

Article

What Drives Sustainable Brand Awareness: Exploring the Cognitive Symmetry between Brand Strategy and Consumer Brand Knowledge

Xuan Gong ¹, Changzheng Wang ^{1,*}, Yi Yan ¹, Maohong Liu ² and Rizwan Ali ³

¹ Economics and Management School, Wuhan University, Wuhan 430000, China; gongxuan@whu.edu.cn (X.G.); Yanyii24@163.com (Y.Y.)

² School of Management, Wuhan University of Science and Technology, Wuhan 430000, China; Liumaohong@126.com

³ School of Electronic Commerce, Wuhan Technology and Business University, Wuhan 430000, China; rizwan.ali@whu.edu.cn

* Correspondence: baiyanlang@sina.com

Received: 26 December 2019; Accepted: 22 January 2020; Published: 1 February 2020

Abstract: The explosive development of social media has given great opportunities to academic and industry research on consumer brand knowledge. Particularly, the brand associative network has been most frequently used to describe consumer brand knowledge structure. However, few researchers have examined the embedded connotation of the brand knowledge structural measurement in regard to sustainable brand performance and adjusted their brand strategies accordingly. Combining psychological cognitive theory and the network analytic method, this paper aims to extend this area by investigating the relationship between brand structural position in consumers' associative knowledge network and sustainable brand awareness. Using a monthly dataset of around 130 million user posts, we find that compared to a prior determined brand strategy, brand network centrality in consumer's brand associative knowledge network shows a much more significant positive effect on sustainable brand awareness. Importantly, we further examined the symmetric matching of brand positioning strategy and consumer's brand knowledge structure for sustainable brand awareness. We find that sustainable brand awareness will be promoted by a symmetric matching brand positioning strategy with its position in the associative knowledge work. Our study facilitates an understanding of brands based on consumer perceptions for managers and enables businesses to adjust their relevant strategies for the achievement of sustainable brand performance.

Keywords: associative knowledge network; symmetry; mobile phone; brand awareness

1. Introduction

Understanding consumer brand knowledge is essential for the sustainable development of brand performance, since consumer's brand knowledge has been indicated as valuable, inimitable, and irreplaceable resources to shaping sustained superior performance [1–4]. Particularly, with the coming of the internet era, consumers have been active content creators to express their opinions, understandings, and perceptions about products and brands through online social media platforms such as Twitter, Microblog, and Facebook. Simultaneously, firms can also build a relationship with their customers and market their brands through all kinds of social media. Such trends provide great opportunities for brand managers to better capture consumers' brand knowledge and make the brand strategies accordingly.

Recently, researchers have been focused on the methodology of identifying consumer knowledge, and there are multiple methods to describe and conceptualize consumer knowledge structures [4–9]. One of the most prominent and widely acknowledged methods of representing consumer knowledge structures is by drawing the consumer associative knowledge network [10], a knowledge network based on the human associative memory (HAM) model, which regards human memory as a network of interrelated informational nodes [10,11]. Particularly, this method has widely been used in describing consumers' brand knowledge. However, while the brand associative knowledge network based on the HAM has been well accepted to depict consumers' brand knowledge structure, few researchers have examined the embedded connotation of the brand knowledge structural measurement in regard to sustainable brand performance and adjusted their brand strategies accordingly. This paper aims to fill in this gap by exploring the relationship between brand structural position in consumers' associative knowledge network and sustainable brand awareness based on big data of user-generated content.

To address our research questions, we describe consumer brand knowledge with the brand associative network and uncover the embedded connotation of brand structure in consumers' associative network by leveraging theory of human cognitive psychology and network theory. We leverage the theory of human cognitive psychology, which explains how brands are related to each other in consumers' associative knowledge network, and we use network theory to explain the brand structural prominence in consumers' associative knowledge network. Although both the consumer associative network and the network analytic approach have been used to describe and analyze consumers' knowledge structure [12,13], to the best of our knowledge, only a few researchers have combined these two methods to detect the brand effects (in this paper we focus on brand awareness) and strategies. Thus, in order to assist the brand managers to optimize their brand strategies, we model the brand knowledge with the associative network and analyze their structural effect using the network method.

Importantly, previous research documents that consumer perceptions of brand features and brand relations are more essential than an a priori managerial statement of intended brand strategies for sustainable brand performance [12]. Similarly, we propose that the mismatch of intended brand strategies and consumer brand perceptions will show limited effects on sustainable brand performance. A superior brand can better serve its customers, and the sustainable brand performance is closely dependent on consumers' perception. Our work suggests that only by symmetrically matching the brand strategy with consumers brand perceptions, they can successfully achieve a sustainable brand effect. Here, symmetry indicates that the cognitive pattern initiated by the focused brand marketing strategy should be a good reflection of the consumer's inherent knowledge structure. Psychologically, symmetry in cognitive perceptions can enhance an individual's memory performance [14–16]. In this study, taking brand positioning strategy as an example, we further examine the symmetric matching of the market positioning strategy and its structural position in the associative knowledge network for sustainable brand awareness.

The goals of this research are as follows: (1) describing the consumers' brand associative knowledge network with big data of user-generated content and diagnosing brand structural features using the network method; (2) investigating the effect of the brand structural features in the associative network on sustainable brand performance (brand awareness in this paper); (3) examining the symmetric matching pattern of the brand positioning strategy and the brand's structural position in consumers' associative knowledge network for sustainable brand awareness.

To address our research questions, we first built the consumer brand associative network through text mining and network analysis. Our data included more than 130 million consumer posts about mobile phone brands on Baidu Post Bar from 1 November 2016 to 31 August 2017. Using word segmentation technology, we aggregated meaningful words and measured the relations between brand names by calculating the co-occurrence of brands appearing in the same post of each month. Then we constructed the brand associative network dynamically by estimation of a weighted brand-to-brand matrix. Secondly, we captured the brands' structural positions in the associative network according to the network theory and examined our research questions with empirical models. The

article is organized as follows. First, we introduce the theoretical background and the hypotheses in the following section. In Section 3, we explain the construction of the brand associative knowledge network. In Section 4, we test our main hypotheses with an empirical model, and we give conclusions and discussions in Section 5.

2. Theoretical Background and Hypotheses

2.1. Brand Associative Network and Brand Awareness

Brand awareness is an important dimension of brand equity and is usually defined as the capability of individuals to recognize and recall a brand given a product category [10,17,18]. In particular, sustainable name awareness is considered as the likelihood that a brand name will come to mind given a relevant clue as the result of the brand knowledge embedded in consumers' deep memory, which can be regarded as a valuable, inimitable, and non-substitutional advantage that brings sustained superior brand performance. A large study showed that how consumers remember and retrieve a brand given a clue depends on their associative knowledge network structure [11,19–21]. The authors document that the process of a consumer to recognize and recall a brand depends on the spreading activation of nodes in the consumer's associative memory. Researchers have psychologically explained this process. The most prominent one is the classical association network memory mode [11,21,22], it describes that individuals retain knowledge as a set of memory nodes and edges. Specifically, information stored in nodes are connected by edges that vary in strength. Nodes can be activated by the directly and indirectly linked nodes in relevant context [22], for example, when considering mobile phone consumption, a consumer may think of the iPhone because of its strong association with the activated product information. The information contained in a certain node is recalled when the activation of this node exceeds a certain threshold interval. Overall, an individual retrieves memory activated by certain nodes according to the structural relationship of the memorial nodes structure.

Brand association is a manifestation of such informational node in the consumer's memory. Henderson et al. [12] mentioned that all encounters a consumer ever has with a brand are stored in the memory as brand associations. Brand associations take multiple forms, including the visual form, verbal form, and special events related to the brand. Among them, the verbal form has been the major form of brand association in social media platforms. For generalization and simplification, we only examine the verbal form of brand association in this study. Previous research determined three types of brand associative knowledge networks, based on brand-to-construct, construct-to-construct, and brand-to-brand matrices [23]. A construct indicates memory nodes or associations related to the brand but does not include the brand names. The brand indicates brand names in consumers' memory associations. The linkage between association nodes indicates the relations of each association in the consumer's memory, such as the co-occurrence frequency of two associations which indicate the interdependence of two associations in the consumer's memory. The brand-to-construct and construct-to-construct associative knowledge networks are usually used to describe detailed consumer knowledge of certain focal brands, and the associative network based on the brand-to-brand matrix is often used to identify brand relations and relative competitiveness in consumers' mental memorial knowledge at the market level. In order to investigate sustainable brand awareness at the market level, this study conceptualizes the brand association network based on the brand-to-brand matrix.

