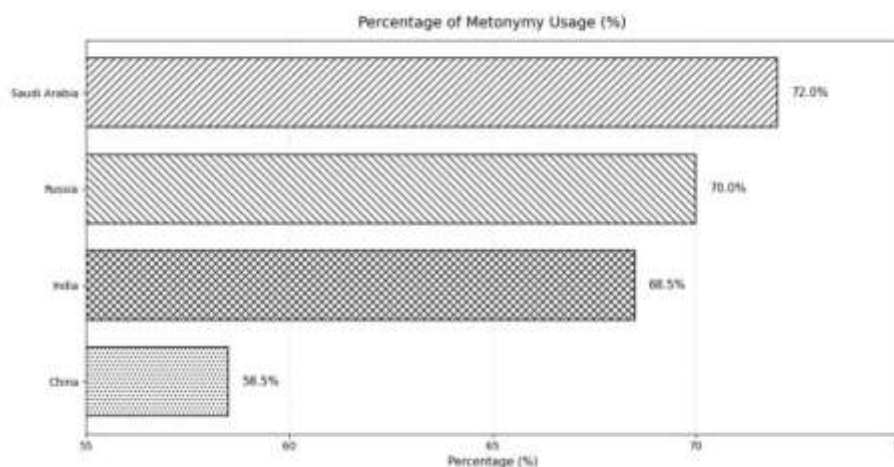


Figure 2. Proportion of Metonymic Icons by Country

The comparison between countries shows that although the frequency of use is different, it is generally dependent on metonymic expression. All four markets show a considerable number of metonymic icons, and no country has a usage rate below 50%. The distribution of Saudi Arabia, Russia and India is relatively close, and their dependence on associative visual performance is also similar. Compared with the other three markets, China's proportion is relatively low, but the widely used metonymy phenomenon shows that this strategy is still an important part of Chinese app icon design.

Table 1 illustrates the distribution of different metonymy types across the four markets. Among the 538 metonymic icons, part-for-whole metonymy was the most frequent category, with 307 cases (57.1%). Compound metonymy ranked second, appearing in 105 icons (19.5%), followed by object-used-for-user metonymy with 74 cases (13.8%). The remaining categories occurred less frequently, including action-related metonymy (30 cases, 5.6%), brand-for-service metonymy (13 cases, 2.4%), and place-for-event metonymy (9 cases, 1.7%). The overall distribution indicates a strong preference for visually concrete associations, while metonymic relationships involving actions, brands, or events were comparatively less common.

Table 1. Cross-national Distribution of Visual Metonymy Types in Social App Icons

Coding variable	Total		China		India		Russia		Saudi Arabia	
	N	%	N	%	N	%	N	%	N	%
Action-related Metonymy	30	5.6%	6	5.1%	9	6.6%	7	5.0%	8	5.6%
Brand-for-service Metonymy	13	2.4%	3	2.6%	3	2.2%	3	2.1%	4	2.8%
Object-used-for-user Metonymy	74	13.8%	15	12.8%	16	11.7%	17	12.1%	26	18.1%
Part-for-whole Metonymy	307	57.1%	71	60.7%	77	56.2%	85	60.7%	74	51.4%
Place-for-event Metonymy	9	1.7%	3	2.6%	2	1.5%	1	0.7%	3	2.1%
Compound Metonymy	105	19.5%	19	16.2%	30	21.9%	27	19.3%	29	20.1%

The cross-national distribution of metonymy types reveals both shared patterns and country-specific tendencies. Part-for-whole metonymy dominates in all four markets, of which Russia is the most frequent (85 cases), followed by India (77 cases), Saudi Arabia (74 cases) and China (71 cases). This consistent preference shows that app icons in different cultural contexts often rely on recognizable parts or symbols to represent broader concepts. Compound metonymy also shows a stable existence in different countries, although their distribution varies slightly. India uses this category the most often (30 cases, 21.9%), followed by Saudi Arabia (29 cases, 20.1%), Russia (27 cases, 19.3%) and China (19 cases, 16.2%). The relatively high proportion in India shows that people are more inclined to combine multiple visual clues in one icon.

