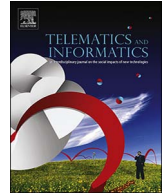


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# Examining the dynamic effects of social network advertising: A semiotic perspective

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### 1. Introduction

With the development of electronic commerce, social network advertising has emerged as a new marketing strategy. E-marketer ([emarketer.com](http://emarketer.com)) shows that the worldwide social network advertising market reached \$32.97 billion in 2016; steady growth is expected in the future ([Emarketer, 2016](#)). Social network advertising relies on social information in generating, targeting, and delivering marketing communications ([Wu, 2014](#)). Using comments, sharing, and other functions, users can participate in communication ([Azeem and Haq, 2012](#)). Therefore, understanding the effects of social network advertising is essential to an advertiser's marketing strategy.

For both marketers and academics, it is of interest to understand the social network advertising effects. Nonetheless, prior studies of social advertising's effects have tended to focus on using page design and marketing mix theories separately ([Steiner and Lavidge, 1961](#); [Charaf et al., 2013](#)). From one point of view, numerous empirical studies used page design or marketing mix elements as independent variables to examine the effects of advertising ([Huang et al., 2012](#)). From another perspective, the group behaviors in social network, such as comments and sharing, can also affect social network advertising's effects ([Chang, 2013](#); [Duffett, 2015](#)). In social network advertising, all page design, marketing and group behavior elements are integrated within a social network ([Huang et al., 2013](#)). It is difficult to analyze which element will best create a particular effect ([Mir, 2014](#)). Current researchers have not paid proper attention to implementing an integrated framework in social network advertising.

To fill the research gap, we examined the dynamic effects of social network advertising from a semiotic perspective. Since the 19th century, semiotics has been seen as the study of signs and their use to convey meaning ([Petofi, 2010](#)). Semiotics has been defined as "being concerned with everything that can be taken as a sign" ([Eco, 1976](#)). In recent history, semiotics developed along two significantly different lines, one traceable to Swiss linguist Ferdinand de Saussure and the other to American philosopher and scientist Charles Sanders Peirce ([Mingers and Willcocks, 2014](#)). The primary focus of Saussure's theory is its emphasis on language as a system of signs ([Eco, 1976](#)). In contrast to Saussure's theory, Peirce was primarily interested in the process of semiotics ([Mingers and Willcocks, 2014](#)). Peirce and Hartshorne (1931) introduced the interaction of three abstract subjects in the semiotic triangle: the sign,

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its thought, and its reference as a core of human cognitive activities.

In this paper we introduce the semiotic triangle in study the effects of social network advertising primarily for the following reasons. First, the semiotic triangle can create an integrated meaning framework to explain the dynamic effects of social network advertising. Because of a lack of the production of meaning in page design and marketing mix theories, prior studies cannot express meaning in social network advertising (Chatterjee et al., 2003; Lewis and Reiley, 2009). According to the semiotic triangle, every meaning process can be analyzed as a semiotic system. In social network advertising, when advertisers communicate with users, they operate on the basis of an agreement about the meaning of various material things, such as page design images and marketing mix. Based on the semiotic triangle, the meaning of social network advertising is the result of the dynamic interaction between sign, thought and referent, which is an active process (Hodge and Kress, 1988; Wu, 2014). Second, the semiotic triangle provides insights into users' mental activity brought on by social network advertising. Previous studies ignore the role of users' mental activity (Mir, 2014). The communication processes in social network advertising, such as comments, forwarding and praises, need the semiotic triangle to express users' mental activity. The semiotic triangle highlights the process that occurs between the user and advertising in the development of meaning (Dong et al., 2014). Because of these advantages of the semiotic triangle, we examine the effects of social network advertising through the semiotic triangle in this paper.

Because of user-generated content, social network advertising is more dynamically social than online advertising (Tu, 2002). The semiotic triangle lacks measurable variables to reflect the users' interaction mechanism in a social network. Therefore, this study includes social facilitation and social presence in the semiotic triangle. Social facilitation is the tendency for people to perform differently when in the presence of others than when alone (Zajonc, 1965). Social facilitation can describe how a group's behavior can impact individual users in the social network. Meanwhile, social presence is the "ability of a communication medium to allow group users to feel the presence of the other group users and the feeling that the group is jointly involved in communicative interaction" (Tu, 2002). Social presence can describe a user's mental activity based on the interactive environment of social networks. Because the user-generated content in a social network may influence a user's behavior intention in different time periods, this study describes the processes as dynamic effects, which can offer novel insights of dynamic nature on social network advertising communication.

The remainder of this paper is structured as follows. The next section presents recent literature. After that, we discuss the logical framework of social network advertising's dynamic effects through a semiotic perspective. An overview of the methodology, data analysis, and results are then reported. After that, findings and implications, limitations and future research are discussed.