The traditional way mostly focuses on the free association by conducting interpersonal interviews or drawing perceptual maps with survey data [7,8,12,13] but it suffers from the limitations of sample representativeness, low efficiency, and high human cost. Recent studies have proposed a brand association method depending on the co-occurrence frequency of brands and being constructed with social tag data [4,24,25], providing a good solution to the limitations of the traditional method. However, few of these researchers have examined the relationship between the brand's structural position in the associative network and brand performance. Previous research also sheds little light on the psychological meaning of a brand in consumers' associative knowledge

structure and seldom discusses how brand managers should make their brand strategies accordingly. By referring to previous work, we constructed the brand-to-brand associative network based on the co-occurrence frequency of brand names appearing in the same post. We narrowed this gap by exploring the effect of a brand's structural position in the associative network on sustainable brand awareness. Furthermore, by examining consumers' psychological patterns, we found that firms need to match their intended brand strategy, i.e., the brand positioning strategy in the current study, symmetrically with consumers' associative knowledge. The literature review on the consumers' associative knowledge network is listed in Table 1.

Table 1. Literature review on consumers' associative knowledge network.

Authors	Data Resources	Methodology	Brand Performance	Symmetric Brand Strategy	Psychological Mechanism
Zaltaman and Coulter, 1995	Interview data (cross-section data)	-	×	×	×
Henderson, Acobucci, and Calder, 1998	Survey data (cross-section data)	Network analysis	×	×	×
John et al., 2006	Interview or survey data (cross-section data)	-	×	×	×
Teichert and Schöntag, 2010	Survey data (cross-section data)	Factor analysis; network analysis	×	×	×
Nam and Kannan, 2014	User-generated data (panel data)	Word frequency analysis; text analysis; empirical analysis	√	×	×
Nam, Joshi, and Kannan, 2017	User-generated data (panel data)	Word frequency analysis	×	×	×
Gong et al., 2019	User-generated data (cross-section data)	Word frequency analysis; network analysis	×	×	×
The current work	User-generated data (panel data)	Word frequency analysis; text analysis; network analysis; empirical analysis	√	√	√

2.2. Consumers' Associative Knowledge, Brand Strategy, and Sustainable Brand Performance (Awareness)

An innovation regarding a firm's brand strategy based on consumers' associative knowledge can be closely related with sustainable brand awareness. Previous literature has documented that brand knowledge stored in consumers' minds may be a firm's most valuable asset for improving marketing productivity and competitiveness [10,26]. Improving the brand strategy according to consumers' associative knowledge can assist a firm in taking advantage of this asset which can lead to sustainable brand advantages in three important ways. First, firms spend large amounts of money on the brand awareness strategy, such as repeated advertisement [27], sponsoring [28], and public relations [26]; however, the effect of the investments is hard to quantify. Consumers' associative brand knowledge reveals the effect of a firm's investment in previous marketing programs [10]. Understanding consumers' associative knowledge can help firms to check their previous branding investment and to optimize the firm's market spending which results in a virtuous cycle of building the firm's brand awareness.

Second, adjusting a firm's brand strategy based on consumers' brand knowledge also indicates an effective two-way communication between the brand and their customers. Specifically, the capability of listening to consumers through examining the embedded brand knowledge helps firms to discover potential brand opportunities. By making an appropriate brand or product strategy correspondingly, firms are able to utilize the consumer opportunities and express their values with marketing innovations (i.e., innovative product or service), which facilitates a firm coping with the changing consumer needs and results in increased sustainable brand awareness and in *caeteris paribus* conditions, leading to competitive advantages for the enterprise.

Third, when a firm can seize potential consumer opportunities by delivering valuable innovations, it also entails firm growth in the short-run and long-run by assimilating adequate financial and human resources [29] which in turn benefits the sustainable brand awareness and firm competitiveness.

2.3. Brand Structural Position in Association Network and Brand Awareness

After building the brand association network, we need to examine the network features and their relationship with brand awareness. Network analysis has been widely used in physics, biology, and sociology to describe complex relationships [24,30–33]. Building on the method of network analysis, we focus on brand centrality, including local and global centrality, in the brand association network. Centrality is the most frequently used index to describe the importance of a node in the focal network [12]. Researchers have developed several centrality indices to measure the structural importance of a node, such as a degree, closeness, betweenness, and eigenvector centrality [34,35]. Each of these indices reacts to specific implications according to whether it describes global or local features in the network. Previous literature classified these centrality indices into two categories: local and global network centrality [36]. Specifically, local network centrality explains the relative importance of a focal point in its neighborhood, while global network centrality focuses on point prominence within the whole network.

To measure the structural position of a brand in the association network, we measured its local centrality by calculating the degree centrality, since degree centrality is the most frequent and typical index indicating the node's influence on its local neighborhood. Degree centrality is generally measured by counting the number of links between the node and its neighbor individuals who are directly connected with each other. Degree centrality has also been widely used to describe an individual's importance in information diffusion in social networks or organizations [37–39]. Additionally, we measured the global centrality of a brand with its closeness centrality in the association network, since closeness centrality has long been used to indicate the ease of connection of a node to all other nodes or vice versa. Closeness centrality is usually measured by calculating the average length of the shortest path between the node and all other nodes in the network [36,40].

Local centrality and brand awareness. Local centrality measured by degree centrality indicates the extent to which the node can quickly connect with wider neighbors. Degree centrality is calculated

based on summing the co-currency frequencies of the focal brand and its neighbor brands. We propose that a brand with higher local centrality implies that the brand is unique in a particular association since the probability that the brand will be directly compared and discussed with neighbor brands at a certain association is higher compared to brands with lower local centrality. Simultaneously, as degree centrality measures network activity [12], it means that the local centrality of a brand indicates that memory activation of neighbor brands is directly dependent on activation of the focal brand regarding certain attributes, revealing the competitive difference of a brand regarding certain attributes in its local network. Overall, brands with high local centrality are more likely to be directly compared with other brands by consumers; thus, increasing local centrality will make the brand easier to recall. Hence, we suggest the following:

Hypothesis 1 (H1). *Higher local centrality in the brand association network is related to higher brand awareness.*

Global centrality and brand awareness: Global centrality measured by closeness centrality indicates the extent to which a node can easily reach other nodes in the network. Theoretically, closeness centrality reflects the repetitiveness of a node since it has been claimed to represent independence from the control of other nodes in a network [12], which suggests that the memory of a node with higher closeness centrality is independent of any particular node. Hence, in the brand association network, higher global centrality means that given any brand in the whole set, it is more likely that the focal brand will be retrieved by consumers. Additionally, it also indicates that a brand with higher global centrality will be more representative for the whole set, just as Han [41] mentioned, as highly prototypical brands are more familiar exemplars of a category. In other words, high global centrality may indicate that the brand will be a prototypical or average group member among all brands. Overall, brands with high global centrality connect easily to all other brands in consumers' memory. Similarly, we suggest the following:

Hypothesis 2 (H2). *Higher global centrality in the brand association network is related to higher brand awareness.*

2.4. Consumers' Psychological Cognitive Patterns and Brand Awareness

Beyond the structure of a consumer associative network, we propose that consumers' psychological cognitive patterns initiated by contextual factors such as brand strategies are also an important factor in determining the "spreading activation" in their association networks. Specifically, Sujan [42] suggested that people have two different patterns for managing their knowledge structures: the prototypical pattern, an abstract mental set that associates an object with a particular class, and the exemplar pattern, which implies a concrete mental set by associating an object with specific instances. Correspondingly, previous studies documented one primary way to differentiate brand associations by their level of abstraction, that is, by how much information is contained in the association [43–45]. Along this dimension, Ng and Houston [46] classified brand association into two major categories: prototypical and exemplar. The former indicates general and more abstract information about the product, such as the perception of benefits and consumers' attitude toward the brand. The latter indicates concrete and specific information about the product, such as a specific brand attribute. These two kinds of associations are in accordance with the two memory patterns, prototypical and exemplar. Generally, when consumers cognize a product in the prototypical pattern, they are more likely to recall the prototypical association of the brand. On the other hand, when consumers cognize the product in the exemplar pattern, they are more likely to recall the exemplar association of the brand. In other words, the cognition pattern affects the "spreading activation" in the brand association network.