The difference is particularly obvious in object-used-for-user metonymy and other less frequently used categories. Saudi Arabia is the most prominent in the use of object-used-for-user metonymy, with a total of 26 cases (18.1%), surpassing China (15 cases, 12.8%), India (16 cases, 11.7%) and Russia (17 cases, 12.1%). India's distribution in various categories is relatively balanced and has the strongest preference for compound metonymy; while Russia is characterized by a high concentration of overall and partial representations. The frequency of use of various categories in China is relatively mild, and there is no particularly prominent secondary mode.

Overall, the research results show that there is a combination of shared practices and culturally differentiated preferences in the use of visual metonymy. In all markets, the widespread use of part-for-whole and compound metonymy reflects people's general reliance on concise and easy-to-recognize visual expressions. At the same time, the differences in secondary metonymy categories reveal the differences in the choice of visual association in different national markets.

5. Discussion

5.1 *The Prevalence of Visual Metonymy as a Cognitive Shortcut*

The research results show that visual metonymy is extremely common in social media app icon design. Of the 800 icons examined, 538 contained at least one metonymic element, accounting for 67.3% of the total number of samples. This high proportion shows that metonymy is not a marginal rhetorical strategy in digital visual communication, but a basic mechanism that condenses app functions, identity, and user experience into small visual units. Littlemore (2015) describes metonymy as a “hidden shortcut” that allows users to access complex meanings through prominent and easy-to-access elements. This study further expands this view, proving that there is a similar cognitive economy in the field of vision: designers often do not directly present the whole app or service, but choose a recognizable element to allow users to enter a wider conceptual field. Therefore, metonymy not only functions as a meaning-construction mechanism in language, but also becomes a recurring strategy to compress meaning in digital visual communication.

One explanation for the high-frequency appearance of visual metonymy is the limitations of the app icons in terms of space and perception. Unlike large-scale visual advertisements or interface screens, app icons must convey meaning in a highly limited square format, and are usually frequently encountered in the process of short visual scanning. Research on the usability of icons shows that specificity, uniqueness, and semantic clarity help to identify and process icons efficiently (McDougall et al., 2000). Similarly, the semantics of icons will also affect the speed and accuracy of visual search (Liu & Li, 2023). Metonymy can effectively cope with these restrictions, because a limited visual element can activate broader meanings. For example, a conversation bubble can evoke the association of communication, the camera may imply photo sharing, and a recognizable brand element can evoke the image of the entire digital service. This characterization economy enables designers to reduce the amount of visual information required to convey the core identity of the app while maintaining semantic access. Therefore, the frequency of metonymy observed in this data set is relatively frequent, partly due to the functional requirements of mobile interface design.

Further explanation involves the relationship between metonymy and processing fluency. App icons usually appear in contexts that require quick identification rather than in-depth interpretation. Relatively easy-to-handle stimuli often produce higher perceptual fluency and more positive responses, and icon research also shows that semantic clarity and visual characteristics are closely related to user performance and attractiveness (Reber et al., 2004; McDougall et al., 2016). Metonymy is particularly suitable for this demand, because it depends on familiar relationships, such as part-whole, producer-product, object-user, and action-function, etc., without the user to establish a completely novel concept mapping. Therefore, the 67.3% universality observed in this study confirms and expands the cognitive shortcut theory of metonymy, proving that it is effective in both speech and visual mode

as a meaning compression strategy. Although this finding does not establish metonymy as literally universal, its high occurrence across all four national markets indicates that metonymic compression represents a relatively widespread tendency in contemporary digital visual communication.

5.2 Unequal Distribution and Emerging Types of Visual Metonymy

However, the overall frequency of metonymic use does not mean that all metonymic relations are adopted to the same extent. The six categories identified in this study showed a clear hierarchical distribution, of which part-for-whole became the most commonly used type. This preference can be attributed to the close fit between the part-for-whole representation and the perception needs of mobile app icons. Because the visual space provided by icons is limited and processed by fast visual scanning, multiple elements presenting a complete service together may increase visual complexity. In contrast, a single prominent component can activate a wider range of conceptual domains with relatively less visual information. This relationship between semantic compression and perceptual accessibility is consistent with previous research results: specificity, uniqueness, and semantic clarity help to improve icon recognition rate and user performance (McDougall et al., 2000; Isherwood et al., 2007). Therefore, the part-for-whole metonymy provides an efficient means to achieve an effective balance between semantic information and visual economy.