## 2. Literature review

### 2.1. Social network advertising effect through a semiotic perspective

The semiotic triangle provides researchers with a means of thinking about the relationship among a sign, a thought and a referent. A sign can be defined as the word that calls up the referent through the mental processes. A thought can be defined as the realm of memories of past experiences and scenes. A referent can be defined as an object, which can be perceived as an impression in the field of thought (Ogden and Richards, 1989). More simply, the semiotic triangle can be explained in the sense that a sign uses X to represent Y to convey a certain meaning. Though X is not Y itself, it still can convey certain meaning, for it can be used to represent Y. For example, the word "car" can be seen as a sign. The steps of the semiotic triangle are as follows. First, the car, as matter, evokes a writer's thought. The writer uses the word "car" to represent a material to convey certain meaning. Second, the writer attributes the matter to the word "car". Thus, the word "car" can be seen as a sign. Third, the word "car" can evoke a reader's thought. The reader's thought can be seen as the notion that a car is the material, which is made up of some sizes, shapes and colors. Fourth, the reader refers the word "car" back to the matter. The reader writing the word "car" can be seen as a referent. Therefore, one can note that the word "car" itself is an arbitrary combination of three letters that conveys the concept of "car" through the form of written expression.

Recently, the semiotic triangle has been used in online marketing, particularly in social network marketing (Mingers and Willcocks, 2014). Fig. 1 depicts the analysis of social network advertising's dynamic effects through a semiotic triangle perspective (Liu, 2005). For example, an advertising designer wants to release a car advertisement through its social network page. The steps are

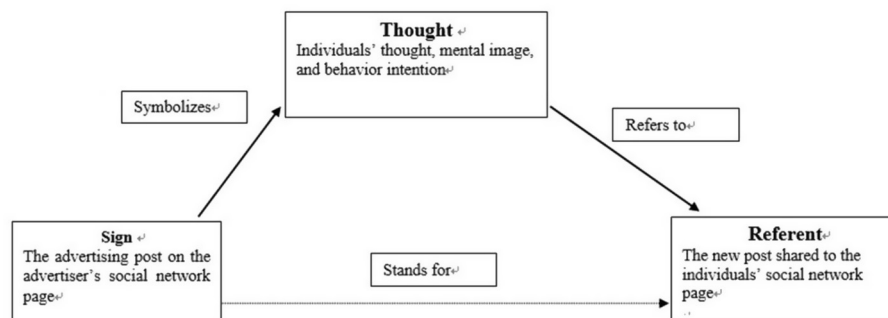


Fig. 1. Analysis of social network advertising dynamic effects through a semiotic perspective.

as follows. First, the car, as a matter, evokes the advertising designer's thoughts. The advertising designer can construe a car advertising in his mind. Second, the advertising designer refers the matter to the signs. The advertising designer uses a set of signs to express the meaning of the car. The signs can be selected and combined to express the advertising designer's thoughts and feelings. The signs can construct a structure in a post, which is viewed as a sign texture. By using a set of signs in social network advertising, the advertising designer wants to establish equivalent signs of the car in users' minds. Third, the signs evoke the user's thought in a social network. In social network advertising, an advertising designer can release car advertising posts through its social network page (Kim et al., 2013). Carrying meaning from the advertising designer, the signs can be symbolized in a social network (Hess et al., 2009). These signs in advertising posts can communicate the integrated meaning of the car. They can affect or even change a user's cognition, emotion, and behavior intention. We can say that the user's thought produces meanings from the signs. Fourth, the user refers the signs back to the matter. Because of social networks' function, users can see the advertisement as well as comments, likes, and sharing generated by other users (Kim et al., 2013). Based on a user's mental process, the user shares the advertisement to his or her page(s) (Charaf et al., 2013). From the user's social network page, the original signs can be updated to create a new post (Dong et al., 2014). This new post can convey new meaning with signs, although it still conveys the original meaning from the advertising designer (Peirce and Hartshorne, 1931). We can say that the user's new post is an "object." This object has been construed with semiotic meaning and explained as a result of communication in a social network (Hodge and Kress, 1988). We can say that the signs stand for its referent. As there is no direct relationship between the sign and its referent, it is indicated by a dotted line (Peirce and Hartshorne, 1931). Therefore, the semiotic triangle can help us understand a social network advertisement as a unified, whole, and interconnected object to express meaning.

## 2.2. The sign and referent in social network advertising

To explain the different relationships between the sign and its referent, Peirce divided signs into three types: icon, index and symbol (Peirce and Hartshorne, 1931). An icon is a sign that imitates or resembles other objects in some way. An icon obtains the same characteristics as its object. For example, a model, or a cartoon can be seen as an icon. An index indicates the state of the object, which is not similar to the object (Barron et al., 1999; Mingers and Willcocks, 2014). An index relates to the object directly, either causally or temporally. For example, a hanging tire is an index signifying a garage. A symbol has no direct relationship to its object at all. A symbol has a relationship purely through the habit of its association. For example, French perfume can be seen as a symbol of an exuberant life style (Hartmann and Vosseveld, 2013).