2.5. Symmetry between the Brand Strategy and Brand Structural Position in the Brand Associative Knowledge Network

Symmetry is primarily a construction that originated from other sciences such as physics, mathematics, and economics [47–50]. Basically, a system shows symmetry when there exists one transformation that leaves the system unchanged and balanced. Theoretically, it was widely acknowledged that the principle of symmetry has formed the basis of the standard model of particle physics and has been a fundamental property of nature [48,49]. Meanwhile, behavioral scientists have extended the importance of symmetry in human perception and cognition in recent years [51,52]. They regard symmetry as a kind of perceptual-cognitive tool for organizing and systematizing large amounts of information from the environment into coherent knowledge. Accordingly, we define a symmetry between environmental information and coherent knowledge when the environmental information is a good reflection of human coherent perception/knowledge. Psychologically, it has been suggested that compared to an asymmetrical pattern, symmetrical patterns are more attractive to humans because symmetrical patterns are easier to be noticed and understood [52]. Hence, a brand with a cognitively symmetrical strategy is easier to be remembered by consumers. In the next section, we aim to examine the symmetry between brand positioning strategy and brand network position in the associative network in regard to consumers' psychological cognitive patterns.

Brand positioning strategy: In most consumption markets, brands in a product category can be categorized into leading and follower brands according to the size of their market share [53]. Brand managers can also intendedly position their brand as a leading brand or a follower brand by announcing their expected market share and relevant service. We propose that positioning a brand as a leading brand stimulates consumers to cognize in a prototypical pattern while positioning a brand as follower brand stimulates consumers to cognize in an exemplar pattern. Sujan [42] put forward that psychologically, people have two patterns in managing their knowledge structure: prototypical and exemplar. Prototypical implies that people associate more general characteristics and topicalities of subjects; for example, we may think that a product is good to use but has a poor design. Exemplar indicates that people associate more concrete and specific memories with a brand; for instance, we may link a brand with specific attributes, such as the screen and size of a mobile phone or specific events related to using it.

Leading brands are usually consumer-centered and aim to provide products that can satisfy a wide range of customers [54], such as iPhone in the mobile phone market and Pepsi in the soft drink industry. Hence, we suggest that leading brands, in order to ensure widespread demand, will be more likely to induce consumers to make associations in a prototypical pattern by expecting the brand to be able to satisfy the masses. Follower brands, to deal with competition, react soon after the marketing activity of leading brands and are more likely to maintain their competitive advantage by keeping the brand uniqueness [55]. As indicated by Quintal and Phau [56], consumers usually choose follower brands to avoid the mass appeal and embrace the uniqueness of the alternatives, which suggests that follower brands evoke thinking in a concrete and exemplar pattern by associating them with uniqueness. Hence, we suggest the following:

Hypothesis 3a (H3a). *Leading brands will be more likely to stimulate cognition in a prototypical pattern.*

Hypothesis 3b (H3b). *Follower brands will be more likely to stimulate cognition in an exemplar pattern.*

The symmetry of brand positioning strategy and brand structural position in the associative knowledge networks: We propose that compared to leading brands, follower brands enhance the positive relationship between local brand centrality and brand awareness for the following reasons. First, when consumers cognize follower brands in an exemplar pattern, they will focus more on the exemplar associations of the brand, which means that they tend to be concerned about concrete and specific brand associations. Such a cognition pattern can be well reflected by the advantage of local centrality in revealing brand uniqueness in consumers' association networks. According to the rule of symmetry, the match of the follower brand's positioning strategy and local centrality in the

associative networks will enhance the attractiveness of the brand and thus increase the probability that the brand will be recognized and recalled by the consumers—i.e., the brand awareness. Second, an exemplar cognition pattern also indicates a concrete mindset to some extent. Chae et al. [57] claimed that when consumers are in a concrete mindset, there is a negative brand spillover effect; in other words, the concrete mindset will restrain consumers from extensive retrieval activity among other brands in the associative network. Thus, the concrete level mindset will strengthen the uniqueness reflected by brands with high local centrality in the association network.

However, leading brands stimulate consumers' prototypical mindset, in which they will seek brand representativeness and typicality instead of the concrete differences between brands. This mindset will be well reflected by the advantage of global centrality in revealing brand representativeness in consumers' association networks. Hence, we propose the following matching pattern between brand positioning strategy and its structural position in the brand associative knowledge network in regard to cognitive symmetry (we display this match in regard to cognitive symmetry in Figure 1):

Hypothesis 4a (H4a). *Compared to leading brands, follower brands enhance the positive relationship between local brand centrality and brand awareness.*

Hypothesis 4b (H4b). *Compared to follower brands, leading brands enhance the positive relationship between local brand centrality and brand awareness.*

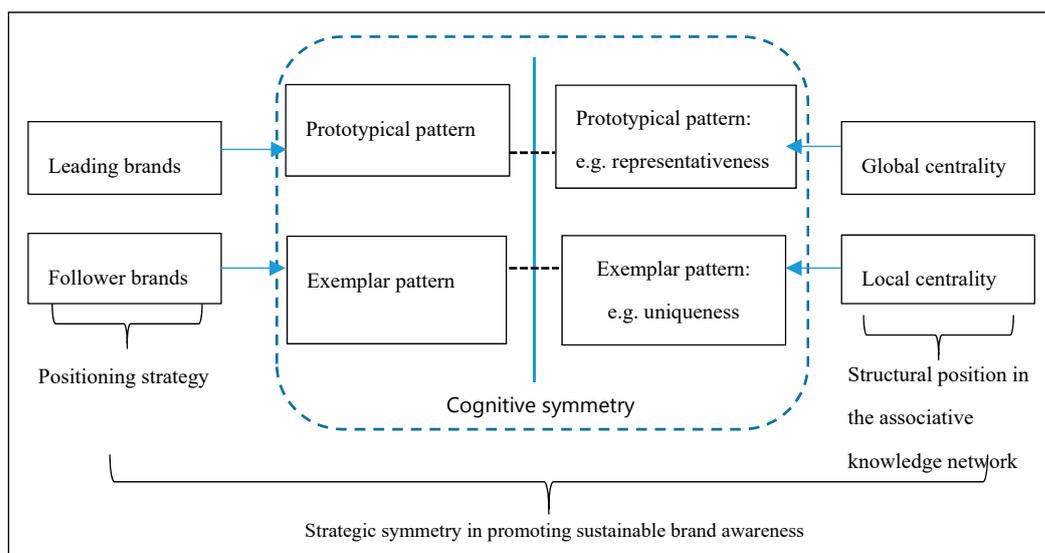


Figure 1. Framework of symmetry of brand positioning strategy and brand associative knowledge structure.

3. Methodology

3.1. Data

We tested our hypotheses with big data of user-generated content crawled from Baidu Post Bar. Baidu Post Bar, the world's largest Chinese forum, is a topic community where consumers with similar interests come together and communicate on shared topics. Baidu Post Bar covers a wide range of topics, including regions, life, education, entertainment, celebrities, games, sports, enterprises, and so on. It provides people with a free network space to express and exchange ideas and brings together like-minded netizens. We chose the topic of mobile phone brands as our research context for the following reasons. First, the mobile phone industry has emerged as a growing industry of great economic and social importance. The sales volume of mobile phones has reached more than 1.471 billion according to a recent report by Gartner; an increase of 2.65% year on year. The mobile

phone industry is continuing to grow as expected. Second, a mobile phone is a product with high consumer engagement; in other words, the proliferation of social media and informational technology has enabled the mobile phone to be a product close to our everyday life, and consumers are active in sharing their attitudes and knowledge about mobile phone brands, ensuring the adequacy and representativeness of our data resource. Finally, the growth in the mobile internet technology in the past two decades has rendered the mobile phone industry an emergent industry undergoing both market and technological turbulence, which has attracted a number of scholars' research attention [58–60]. Particularly, the mobile phone, as a typical high-tech informational product, has been facing rapidly changing technologies in recent years, which creates frequent alterations that force firms to keep up with and adapt to technological trends, intensifying the instability of the environment. Thus, investigating the mobile phone industry will provide valuable implications to other industries in a dynamically changing environment.