The WeChat and Messenger icons clearly illustrate this mechanism (Figure 3). The two overlapping dialogue bubbles in the WeChat icon represent a prominent part of interpersonal communication, while the white lightning symbol in the Messenger icon serves as a recognizable hint for messaging and online interaction. In both cases, limited visual elements can evoke the broader function of communication without having to present all the service content. This performance is especially advantageous when users need to quickly identify an app among many competitive icons. The effectiveness of this strategy is consistent with the research results: icon semantics affect visual search performance, and easy-to-handle visual stimulation helps promote positive perception responses (Liu & Li, 2023; Reber et al., 2004). Therefore, the dominant position of part-for-whole metonymy in the current corpus can be understood as a mobile interface solution that both meets cognitive needs and has design efficiency.



Figure 3. Examples of Part-for-Whole Metonymy in App Icons

The unequal distribution of the six categories also reveals an important distinction between verbal and visual metonymy. Lakoff and Johnson (1980) mainly developed their influential theories through the relationship of language concepts, and the subsequent cognitive linguistics research further systematized metonymy, such as the relationship between part-for-whole, producer-for-product, and place-for-institution (Radden & Kövecses, 1999; Panther & Thornburg, 2007). However, in current visual context, we can find some new forms. For example, brand-for-service and compound metonymy. It is worth noting that these categories show functional characteristics of the app icon, where textual brand prompts, recognizable objects, functional symbols, and user-related elements can work together at the same time. Therefore, visual metonymy does not just copy categories from verbal metonymy. Instead, it develops new combinations that can meet functional needs of digital interfaces and brand identification requirements. This observation is consistent with multimodal research, showing that when meaning is constructed through visual resources, metonymic relationships can be reorganized and combined (Pérez-Sobrino, 2017; Urios-Aparisi, 2009; Kashanizadeh & Forceville, 2020).

Within this broader pattern, compound metonymy is particularly noteworthy because multiple metonymic relationships can operate simultaneously within a single icon. Two repeated combinations can be identified. The first is the combination of part-for-whole and brand-for-service, such as Baidu Tieba and Korean Drama Network. In the icon of Baidu Tieba, the outer dialogue bubble shape represents the core components of social discussion, posting, and communication, while the eye-catching word “贴” is used as the identifiable brand logo of the platform and its services. Similarly, the television-shaped outline of Korean Drama Network represents the specific components of the broader field of video viewing and streaming media, while the text and unique brand layout of “韩剧” indicate the specific service content. The second combination is the combination of part-for-whole and object-used-for-user, such as WhosHere and Phone Tracker: IM Map Navigator. In the icon of WhosHere, the abstract human figure represents users or social groups looking for nearby contacts, while radar-like positioning ripples reflect prominent elements in location-based search and real-time social interaction. In “Mobile Phone Tracking: IM Map Navigation”, the two characters standing on the map represent family members, friends or paired users who use the tracking service, while the map and road network elements symbolize a wider range of functions such as GPS navigation, location tracking and route recording. In both cases, compound metonymy simultaneously conveys the objects involved in the service and their functions, showing how to condense multiple meanings in the limited visual space of app icons.



Figure 4. Examples of Compound Metonymy in App Icons

5.3 Cross-National Variation in Visual Metonymy Use

The above research results show that metonymy is a broad and structurally different visual strategy. The transnational distribution further shows that this sharing mechanism is not consistently reflected in all cultural markets. Saudi Arabia has the highest overall proportion, with 144 metonymic icons, accounting for 72.0% of the total number of samples. Followed by Russia (70.0%), India (68.5%) and China (58.5%). However, China's relatively low proportion should not be understood as implying that Chinese designers or users have a low acceptance of metonymy communication. On the contrary, this may reflect the different balance between literal and visual meaning construction in China's digital environment. In China's app icons, there are often recognizable text brand names at the same time, and Chinese characters provide visually compact and semantically rich text clues. Therefore, designers may be more inclined to rely on text labels, font design and unique brand colors to directly convey the app identity, thereby reducing the need to encode meaning separately through image metonymy. The cultural orientation in technical design emphasizes that visual communication strategies are influenced by the local language and cultural environment, while research on mobile icons also shows that cultural background affects the intelligibility of icons (Sun, 2012; Pappachan & Ziefle, 2008). Therefore, this Chinese result does not seem to be a rejection of metonymy, but rather a different balance between literal immediacy and visual condensation.