The semiotic triangle sees the dynamic effects of social network advertising as the meaning process from sign to referent based on meaning systems (Eco, 1976). In these systems, sign and referent are the heart of the representation and transmission of information and meaning. Signs rely upon a shared set of meanings within a particular community and are the basis of all communication. To communicate, one must complete the meaning process from signs to referents. Considering Fig. 1 in detail, when advertising designers release a car advertising post in a social network, they integrate various material elements, such as page design and marketing mixes that act as three types of signs. Through mental and behavioral processes, users construct their own meanings of the car advertisement. According to these processes, the signs are the mental concepts we use to divide reality and categorize it so that we can understand it. So, a communication effect represents the completion of the meaning.

The relationship between sign and referent can explain types of signs and social network advertising communication (Liu, 2005). Some researchers have used types of signs to examine social network advertising communication (Warschauer, 2007; Pan et al., 2014). However, there is a lack of empirical tests of the mechanism between types of signs and the communication effect. Therefore, this study builds the social network advertising effect mechanism between types of signs and communication effects and then carries out relevant empirical tests.

## 2.3. Thought in social network advertising

In human communication, to explain the thought, semiotics distinguished some stages: the immediate and dynamical interpretant stages (Kabuto, 2014; Mingers and Willcocks, 2014). The immediate interpretant relates to the quality of the impression that the sign is appropriate to produce and does not include any actual reaction. The dynamical interpretant relates to the experience in each act of interpretation (Kabuto, 2014; Mingers and Willcocks, 2014).

In social network advertising, the interpretant can be seen in several stages: appreciating the general meaning of the social network advertisement, bringing in an individual's motivations, and forwarding a new post. In the first stage, the meaning of the sign is presented as a whole any user would understand. It can be called an "immediate interpretant." In the second stage, the sign has some effects on an interpreter. Moreover, the individual generates mental activity and behavior intention based on the sign. In this case, the user's mental process is called "dynamic interpretant." Based on the stages, users perceive and experience advertising. The final stage refers to the way the sign represents itself as related to the object.

Interestingly, in the literature of social psychology, there are many variables describing wider forms of interpretation. The common variables are social facilitation and social presence. Social facilitation means that the existence of others increases an individual's generalized level of motivation, enhancing the individual's dominant reaction rather than a competing reaction (Zajonc, 1965). In social network advertising, group behaviors can ultimately affect individual users' performance or the process from thought to referent (Wu, 2014). Thus, this study introduces social facilitation as an immediate interpretant (McFerran et al., 2010). As a way to express the effects of group interaction on an individual's mental activity and behavioral intention, we introduce social presence as a dynamic interpretant. In a social network, social presence is defined as the real and perceived degree to which a person is regarded by

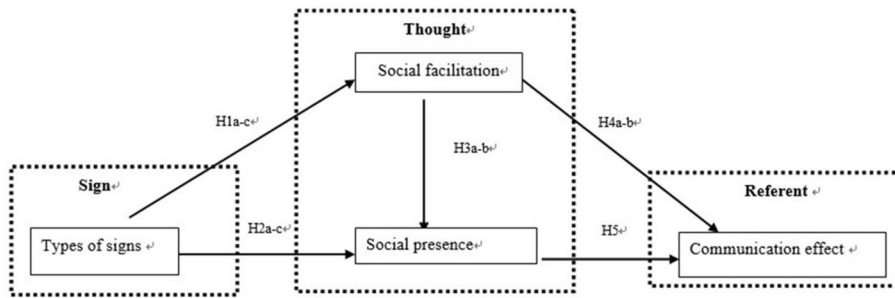


Fig. 2. Research model.

others (Short et al., 1976). Prior studies proposed that social presence can promote users' interaction, awareness and purchase interaction in social networks (Tu, 2002; Bente et al., 2008; Leong, 2011). However, there is no mechanism to integrate social psychology variables to represent thought in social network advertising (Mcferran et al., 2010; Kim and Sundar, 2014). Therefore, this study introduces social facilitation and social presence as thought to study the effect of social network advertising.

### 3. Hypotheses development

Drawing from semiotic and social psychology theories, the research framework is shown in Fig. 2.

#### 3.1. Effects of sign on thought in social network advertising

Through the semiotic perspective, sign communication occurs when users share advertising content and discuss the brand on user pages, which is the sharing function in a microblog (Kim et al., 2013). Here, the thought can be seen as an infinite process to express semiotic meaning. To explain the different relations between sign and thought, it can be divided into three types: icon, index and symbol (Peirce and Hartshorne (1931)). In social network advertising, signs can help users more effectively generate content, and then construct and share their meanings (Mingers and Willcocks, 2014). Because it is the users' intrinsic meaning or interpretability of the sign before anyone else has interpreted it, a sign only affects users' subconscious. The immediate interpretant appreciates the general meaning of the signs, which any competent user in a social network would be able to do. This allows for more effective interaction and has further benefits in encouraging individual activity, which can be measured as social facilitation. We can infer that the more signs, the more intrinsic meaning acceptance by social network user groups.