The mobile phone Post Bar theme on the Baidu platform has attracted more than 3.5 million users, and the number of posts totals more than 7.5 million. An abundance of mobile phone users gather in the Post Bar and freely discuss their opinions about mobile phone brands, which ensures the organic and representative nature of our dataset. Meanwhile, to further ensure the newness of the data, we crawled posts in the mobile phone theme from 1 November 2016 to 31 August 2017 by using the Python language. As a result, we gathered 1,358,381 posts. Overall, 10 main mobile phone brands are discussed in the dataset: Xiaomi, Gionee, Meizu, Honor, Huawei, Samsung, Apple, Letv, OPPO, and VIVO. Brand awareness is adapted from a brand search index provided by an open website of Baidu (<http://index.baidu.com/>). Finally, data of the brand market position were provided by an authorized market-research institution. We combined the datasets according to the brand name and time information of the data.

3.2. Constructing the Brand Associative Knowledge Network

Given the valuable information in the brand-themed posts, the next thing we needed to do was to build the brand associative knowledge network with the given data, according to which we analyzed the relationship of the brand structure in the network and brand awareness empirically. The brand associative network we focused on was based on a brand-to-brand association matrix, where the links between pairs of brands represented the strength of the relationship of the brands according to the occurrence of the two brands in the posts, and the occurrence of the two brands in the posts revealed the extent to which consumers linked two brands together in their memorial knowledge.

The process of constructing the brand association network and the whole analysis was as follows (Figure 2). First, after crawling the dataset, we completed the word segmentation with the Jieba module of Python. Second, we cleaned the dataset, including transforming all words to lowercase, removing meaningless stop words, and excluding posts that had nothing to do with mobile phone brands. Third, we conducted a co-occurrence analysis within brands. Nam [24,25] proposed a brand-construct association method by calculating the co-occurrence frequency of brands and constructs with social tag data. In our context, as consumers usually discuss and compare brands in the Post Bar, most of the time, two or more brands co-occurred in one post. Similarly, we built brand-brand associations by estimating the co-occurrence frequency of two brands within the given posts. The brand association network can be described by a matrix W_{ij} , where element w_{ij} is equal to the co-occurrence frequency of brand i and brand j in the same post. In our brand association network, a higher frequency of two brands occurring in the same post (w_{ij}) indicates that the two brands (brand i and brand j) are more frequently mentioned by consumers in the same post.

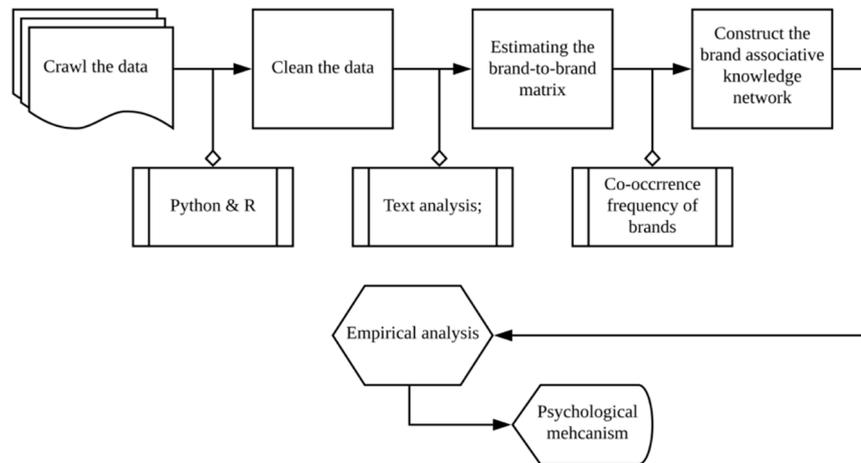


Figure 2. Overall analysis process.

Brand–brand association matrix W_{ij} is a weighted matrix, where the weighting of each linkage w_{ij} indicates the co-occurrence frequency of brand i and brand j in the same post. By capturing W_{ij} of brands in each month, we can draw the monthly brand associative network dynamically based on consumers’ brand knowledge. For visualization, we drew the consumer’s associative knowledge network of the first month (Figure 3A), the fifth month (Figure 3B), and the last month (Figure 3C) in the observational time window in Figure 2. Finally, when the brand associative knowledge networks had been prepared, we continued the analysis with empirical models and explained our result by examining the consumer’s psychological mechanism.

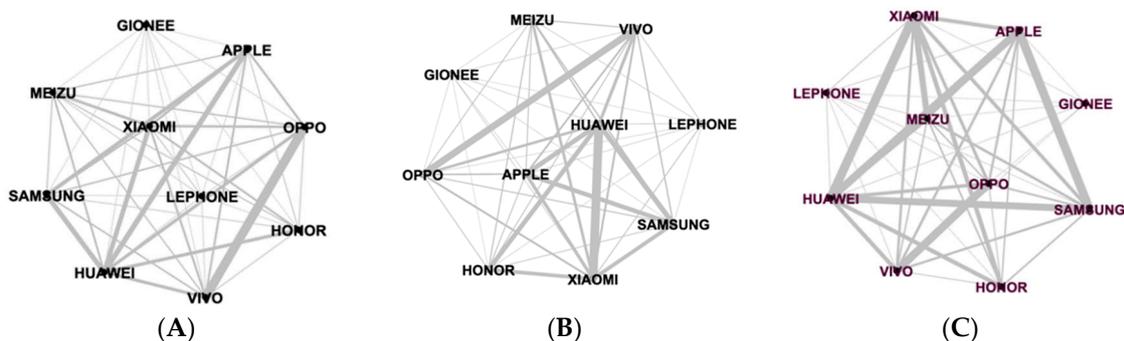


Figure 3. Visualization of the brand associative knowledge network. (A) Illustration of the brand associative knowledge network of the ten main mobile phone brands from 1 November 2016 to 31 August 2017. (B) Illustration of the brand associative knowledge network of the ten main mobile phone brands from 1 March 2017 to 30 March 2017. (C) Illustration of the brand associative knowledge network of the ten main mobile phone brands from 1 August 2017 to 31 August 2017. The darker the shade, the more likely it is for the brands to be linked with each other in the given time window. The darker the shade, the more likely it is for the brands to be linked with each other in the consumers’ associative knowledge network.

4. Empirical Analysis

Building on the brand association network, we conducted two further studies to verify our hypotheses. In study 1, we empirically investigated the effect of the brand’s structural position in the association network on brand awareness and examined the matching pattern of brand positioning strategy and brand structural position in the consumers’ associative knowledge network for sustainable brand awareness. In experiment 2, we estimated consumers’ psychological cognitive mechanism of the former matching strategy using text analysis.

4.1. Experiment 1: Main Effect and Symmetrical Matching Effect

Given the brand association network based on the consumers' knowledge structure, we estimated the brand's structural positions according to network theory. Specifically, we estimated brand centrality according to the co-occurrence frequency of brands in the posts. Next, we empirically investigated the main hypotheses in the current research. The analyzed econometric model is depicted in the following model:

$$Y_{it} = c + \beta_1 X_{local_it} + \beta_2 X_{global_it} + \beta_3 X_{positioning\ strategy_i} + \beta_4 X_{positioning\ strategy_i} * X_{local_it} + \beta_5 X_{positioning\ strategy_i} * X_{global_it} + Z + e_{it} \quad (1)$$

where the subscript i indicates the brand, t indicates the time (month), Y_{it} indicates sustainable brand awareness, c is a constant term, X_{local_it} and X_{global_it} indicate local and global centrality, $X_{position\ strategy_i}$ indicates the brand market position, which is a dummy variable with a value of 1 when brand i is a leading brand and a value of 0 when brand i is a follower brand in the current year, Z indicates the control variable, and e_{it} is the error term.

4.1.1. Variables

Dependent variable: Brand awareness is measured with the consumers' brand search index. The brand search index is estimated according to the frequency of search behaviors of online users regarding the focal brand. Since searching behavior represents the action of a user recalling and cognizing a brand, brand awareness can be estimated by the consumers' brand search index. On the other hand, searching behavior also reflects the sustainable interest of a consumer in the brand; thus, the consumers' search index is an appropriate proxy for sustainable brand awareness.