Saudi Arabia presents another unique pattern, with the highest overall metonymy rate (72.0%) and the highest proportion of object-used-for-user metonymy (18.1%). This relatively strong indirect user representation may be related to the role of culturally identifiable objects in expressing social identity. Designers do not need to present users through clear portraits or facial depictions, but can use objects, clothing-related elements or other identifiable visual symbols to evoke specific users or social groups. This indirect representation can convey identity information while maintaining visual economy and cultural specificity. A visual analysis of Saudi media shows that symbolic images are involved in the construction and negotiation of social and ethnic identity (Alharbi, 2026). However, this interpretation still needs to be cautious, because this study does not directly measure users' religious beliefs, privacy attitudes or cultural preferences. Therefore, Saudi Arabia's findings should be understood as the

possible relationship between identity representation and metonymic visual strategy choice in cultural context, rather than the evidence of direct causal effect.

By heavily relying on the metonymy of part-for-whole, Russia presents another unique pattern. In the Russian sample, this category appeared 85 times, the highest absolute number of the four markets. This finding reinforces the dominant pattern identified in Section 5.2, and shows that Russian app icons rely in particular on a single prominent element to convey a broader meaning of the app. A possible background explanation lies in the historical significance of Russian constructivism, which attaches great importance to functional organization, geometric form, visual clarity, and the communication function of design (Fabres, 2012; Lodder, 2022). These principles may provide a broader cultural context for Russia's preference for prominent and functional visual elements, because the selection of a significant element can be directly related to the overall function of the app without the need for multi-layer presentation. However, this explanation should not be understood as evidence of direct historical continuity between constructivism and contemporary app icon design. On the contrary, the Russian research results show that functional clarity, visual simplicity and prominent presentation are compatible with the metonymic strategies observed in the market. On the whole, cross-country studies show that visual metonymy reflects a common cognitive mechanism, and its specific realization depends on the language, culture and design environment in which digital icons are produced and used.

6. Conclusion

This study investigates the operation of visual metonymy in 800 social media app icons in China, Russia, Saudi Arabia and India. The analysis found that 538 icons contained metonymic elements, accounting for 67.3% of the data set, indicating that metonymic expression plays a significant role in contemporary app icon design. The results also reveal notable differences across metonymy categories. Among them, part-for-whole is the most common, because designers can evoke a wider range of services or functions through prominent visual elements. In addition, the analysis also identified some visual configurations that transcend traditional language classifications, including brand-for-service and compound metonymy. At the national level, the distribution varies from market to market: Saudi Arabia has the highest overall proportion, Russia uses part-for-whole the strongest, and China's overall proportion is relatively low. These patterns show that visual metonymy plays a role through a widely shared meaning construction mechanism, while manifesting different forms of expression in specific cultural and design contexts.

However, there are still some limitations to be acknowledged. The corpus only contains social media icons from four national markets, which limits the generalization of the research results in other app categories and cultural backgrounds. In addition, the identification of metonymic relations mainly relies on qualitative coding, which fails to reflect how actual users perceive or interpret these visual

associations. Future research can explore larger and more diverse data sets and include empirical user studies. Recognition tasks, eye tracking experiments and cross-cultural comparative analysis help to further reveal how different metonymic structures affect users' attention, understanding and memory. Such research will contribute to a more comprehensive understanding of the relationship between visual metonymy, interface design and cultural contextual interpretation.

Acknowledgement

This paper was supported by Jiangsu Province College Students' Innovation and Entrepreneurship Training Program Project (202411287052Z).

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