Empirical studies have shown that the types of signs have a positive impact on social facilitation. Green et al., (2008) proposed that signs can stimulate mental representations and promote social facilitation. Fortin and Dholakia (2005) found that signs can foster social facilitation, and then promote consumers' purchase intent. Culache and Obad (2014) proposed that by dynamically adjusting the stimulus with signs, a page's signs have a positive influence on social facilitation. We believe that social network advertising, which contains types of signs, is often accompanied by a persuasive stimulus within user groups. We can infer that the more signs there are, the higher the possibility that the users will perceive meaning in advertising. We hypothesize:

H1a: The number of symbols in social network advertising will be positively related to social facilitation.

H1b: The number of indexes in social network advertising will be positively related to social facilitation.

H1c: The number of icons in social network advertising will be positively related to social facilitation.

The dynamic interpretant brings in the users' motivations (Mingers and Willcocks, 2014). In social network advertising, because of user-generated content, users have been organized into sharing information systems with organizational identification (Mingers and Willcocks, 2014; Go and You, 2016). As a measurable variable, social presence can be described as a perception of belonging or inclusion (Mingers and Willcocks, 2014). The dynamic interpretant can generate some mental activity by the users, which is the degree of perception of and reaction to being connected by social media to social groups. The more signs, the greater the degree of feeling in social network advertising. Some studies have shown that the types of signs are positively related to social presence. Collins (2008) believes that signs can produce a highly positive emotional energy of consciousness, which can be measured as social presence. Empirical studies have found that signs on websites can promote interactivity and in turn promote users' social presence (Jin, 2009; Scavini, 2010; Coursaris and Sung, 2012; Verhagen et al., 2014). The inference, therefore, is that all the types of signs are positively related to social presence in social network advertising. We hypothesize:

H2a: The number of symbols in social network advertising will be positively related to social presence.

H2b: The number of indexes in social network advertising will be positively related to social presence.

H2c: The number of icons in social network advertising will be positively related to social presence.

#### 3.2. Users' mental activity in social network advertising

The thought, which can be seen as user groups' social facilitation and individual users' social presence, comes from the immediate stage to the dynamic stage (Mingers and Willcocks, 2014). However, the relationship between social facilitation and social presence

has proved controversial. Some empirical studies show that social facilitation is positively related to social presence (Lengel, 1984). Some empirical researchers found that social facilitation can promote social presence in an online environment (Gefen and Straub, 2004; Shen and Khalifa, 2008). In social network advertising, the stronger the influence on social facilitation, the more obvious it is in users' social presence. We can infer that social facilitation in social network advertising is positively related to social presence.

Meanwhile, some studies came to the opposite conclusion with long-term data. Kim and Sundar (2014) found that social facilitation of the online medical services community is not obvious when users search for information. The reason may be that information in an online community overloads the user, causing an inhibitory effect on the individual. Buijzen et al. (2010) proposed that information overload is related positively to brand awareness for the short term, but negatively over the long term. There are many signs with stimulus in a social network. During the short term, the stimulus is positively related to social presence. At the same time, because of frequent updates in social network advertising, the stimulus will bring information overload (Collins, 2012). The unavoidable conflict can either increase drive or yield cognitive overload (Uziel, 2007). We can infer that, after a period, social facilitation is related to social presence, going from positive to negative. We hypothesize:

H3a: The social facilitation of social network advertising is positively related to social presence in an earlier stage.

H3b: The social facilitation of social network advertising is related to social presence from positive to negative in a later period.

### 3.3. Effects of thought on referent in social network advertising

From the thought to its referent, the signs treat social networks as information systems in which information is created, processed, distributed, and used (Liu, 2005). Based on the hypotheses above, the signs in social network advertising are positively related to social facilitation. Meanwhile, certain features and traits, such as communication style, characterize the human personality. These personality traits exert influence, particularly over processes of making social decisions (Urea, 2015). The conflict between user groups and individual personality over a period of time can affect individual performance, from promotion to inhibition. Thus, social facilitation can be positively related to communication effects at an earlier stage but negatively related to communication effects at a later stage.

Empirical studies have not come to logical conclusions regarding social facilitation's positive or negative role in communication effects. On one hand, some empirical studies show that social facilitation is positively related to communication effects (Goggins et al., 2013; Boddy et al., 2009). With the development of social networks, Vranca (2013) and Shaughnessy (2013) began to focus on the social facilitation of users in earned media. The empirical results suggest that the number of fans has a positive influence on later users, promoting the advertising communication effect. On the other hand, based on Distraction-conflict theory (Baron, 1986), when sign text information accumulates over time and leads to overload, social facilitation may have inhibitory effects on the audience (Virginie et al., 2014). Uziel (2015) found that social facilitation changes an individual's cognition. Social facilitation is related to communication effects, from positive at first, to negative in a later period. Combining these two aspects, we hypothesize:

H4a: The social facilitation of social network advertising is positively related to communication effect in an earlier stage.

H4b: The social facilitation of social network advertising is related to communication effect from positive to negative in a later stage.