Independent variables: X_{local_it} is measured with the degree centrality of a brand in the association network. Degree centrality of brand i in the matrix W_{ij} is measured by accumulating the co-occurrence frequency of brand i and all its neighbor bands, given in Equation (2):

$$X_{local_it} = \sum_j^N w_{ij} \quad (2)$$

where j represents brand i 's neighbor brands in the association network, and w_{ij} is the weighting of linkage between brand i and brand j , estimated by their co-occurrence frequency in all posts.

X_{global_it} is measured with the closeness centrality of brands in the association network. Closeness centrality is calculated as the reciprocal of the sum of the length of the shortest path between the node and all other nodes in the network. Particularly, Dijkstra [61] proposed a method to estimate the shortest path within two nodes in the weighted matrix, with the idea that the weighting of the linkage within two nodes indicates the strength of the relation and a stronger relation implies that the path within the two nodes is shorter. Based on this idea, Newman [31] improved the algorithm of estimating the shortest path between node i and node j , which can be described as follows:

$$d(i, j) = \min\left(\frac{1}{w_{ih}} + \dots + \frac{1}{w_{hj}}\right) \quad (3)$$

where w_{ih}, \dots, w_{hj} indicates the weighting of the edges that connect brand i and brand j in the association network. Thus, the closeness centrality of brand i can be estimated by Equation (4):

$$X_{global_it} = \left[\sum_j^N d(i, j) \right]^{-1} \quad (4)$$

where j represents the rest of the brands in the network in addition to brand i .

Moderations and control variables: Brand positioning is adapted from prior brand rankings according to the market share in the previous month. A larger prior market share indicates a higher

likelihood that the brand managers position their brand as a leading brand. In the current study, we coded the brand positioning as a dummy variable. Specifically, we categorized the top three brands as market-leading brands by taking the value of 1; we coded the remaining brands as follower brands by taking the value of 0. As for the control variables, we controlled other variables that may affect brand awareness, including the total number of products under a brand, the number of new products under a brand between the end of 2016 and the middle of 2017, the amount of media exposure of a brand, and the age of the brand.

4.1.2. Analysis

To minimize the problem of multicollinearity, we centralized the variables in the main regression model. The largest variance inflation factor is 6.93, which is below the recommended cutoff of 10; hence, multicollinearity is unlikely to be an issue. We provided the overall descriptive statistics and pairwise correlations in Table 2. Additionally, we also present the dynamic changing of brand centrality of the ten main mobile phone brands in the associative knowledge network in our time window in Figure 4.

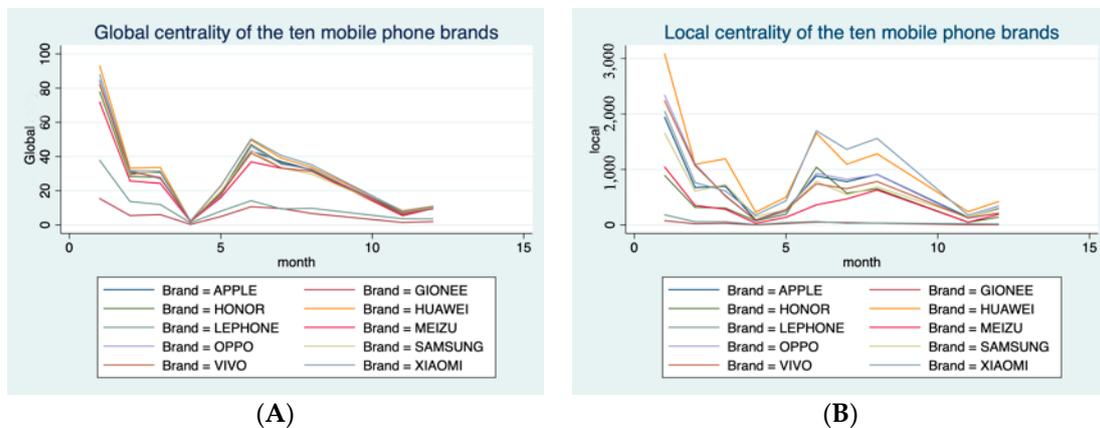


Figure 4. Dynamic changing of brand centrality of the ten mobile phone brands in the brand associative knowledge network. (A) Illustration of the dynamic change of global brand centrality in the associative knowledge network. (B) Illustration of the dynamic change of local brand centrality in the associative knowledge network.

Table 2. Bivariate Correlation Coefficients and Descriptive Statistics.

Variables	1	2	3	4	5	6	7	8
Brand awareness	1							
Local centrality	0.3534 *	1						
Global centrality	0.2552	0.6911 *	1					
Market position	0.1675	0.3017 *	0.1449	1				
Brand age	0.1081	0.1056	0.085	-0.113	1			
Total products	-0.199	0.0591	0.0375	-0.0422	0.8663 *	1		
New products	-0.0576	0.2656 *	0.1728	0.0368	0.3932 *	0.6413 *	1	
Brand exposure	0.2524	0.2298	0.0916	0.0012	0.5962 *	0.5242 *	0.4906 *	1
Average	3.41×10^7	5505.19	25.271	0.3	23.06	324.23	44.89	86,336.72
Standard error	2.45×10^7	5994.305	21.979	0.460	22.472	464.172	19.258	133,426.9

Note: * $p < 0.05$.

Before running the regression model, we needed to account for whether a hysteresis effect existed; that is, whether the product awareness of the previous month would affect the follow-up brand awareness. When a hysteresis effect exists, the static linear model cannot give unbiased and consistent estimation. Referring to Blundell and Bond's [62] research, we applied the method of system generalized method of moments (system GMM), a robust econometric model to estimate the parameters in dynamic panel data, to estimate our model by setting the lagged value of the response variable as 3. By running the system GMM model, we found no significant effect of the first 3 orders of brand awareness on the current brand awareness. Thus, the hysteresis effect is unlikely to be an issue.

Endogeneity: Possible endogeneity problems should be addressed in our model. Endogeneity is less of a problem for the mentioned centrality measures, as they are difficult to be affected by the firm's behavior, especially at a monthly level. Nevertheless, brand managers control some other conditions that may affect the brand perception that cannot be observed by researchers, which makes the centrality measures potentially endogenous. We addressed endogeneity with the control function approach [63]. The control function method is essentially a two-stage regression model, where residuals are obtained in the first-stage regression and added in the second-stage model to control the problem of endogeneity.

According to the rule of the control function approach, we need to conclude at least one extra instrumental variable in the first-step regression but not in the second-stage regression. Specifically, we use the average brand centrality in the same month as the instruments. As consumers always discuss and compare different brands in the Post bar, and brands are competing with each other, consumers' perceptions of a brand can be closely related to the average brand perception in the consumers' brand knowledge network. However, such average brand perception cannot be a precondition affecting the focal brand's performance. Hence average brand centralities satisfy the condition of externality and correlation. Second, we use 1-lagged brand awareness as an additional instrument, since the previous brand awareness may affect future consumer brand knowledge, and the hysteresis effect is unlikely to be an issue as mentioned.

Next, in the second-stage regressions, we added the residuals obtained from the first-stage models. We conducted our analysis with four main models: in model 1, we included only control variables in the regression; in model 2, we examined the main effect by including the two independent variables, local and global centrality of brands, in the association network; and in model 3, we added the moderation of brand market position. In model 4, we added the obtained residuals in the regression. In order to account for unobserved heterogeneity and endogeneity in the independent variables, we used a random effect regression model with the least-squares estimation [64]. The regression results are shown in Table 3.

Table 3. Regression results.

Variables	Dependent Variable: Brand Awareness				
	Hypotheses	Model 1	Model 2	Model 3	Model 4
Interception		0.011 (0.571)	0.006 (0.684)	0.016 (0.372)	0.048 *** (0.000)
Main effects:					
Local centrality	H1		0.435 *** (0.000)	0.756 * (0.064)	0.245 *** (0.000)
Global centrality	H2		0.794 *** (0.000)	0.329 (0.447)	0.375 *** (0.000)
(Symmetric matching)					
Moderate effects:					
Positioning strategy × Global centrality	H4(a)			3.219 ** (0.021)	8.299 * (0.055)
Positioning strategy × Local centrality	H4(b)			-1.110 ** (0.017)	-4.78 *** (0.001)

Positioning strategy			−0.021 (0.093)	−0.027 *** (0.003)
Control variables:				
Total products	−0.841 *** (0.000)	−0.318 *** (0.000)	−0.311 *** (0.004)	0.300 (0.323)
New products	0.723 *** (0.000)	−0.401 ** (0.019)	−0.320 (0.157)	−0.3221 (0.121)
Brand exposure	0.065 (0.160)	0.020 (0.553)	0.019 (0.552)	−0.022 *** (0.000)
Brand age	0.948 (0.000)	0.410 *** (0.000)	0.379 *** (0.001)	0.072 *** (0.000)
Bias correction:				
ξ_1				−0.219 *** (0.000)
ξ_2				0.352 *** (0.000)
R2	0.515	0.769	0.799	
Adjusted R2	0.495	0.755	0.779	

Note: Numbers in the parentheses are the P values. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.1.3. Results

From model 4 in Table 3, we find that both local ($\beta = 0.245$, $p < 0.01$) and global ($\beta = 0.375$, $p < 0.01$) centrality in the association network show a positive relationship with brand awareness, which supports H1 and H2. In accordance with our intuition, the manager's intended brand strategy, i.e., brand positioning strategy, alone shows no significance on sustainable brand awareness in model 3 (i.e., the estimated coefficient of the positioning strategy is not significant ($p > 0.09$)), and it shows even a negative effect on the sustainable brand awareness in model 4 ($\beta = -0.027$, $p = 0.003$). Importantly, we checked the symmetrical matching pattern by adding the moderation of brand market position. In model 4, we found that market position positively moderates the relationship between global centrality and brand awareness (the coefficient is marginally significant: $\beta = 8.299$, $p = 0.055$) and negatively moderates the relationship between local centrality and brand awareness ($\beta = -4.78$, $p < 0.01$) in the association network, which indicates that a leading brand positioning strategy enhances the positive relationship of global brand centrality in the associative network and brand awareness, while a follower brand positioning strategy enhances the positive relationship of local brand centrality in the associative positioning strategy. This result is consistent with H4a and H4b.

Overall, the descriptions of the hypothesis testing results are listed in Table 4.

Table 4. Description of the hypothesis testing results.

Hypotheses	Method	Coefficient Estimation (Model 4)	Description
H1: Higher local centrality in the brand association network is related to higher brand awareness.	Study 1: Empirical analysis	Local centrality: $\beta = 0.245$, $p < 0.01$	H1 and H2 are tested by checking the main effect of local centrality and global centrality on the sustainable brand awareness
H2: Higher global centrality in the brand association network is related to higher brand awareness.		global centrality: $\beta = 0.375$, $p < 0.01$	
H4(a): Compared to leading brands, follower brands enhance the		two-way interaction term of positioning strategy and global centrality: $\beta = 8.299$, $p = 0.055$	H4 is tested by checking the moderating effect

positive relationship between local brand centrality and brand awareness.		of brand positioning strategy on the two centralities
H4(b): Compared to follower brands, leading brands enhance the positive relationship between local brand centrality and brand awareness.		two-way interaction term of positioning strategy and local centrality: $\beta = -4.78, p < 0.01$
H3(a): Leading brands are more likely to stimulate cognition in a prototypical pattern;	Study 2: Textual analysis	H3 is tested by one-way ANOVA analysis on the consumer cognition pattern of brands with different positioning strategy
H3(b): Follower brands are more likely to stimulate cognition in an exemplar pattern.		

4.1.4. Robustness Check

In the above analysis, we used the linear regression model to run the model. Since the dependent variable brand awareness, estimated with consumers' search frequency, is a count variable, in order to check the robustness of our result, we also conducted unilinear panel data analysis by using Poisson regression with the three models. In model 1, we included only control variables; in model 2, we examined the main effect by including both independent and control variables; and in model 3, we added the moderations. We present the results of the regression in Table 5. We found that the results of the Poisson regression model show similar results.

Table 5. Results of Poisson regression model.

Variables	Dependent Variable: Brand Awareness		
	Model 1	Model 2	Model 3
Interception	15.974 (0.00)	15.973 (0.00)	14.781 (0.00)
Main effects:			
Local centrality		0.000 *** (0.00)	0.000 *** (0.00)
Global centrality		0.008 *** (0.000)	0.008 *** (0.00)
(Symmetric matching) Moderate effects:			
Positioning strategy × Global centrality			0.006 *** (0.00)
Positioning strategy × Local centrality			-0.00 *** (0.00)
Positioning strategy			0.690 (0.126)
Control variables:			
Total products	-0.000 *** (0.03)	-0.003 ** (0.030)	-0.003 *** (0.005)
New products	0.002 (0.118)	0.026 ** (0.04)	-0.031 ** (0.04)
Brand exposure	0.000 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.552)
Brand age	0.043 *** (0.000)	0.043 *** (0.040)	0.052 *** (0.001)

Note: ** $p < 0.05$; *** $p < 0.01$.

4.2. Study 2: Consumers' Psychological Cognitive Mechanism Regarding Leading and Follower Brands

The purpose of study 2 was to uncover consumers' psychological mechanisms regarding consumer cognitive symmetry and further to test H3(a) and H3(b). In hypothesis 3, we proposed that consumers cognize leading brands in a prototypical pattern and follower brands in an exemplar pattern. In order to identify how consumers understand and perceive brands, we conducted a text analysis of the post content of each brand.

The process of experiment 2 was as follows. First, after we completed the word segmentation with Jieba, we conducted the word frequency analysis and estimated the distribution of the word frequency. It shows in Figure 5 that the association of brands follows a typical power-law distribution. For the representativeness and simplicity of the analysis, we analyzed the top 100 most frequently mentioned brand associations excluding the brand names. We display the frequency histogram of the top 30 most frequently mentioned associations in Figure 6.

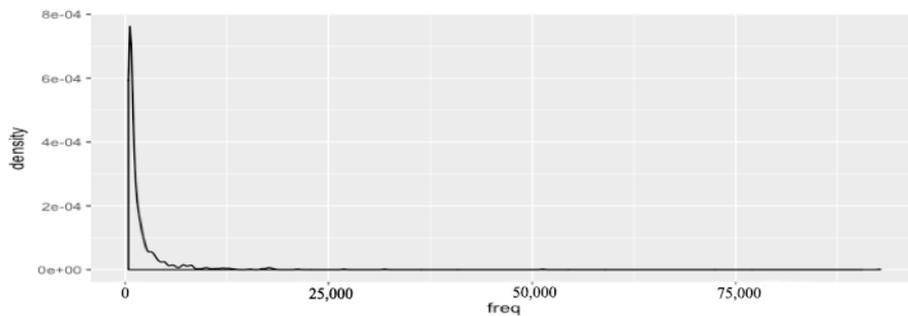


Figure 5. Density distribution of brand associations.

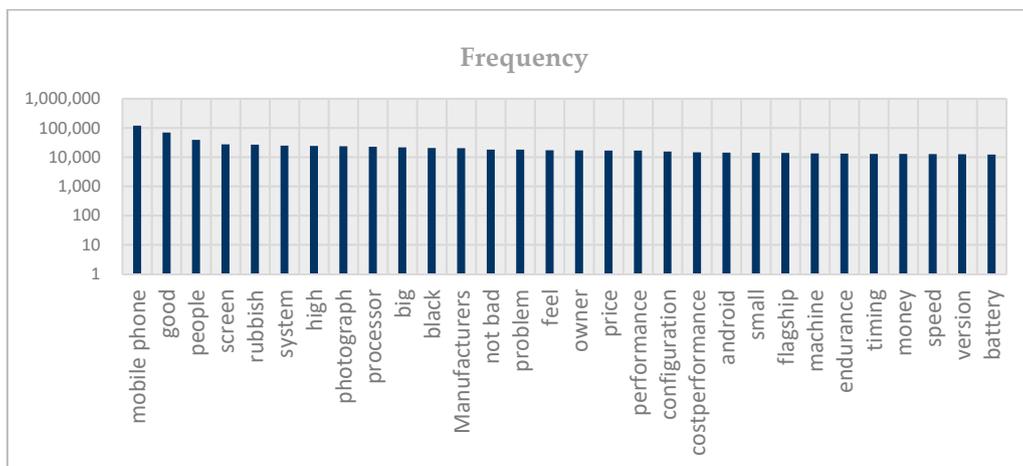


Figure 6. Frequency histogram of the top 30 brand associations.