From the thought to its referent, the meaning of the signs can be generated in a particular user. It also causes some mental and physical action in the user. Based on the previous hypothesis, users' mental action can be described as social presence. Users with social presence can increase organizational identification, and users with organizational identification can promote communication (Allen, 2013).

Some empirical studies show that social presence is positively related to communication effect. In social network advertising, a sense of social presence via social media technology can improve communication between dispersed social network users (Allen, 2013). Studies have shown that social presence can enhance the information communication effect in the social network environment (Bioccae, 2001; Kim et al., 2013). The intensity of social presence is related to the user's degree of connection and then related to the communication effect (Allen, 2013). Drawing on many existing studies, we infer that social presence is positively related to the communication effect. Combining the hypotheses above, we hypothesize:

H5: Social presence is positively related to communication effect.

## 4. Methodology

### 4.1. Data

This section is divided into two steps. First, we chose movies as samples. Second, we described the data collection principle and process. We chose movies as samples for the following reasons. A movie is a kind of perishable good that has the characteristic of long lead-times, a short sales period, and volatile markets (Kim et al., 2013). As the last process, the release becomes the key element of return on investment (Homburg et al., 2010). At the same time, a movie marketing plan is often based on the annual cycle with the annual budget. In recent years, the movie's market size is about 120 units a year in Mainland China. In collecting the annual data, we studied the movies that were shown in Mainland China in 2014 and that opened an official microblog in Sina ([weibo.com](http://weibo.com)).

We chose Mtime ([mtime.com](http://mtime.com)), one of Mainland China's most professional film libraries, as sample source for the movies. Because it is the most mainstream social network in Mainland China, we chose Sina's microblog ([weibo.com](http://weibo.com)) as the social network sample source. Using Mtime's movie trailers, we investigated each film's titles and opening day. We retrieved the film to determine whether the film had an official Sina microblog (Sina microblog certification plus V). If the film had an official microblog, we collected the



microblog as the films' social network. We collected a total of 106 official microblogs from January to December 2014. In these microblogs, we chose a post as a form of advertising. The selection principles are as follows: seven days before the movie's premiere, we began to pay attention to the film's microblog, and we retrieved the posts with "original" and "containing images" characteristics. The targeted posts are the first-release movie posters in microblogs. We downloaded the posts to preserve them as sign texts. We collected the number of reviews, sharing, and likes in the microblog once per day. The observation period was a total of 15 days, from seven days before the premiere to seven days after the premiere.

The data collection principles are as follows: if the movie poster had been issued seven days before the movie premiere, we started collecting post data from seven days before the movie premiere to seven days after the premiere. However, if movie posters were issued relatively late, we set up a replacement rule. If the movie poster was not released on the day of the premiere, we chose a post that was issued on the earliest day. If there were no posts on that day, we chose the post that was issued the earliest on the second day. Until the day when the movie was released, we started collecting movie "post" data. According to this principle, we eliminated a low-budget movie that did not have a movie poster released in its official microblog during 2014. We also have collected the dimensions of the posters, the comments, the like, and the sharing. We collected a database of 105 films, each of which has 15 time-series data sets. Finally, we collected panel data in a database that has a capacity of 1575 (105 members in the section \* 15 points in each movie).

#### 4.2. Content analysis

Content analysis is a research technique that can be copied and effectively inferred from texts to the contexts of their use which enables an evaluation that is more objective than comparing content based on the impressions of a listener. The steps of content analysis are as follows. First, we determined analysis units; second, we started coding, and third, we tested the reliability and validity.

First, we determined analysis units. Based on Peirce's category, we put all units into three categories: icon, index and symbol (Porcar, 2011). In Table 1, a measurement standard is established. To analyze the posts, we followed two principles: the categories should be mutually exclusive and independent (Kabuto, 2014). An analysis unit can only be placed in one category; an effective category system should possess completeness, which can ensure that all units have been analyzed (Porcar, 2011). We built a table of advertising semiotic meaning categories to record the frequency of each unit (Appendix A). To avoid missing information, we extracted 3–5 posts from each sample, read the details of the test category and provided necessary corrections (Porcar, 2011). To analyze the reliability, we engaged two marketing professionals to judge the records. Agreement was higher than 85% in all categories. This indicates that the category system can be used for coding.

Second, we started coding based on the follows steps: counting to determine the number of each category's signs and starting the formal coding. The purpose was to create the coding rules for each category of the unit of analysis and determine the initial coding rules. We engaged two coders to code the same posts. The variables and explanations are provided in Table 1. The two coders determined the final rule and started the formal coding. Appendix B shows the coding results of a sample poster.

Third, we tested validity and reliability. In order to test whether the measurement content and measurement objectives are suitable, content validity used to test (Jeffrey, 2009). We invited three judges who were familiar with the study of social network advertising to explain the encoding rules. The judges found that the category system properly represented the content. In order to ensure that the errors were minimized in measurement, a sample of 100 posts was randomly selected. Three judges were invited to test the rationality of the general category and the correlation between the categories (Jeffrey, 2009). We then summarized and compared the results, using SPSS 19.0: the result was an  $r$  value of 0.87, indicating the category system's high level of reliability.