Second, by referring to previous research [46], we coded these words into two categories: words related to the prototypical pattern and words related to the exemplar pattern. Specifically, we coded the words describing general characteristics of a brand as related to the prototypical pattern, for example, “domestic” and “fluency”, and we coded the words describing concrete attributes as related to the exemplar pattern, for example, “processor” and “system”. For the coding process, we assigned independent Ph.D. students to code the words, and discrepancies between coders were addressed through discussion. Then we calculated the proportions of the two kinds of words under each brand. Finally, we conducted a one-way ANOVA to examine the differences in cognition patterns for different types of products. For visualization, the most frequently mentioned brand associations for leading and follower brands in word clouds are shown in Figure 7, in which the size of the word indicates the frequency at which the word was discussed.

(brand awareness). Importantly, our paper is the first to examine the cognitive symmetry between brand position in consumers' association networks and the brand positioning strategy, showing that a prior intended brand strategy matched symmetrically with the brand's position in consumers' associative knowledge can assist in achieving a sustainable brand performance.

Our paper also contributes to the literature on consumers' psychological mechanism regarding brands with different positioning strategies. While previous studies mainly focused on survey data or lab experiments to understand consumers' perceptions of different brands, building on the technique of text mining, our study provides a valid understanding of consumers' cognition patterns regarding leading versus follower brands according to the content of user discussions, which also advances the previous literature on brand market position based on market share.

This study also has several managerial implications. First, facing a competitive and dynamic marketing environment, it is urgent for companies to manage their brands according to consumers' knowledge structures. Our study proposes a method to build brand association networks based on brand-to-brand associations in consumers' knowledge structures. The proposed method can be applied directly by companies to monitor their brand positions in consumers' deep knowledge structures and detect their close competitors in consumers' associations.

Second, brand managers spend large amounts of money on building brand awareness through various marketing programs, such as repeated advertising [27], sponsoring [28], and public relations [26]. While the actual effect of these marketing programs is hard to measure, our method enables firms to dynamically evaluate the effect of their previous brand awareness programs by constructing a consumer knowledge associative network and calculating the brand's structural position in the associative network. Thus, our approach helps firms to manage and optimize their brand investment and guides firms to long-run brand success. Further, by implementing our approach, firms can estimate the effect of other marketing mix variables on the sustainable brand awareness.

Third, this study suggests that brand positions in consumers' association networks are closely related to achieving a sustainably successful brand. On the one hand, our method entails for a firm to uncover potential consumer needs and relevant opportunities, which fosters future innovations and promotes sustainable brand awareness and superior firm success. On the other hand, our work suggests that matching brand strategies symmetrically with the brand position in consumers' association networks facilitates the sustainable brand awareness. Specifically, our findings show a matching effect of brand positioning strategy and brand centrality in association networks and sustainable brand awareness. This indicates that in order to achieve sustainable brand performance, brand managers should make their brand strategies symmetrical with consumers' mental associative knowledge. In our current work, it is suggested that positioning a brand with high global centrality in the associative network as a leading brand will help to achieve higher sustainable brand awareness, while positioning a brand with high local centrality instead of global centrality as a follower brand will help firms achieve higher sustainable brand awareness. Our study stands in the managers' perspective and shows the importance of understanding consumers' brand associative knowledge structures in promoting the effectiveness of brand strategies.

Additionally, our work also gives valuable implications for other common marketing tasks. For example, by reducing the need to analyze the brand advantage at the market level, brand managers can use the brand-construct or the construct-construct method in a similar way to capture a focal brand's consumer knowledge network and analyze the brand associations (e.g., the structural position of brand associations in the brand associative network; the effect of particular brand association's network feature on the brand performance) at the brand level. Firm managers can also analyze the different brand evolution paths by dynamically monitoring the brand knowledge network at both the brand and market level among the considered brands set and make the competitive strategy accordingly.

Finally, this study has several limitations that provide worthwhile avenues for further research. First, our study only examined user-generated content in the context of the mobile phone industry, an industry of great economic importance. In future work, we could improve the external validity of this study in other industries. Second, although Baidu Post Bar is the world's largest Chinese-

speaking Forum, we could extend our study in the future by taking a further look at user-generated content on other platforms to increase the robustness of our study. Third, we examined the moderation of the brand market position and found an appropriate matching strategy between market position and association network position to promote sustainable brand awareness. We encourage future researchers to develop the work further; for example, in order to build sustainable brand performance, other brand strategies such as alliance and competition can be considered with brand association network structures.

Author Contributions: Conceptualization, X.G. and C.W.; Data curation, Y.Y.; Formal analysis, X.G. and Y.Y.; Funding acquisition, M.L.; Investigation, X.G.; Methodology, Y.Y.; Project administration, C.W.; Resources, M.H.; Visualization, X.G.; Writing—Original draft, X.G.; Writing—Review & editing, R.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by National Natural Science Foundation of China (Grant NO. 91746206) and supported by the National Natural Science Foundation of China (Grant NO. 71672132) and MOE (Ministry of Education in China) Project of Humanities and Social Sciences Planning Project of Ministry of Education: The formation and impact of controversial word-of-mouth content on new product launch: from the perspective of product attributes and social value (Project No. 18YJA630064).

Conflicts of Interest: The authors declare no conflict of interest.

Reference

- Hunt, S.D. The Strategic Imperative and Sustainable Competitive Advantage: Public Policy Implications of Resource-Advantage Theory. *J. Acad. Mark. Sci.* **1999**, *27*, 144–159.
- Barney, J. Firm resources and sustained competitive advantage. *J. Manag.* **1991**, *17*, 99–120.
- Barney, J.; Wright, M.; Ketchen, D.J. The resource-based view of the firm: Ten years after 1991. *J. Manag.* **2001**, *27*, 625–641.
- Xuan, G.; Yunchan, Z.; Rizwan, A.; Ruijin, G. Capturing Associations and Sustainable Competitiveness of Brands from Social Tags. *Sustainability* **2019**, *11*, 1592.
- Hansen, M.T. Knowledge Networks: Explaining Effective Knowledge Sharing in Multiunit Companies. *Organ. Sci.* **2002**, *13*, 232–248.
- Culotta, A.; Cutler, J. Mining Brand Perceptions from Twitter Social Network. *Mark. Sci.* **2016**, *35*, 343–362.
- John, D.R.; Loken, B.; Kim, K.; Monga, A.B. Brand Concept Maps: A Methodology for Identifying Brand Association Networks. *J. Mark. Res.* **2006**, *43*, 549–563.
- Zaltman, G.; Coulter, R.H. Seeing the Voice of the Customer: Metaphor-Based Advertising Research. *J. Advert. Res.* **1995**, *35*, 35–51.
- Saura, J.R.; Reyes-Menendez, A.; Bennett, D.R. How to Extract Meaningful Insights from UGC: A Knowledge-Based Method Applied to Education. *Appl. Sci.* **2019**, *9*, 4603.
- Keller, K.L. Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. *J. Mark.* **1993**, *57*, 1–22.
- Anderson, J.R. *The Architecture of Cognition*; Harvard University Press: Cambridge, MA, 1983.
- Henderson, G.R.; Iacobucci, D.; Calder, B.J. Brand diagnostics: Mapping branding effects using consumer associative networks. *Eur. J. Oper. Res.* **1998**, *111*, 306–327.
- Teichert, T.; Heyer, G.; Schontag, K. *Co-Word Analysis for Assessing Consumer Associations: A Case Study in Market Research*; In: Ahmad K. (eds) *Affective Computing and Sentiment Analysis. Text, Speech and Language Technology*, vol 45. Springer, Dordrecht, 2011.
- Attneave, F. Symmetry, Information, and Memory for Patterns. *Am. J. Psychol.* **1955**, *68*, 209–222.
- Horowitz, L.M.; Gordon, A.M. Associative symmetry and second-language learning. *J. Educ. Psychol.* **1972**, *63*, 287–294.
- Mendelson, M.J.; Lee, S.P. The effects of symmetry and contour on recognition memory in children. *J. Exp. Child Psychol.* **1982**, *32*, 373–388.
- Aaker, D.A. Measuring Brand Equity Across Products and Markets. *Calif. Manag. Rev.* **1996**, *38*, 102–120.
- Smith, D.C. Managing Brand Equity: Capitalizing on the Value of a Brand Name, by David A. Aake. *J. Brand Manag.* **1993**, *1*, 69–71.
- Collins, A.M.; Loftus, E.F. A Spreading Activation Theory of Semantic Processing. *Psychol. Rev.* **1975**, *82*, 407–428.

20. Raaijmakers, J.G.W.; Shiffrin, R.M. Search of Associative Memory. *Psychol. Rev.* **1981**, *88*, 93–134.
21. Wyer, R.S.; Srull, T.K. Person Memory and Judgment. *Psychol. Rev.* **1989**, *96*, 58–83.
22. Anderson, J.R.; Bower, G.H. *Human Associative Memory*; John Wiley & Sons Inc: Washington: Winston and Sons, 1973.
23. Chen, X. *Assessment of Destination Brand Associations: An Application of Associative Network Theory and Network Analysis Methods*; Dissertations & Theses—Gradworks: East Eisenhower Parkway, 2010.
24. Nam, H.; Kannan, P.K. The Informational Value of Social Tagging Networks. *J. Mark.* **2014**, *78*, 21–40.
25. Nam, H.; Joshi, Y.V.; Kannan, P.K. Harvesting Brand Information from Social Tags. *J. Mark.* **2017**, *81*, 88–108.
26. Keller, K.L. *Strategic Brand Management: Building, Measuring, and Managing Brand Equity*, 3rd ed.; Prentice Hall: Upper Saddle River, NJ, USA, 2007.
27. Miller, S.; Berry, S. Brand salience versus brand image: Two theories of advertising effectiveness. *J. Advert. Res.* **1998**, *38*, 77–82.
28. Cornwell, T.B.; Roy, D.P. Exploring managers' perceptions of the impact of sponsorship on brand equity. *J. Advert.* **2001**, *30*, 41–51.
29. Avram, A.; Benvenuto, M.; Avram, C.; Gravili, G. Assuring SME's Sustainable Competitiveness in the Digital Era: A Labor Policy between Guaranteed Minimum Wage and ICT Skill Mismatch. *Sustainability* **2019**, *11*, 2918.
30. Newman, M.E.J. Spread of epidemic disease on networks. *Phys. Rev. E* **2002**, *66*, 016128.
31. Newman, M. Analysis of weighted networks. *Phys. Rev. E* **2004**, *70*, 056131.
32. Aral, S.; Walker, D. Creating Social Contagion Through Viral Product Design: A Randomized Trial of Peer Influence in Networks. *Manag. Sci.* **2011**, *57*, 1623–1639.
33. Bapna, R.; Umyarov, A. Do Your Online Friends Make You Pay? A Randomized Field Experiment on Peer Influence in Online Social Networks. *Manag. Sci.* **2015**, *61*, 2903–1920.
34. Freeman, L.C. Centrality in social networks conceptual clarification. *Soc. Netw.* **1978**, *1*, 215–239.
35. Wasserman, S.; Faust, K. *Social Network Analysis: Methods and Applications*; Cambridge University Press: New York, NY, USA, 1994.
36. Ransbotham, S.; Kane, G.C.; Lurie, N.H. Network Characteristics and the Value of Collaborative User-Generated Content. *Soc. Sci. Electron. Publ.* **2011**, *31*, 387–405.
37. Goldenberg, J.; Han, S.; Lehmann, D.R.; Hong, J.W. The Role of Hubs in the Adoption Process. *J. Mark.* **2009**, *73*, 1–13.
38. Pietro Battiston, L.S. Boundedly rational opinion dynamics in social networks: Does indegree matter? *J. Econ. Behav. Organ.* **2015**, *119*, 400–421.
39. Iyengar, R.; Van den Bulte, C.; Valente, T.W. Opinion Leadership and Social Contagion in New Product Diffusion. *Mark. Sci.* **2010**, *30*, 224–229.
40. Sabidussi, G. The centrality of a graph. *Psychometrika* **1966**, *31*, 581.
41. Han, J.K. Brand extensions in a competitive context: Effects of competitive targets and product attribute typicality of perceived quality. *Acad. Mark. Sci. Rev.* **1998**, *1*, 1–13.
42. Sujan, M. Consumer knowledge: Effects on evaluation strategies mediating consumer judgments. *J. Consum. Res.* **1985**, *12*, 31–46.
43. Alba, J.W.; Hutchinson, W. Dimensions of Consumer Expertise. *J. Consum. Res.* **1987**, *13*, 411–453.
44. Johnson, M.D. Consumer Choice Strategies for Comparing Noncomparable Alternatives. *J. Consum. Res.* **1984**, *11*, 741–753.
45. Russo, E.J.; Johnson, E.J. What Do Consumers Know About Familiar Products? *Adv. Consum. Res.* **1980**, *7*, 417–423.
46. Ng, S.; Houston, M.J. Exemplars or Beliefs? The Impact of Self-View on the Nature and Relative Influence of Brand Associations. *J. Consum. Res.* **2006**, *32*, 519–529.
47. Livio, M. *The Equation That Couldn't Be Solved: How Mathematical Genius Discovered the Language of Symmetry*; Simon & Schuster: New York, NY, USA, 2006.
48. Einstein, A. Zur Elektrodynamik bewegter Körper. *Ann. Phys.* **1905**, *322*, 891–921.
49. Schwichtenberg, J. *Physics from Symmetry*; Springer: New York, NY, USA, 2015.
50. Sato, R.; Ramachandran, R.V. *Symmetry and Economic Invariance*; Springer: New York, NY, USA, 2014.
51. Evans, D.W.; Orr, P.T.; Lazar, S.M.; Breton, D.; Gerard, J. Human Preferences for Symmetry: Subjective Experience, Cognitive Conflict and Cortical Brain Activity. *PLoS ONE* **2012**, *7*, e38966.

52. Enquist, M.; Arak, A. Symmetry, Beauty and Evolution. *Nature* **1994**, *372*, 169–172.
53. Bernstein, S. From share leader to true brand leader. *Strateg. Dir.* **2008**, *5*, doi:10.1108/sd.2008.05624ead.007.
54. Lowe, B.; Alpert, F. The relative influence of pioneer and follower price on reference price and value perceptions. *J. Prod. Brand Manag.* **2010**, *19*, 504–511.
55. Quintal, V.; Phau, I. Do Prototypical Brands Have an Advantage Over Me-Too Brands in the Mature Marketplace? *J. Int. Consum. Mark.* **2013**, *25*, 305–318.
56. Quintal, V.; Phau, I. Brand leaders and me-too alternatives: How do consumers choose? *Mark. Intell. Plan.* **2013**, *31*, 367–387.
57. Chae, I.; Stephen, A.; Bart, Y. Spillover effects in seeded word-of-mouth marketing campaigns. *Mark. Sci.* **2016**, *36*, 89–104.
58. Eagle, N.; Pentland, A.; Lazer, D. Inferring friendship network structure by using mobile phone data. *Proc. Natl. Acad. Sci. USA* **2009**, *106*, 15274–15278.
59. Terhi-Anna, W. Mobile Phone Use as Part of Young People’s Consumption Styles. *J. Consum. Policy* **2003**, *26*, 441–463.
60. Ippoliti, N.B.; L’Engle, K.; Ippoliti, N. B.; L’Engle, K. Meet Us on the Phone: Mobile Phone Programs for Adolescent Sexual and Reproductive Health in Low-To-Middle Income Countries. *Reprod. Health* **2017**, *14*, 11.
61. Dijkstra, E.W. A note on two problems in connection with graphs. *Numer. Math.* **1959**, *1*, 269–271.
62. Blundell, R.; Bond, S. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *J. Econ.* **1998**, *87*, 115–143.
63. Petrin, A.; Train, K. A Control Function Approach to Endogeneity in Consumer Choice Models. *J. Mark. Res.* **2010**, *47*, 3–13.
64. Rabe-Hesketh, S.; Skrondal, A.; Pickles, A. Maximum Likelihood Estimation of Limited and Discrete Dependent Variable Models with Nested Random Effects. *J. Econ.* **2005**, *128*, 301–323.



© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).