### 5. Data analysis and results

#### 5.1. Descriptive statistics

Panel data analysis is a statistical method widely used in econometrics and social science, which involves two and "n"-dimensional panel data (Jeffrey, 2009). Having panel data allows us to study dynamic relationships, increase the efficiency of estimates and reduce heterogeneity bias (Jeffrey, 2009).

Table 2 presents the descriptive statistics. It shows that the icon value is high, and the index has a large variance. With respect to the communication effect, sharing has the highest average number, the largest maximum, and the largest variance. We can conclude that sharing has different characteristics in different social network advertisings.

#### 5.2. Cross-sectional regression analysis

For modeling and analyzing variables in our study, we used cross-sectional regression analysis. Table 3 shows the results. The results show that the symbol ( $\beta = 0.093$ ,  $p > 0.05$ ) and index ( $\beta = 0.053$ ,  $p > 0.05$ ) have no significant influences on social facilitation; these results cannot support H1a and H1c. The icon has a significant influence on social facilitation, supporting H1b. We can conclude that a single type of sign cannot promote click rates and purchase intention. The symbol and index have significant influences on social presence, supporting H2a and H2c. However, the icon has no significant influence on social presence ( $\beta = 0.283$ ,  $p > 0.05$ ); the result cannot support H2b. The reason may be that an icon expresses a certain commonality between a sign and meaning. An icon needs to match other signs to create emotional energy. Social facilitation has a significant influence on social presence ( $\beta = 0.327$ ,  $p < 0.05$ ), supporting H3a. Social facilitation has a significant influence on communication effect ( $\beta = 0.201$ ,

**Table 1**  
Explanations and examples of the variables.

Variable category	Variable name	Explanation	Measurement standard	Examples in Appendix B	Literature sources
Sign	Symbol	A symbol is a sign that refers to the object that it denotes by virtue of a law, usually an association of general ideas, which operates to cause the symbol to be interpreted as referring to that object	Image and totem can be measured as symbols	Character's images can be coded as symbols The relation between the symbol and its object depends on the habit of its association	Peirce and Hartshorne (1931) Petofi (2010)
	Index	An index is a sign that refers to the object that it denotes by virtue of being really affected by that object	Pure text, pure word and pointer can be measured as indexes	Movie name, "movie", gift, tickets, official microblog, and expectation or feeling word can be coded as indexes. Indexes can express meanings of the movie directly. (Simple repetition of words can be calculated once.)	Peirce and Hartshorne (1931)Petofi (2010)
	Icon	An icon is a sign that refers to the object that it denotes merely by virtue of characters of its own	Cartoon text, variant text and scale-model can be measured as icons	As a cartoon, red heart shape can be coded as an icon. As variant words, "north" and "love" with red words in Chinese can be coded as icons. Icons have some variant or imitator form to express meanings of the movie	Peirce and Hartshorne (1931)Petofi (2010)
Thought	Social facilitation	Number of reviews	The previous posts' comments	The number of reviews in the poster can be coded as the social facilitation	Uziel (2007)
	Social presence	Number of likes	Progressive cognitive to emotional level	The number of likes in the poster can be coded social presence	Uziel (2007)
Referent	Communications effect	Number of sharing	Forming a social network page spread by sharing to other users	The number of sharing of the poster can be coded as the communications effect	Wu (2014)

**Table 2**  
Coding scheme and summary statistics.

Variable	Definition	Coding	Maximum	Minimum	Mean	SD
Sign	Number of symbols	Symbol	12	1	7.63	3.52
	Number of icons	Icon	9	0	8.37	5.41
	Number of indexes	Index	10	1	5.42	8.74
Social facilitation	Number of reviews	Review	285,678	0	17034.96	236.57
Social presence	Number of likes	Like	87,176	0	2398.22	138.86
Communications effect	Number of sharing	Sharing	618,323	0	18405.18	671.36

**Table 3**  
Regression results.

H	Item	$\beta$	T	p	Accept or reject
H1a	Symbol $\rightarrow$ In (Review)	0.093	-1.177	0.529	Reject
H1b	Icon $\rightarrow$ In (Review)	0.421	1.245	0.025	Accept
H1c	Index $\rightarrow$ In (Review)	0.053	-0.573	0.575	Reject
H2a	Symbol $\rightarrow$ In (Like)	0.113	0.418	0.034	Accept
H2b	Icon $\rightarrow$ In (Like)	0.283	0.615	0.682	Reject
H2c	Index $\rightarrow$ In (Like)	0.014	-0.434	0.021	Accept
H3a	In (Review) $\rightarrow$ In (Like)	0.327	2.514	0.025	Accept
H4a	In (Review) $\rightarrow$ In (Sharing)	0.201	1.836	0.043	Accept
H5	In (Like) $\rightarrow$ In (Sharing)	0.689	1.296	***	Accept

Note: \*\*\* are significant at  $p < 0.001$ .

$p < 0.05$ ), supporting H4a. Social presence has a significant influence on communication effect ( $\beta = 0.689$ ,  $p < 0.001$ ), supporting H5.

Regarding the mediating effects of social facilitation on the relation between all the types of signs and social presence, the bootstrap estimation procedure was used (Jeffrey, 2009). Using SPSS 19.0, we calculated the direct effect, mediating effect, and total effect. Table 4 presents the results. The results show that the relationships between signs and thought are different. The relationship between icon and social presence is the most obvious. The relationship between index and social presence is unremarkable.

### 5.3. VAR analysis

In order to test H3b and H4b, we built a vector auto regression (VAR) model by extracting the key elements using generalized forecast error variance decomposition (GFEVD) (Lütkepohl, 2005). We tested 76 samples from the movies that had a stable state in the 105 data column. From the above augmented Dickey-Fuller test (ADF) unit root test, all variables in the 1% significance level did not have a stationary sequence. The first order difference of the variables under the ADF unit root test rejects the null hypothesis at a 10% significance level at least. Therefore, each variable is a first order form time-series during the sample period.

When we estimated the Johansen maximum likelihood, we should consider the lag order number of the VAR model. After using the likelihood ratio (LR) test, the Akaike information criterion (AIC) criterion method, and Schwarz criterion (SC) information rules, we determined the optimal lag order number as 2 (Lütkepohl, 2005). We used Eviews 6.0 to calculate the model parameters. For the estimation results in each equation in the VAR model, their respective  $r$  value are much  $> 0.7$ . This shows that their entire endogenous variable in lag phase 1 and 2 are able to explain each of them. AIC and SC information rules are relatively small, which suggests that the setting of the VAR model is appropriate. In order to understand the dynamic characteristics of the VAR model, we used impulse response function and variance analysis (Lütkepohl, 2005).

Fig. 3 shows that the lags of the impulse response function are 10 days, which covers the main effect on the spreading period before and after the day of the premiere. The impact trend of social presence was reflected in the first day and then decayed rapidly in the second day. Although there is some rebound in the third day, the follow-up response has basically no impact on the social

**Table 4**  
Mediating effect.

IV	M	DV	IV $\rightarrow$ DV	IV $\rightarrow$ M	IV + M $\rightarrow$ DV		Mediating effect
					IV	M	
Symbol	Review	Like	0.213	0.093	0.356	0.365	15.9%
Icon	Review	Like	0.469	0.421	0.229	0.745	66.9%
Index	Review	Like	0.511	0.053	0.486	0.324	3.3%

Note: IV is independent variable; M is mediating variable; DV is dependent variable.



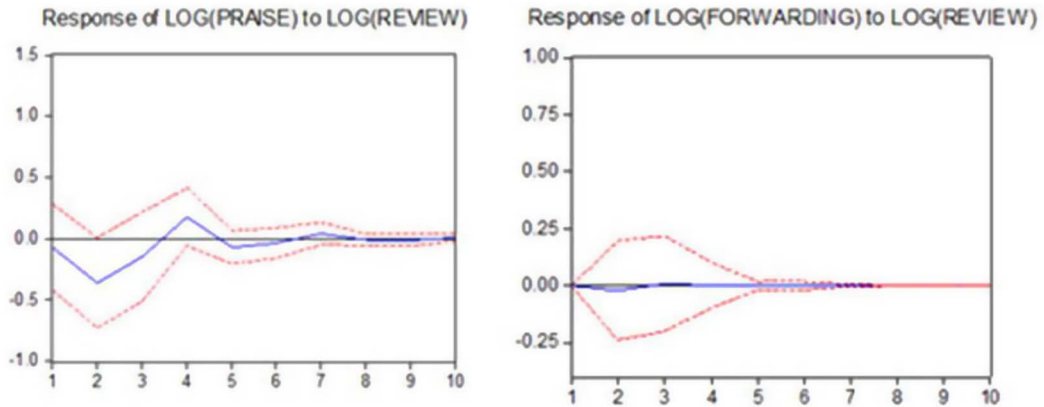


Fig. 3. Impulse response of the variables review, like and sharing.

presence in the long term. We can conclude that H3b is relatively significant. The result indicates that an online water army may promote social presence in the short term. The impact trend of social facilitation was reflected in the first 2–3 days and then decayed rapidly. The follow-up had little impact on the communication effect in the long term. We can conclude that H4b is not relatively significant. That is to say, even the online water army's repeated postings have no direct effect on the communication effect in the long term. We can conclude that there is a social inhibitory effect. This may cause psychological frustration. Therefore, we suggest that an online water army is not the optimal choice for advertisers in the long term.

#### 5.4. Variance decomposition

In order to examine the interaction of variables, we used VAR variance decomposition to analyze the mutual influence between signs, social presence, and communication effect (Lütkepohl, 2005). Fig. 4 shows that the average contribution of signs to social presence (%) is symbol (9.02), icon (4.61), and index (8.21). The average contribution of signs to communication effect (%) is symbol (6.63), icon (15.45), and index (6.19). The results indicate that symbol is relatively significant in the contribution to social presence, but icon is relatively significant in the contribution to communication effect. We can conclude that symbol can promote social presence in the initial stage, and icon can promote a persistent communication effect.

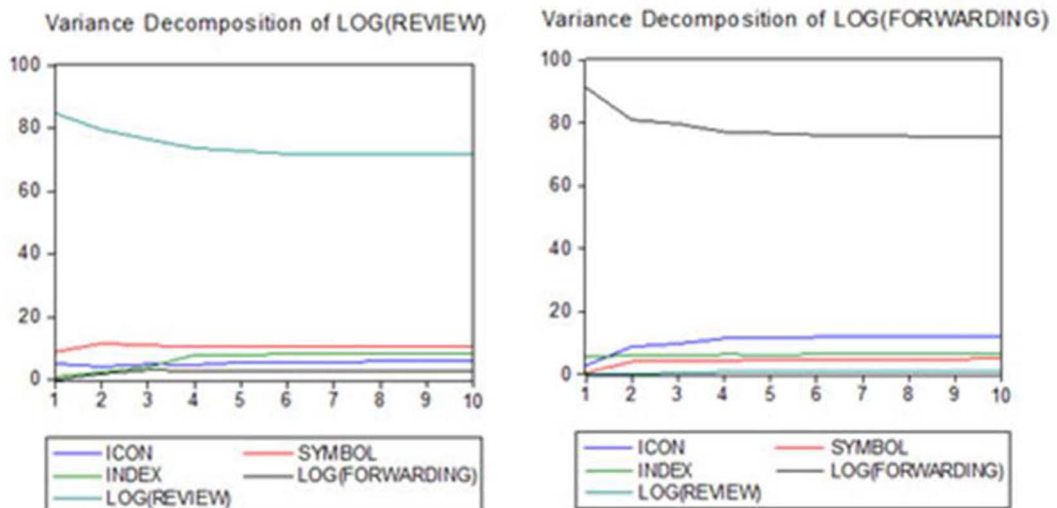


Fig. 4. VAR variance decomposition to analyze the mutual influence between signs, social presence, and communication effect.

## 6. Discussion and implications

### 6.1. Theoretical contributions

This study is one of the first semiotic frameworks to integrate the effects of social network advertising through a semiotic triangle. Prior studies overlook the fact that social network advertising is an interactive system with advertiser- and user-generated content (Mingers and Willcocks, 2014). To address this gap, this study has developed a quantitative model to integrate the effects of social network advertising through a semiotic triangle.

Second, this study has confirmed a logical relationship between sign, thought and referent in social network advertising. Unlike the traditional one-way transmission of information in online advertising, social network advertising is characterized by user-generated content and user interaction (Gooch and Watts, 2014). This study explains that the group mental mechanism may impact users' psychology and behavior in a social network advertisement. The empirical results have confirmed that different types of signs have different effects on social presence.

Third, this study has confirmed the dynamic effect of social network advertising. Previous theoretical studies have generated controversial findings about social facilitation in social network advertising (Goggins et al., 2013; Boddy et al., 2009). Our results indicate that social facilitation in social network advertising can impact social presence positively in the earlier stages but negatively in later periods. However, manipulating social presence excessively can lead to an inhibitory effect of social facilitation.

### 6.2. Practical implications

From a practical point of view, this study may help advertisers use different signs in different marketing stages. In the early stages, advertisers should consider highlighting the signs with color and artistic conceptions to convey brand image benefits. In the online promotion stages, advertisers should use icons to create a stable phase in the brand communication theme. In the online-communication-extending period, icons should combine with symbols and indexes. The combination of signs can extend the promotion period and avoid users' visual fatigue.

Second, this study has some important marketing strategy implications for advertisers. Our results may also help advertisers update their signs and enhance marketing strategy. An advertiser communicates marketing information using logos, colors, and a series of visual display tools. It is easy to cause information overload and visual fatigue. To avoid these problems, our suggestions are as follows. On the one hand, advertisers need to build a visual focal point with icons known as visual punctum, which is the visual center of the screen. The users will always focus on this point (Hodge and Kress, 1988). With a visual focal point, it is easier for users to click on the visual focal point. On the other hand, advertisers should use not only copywriting to attract consumers initially but also symbols and indexes to describe the connotation and value of the product.

Third, our model can help advertisers create a continuous marketing mix strategy. To delay social inhibition, advertisers should build different signs for interaction topics during different promotion periods to constitute a visual marketing chain (Collins, 2004). Unlike repeating posts of an online water army, a marketing chain can update signs dynamically. Using symbol can express an artistic conception; using index can express the location of product information (Collins, 2011). Taking care of a continuous marketing mix strategy may require updating signs.

## 7. Conclusion

The main purpose of our study is to examine the dynamic effects of social network advertising. Our study contributes to the social network research and social media marketing practice. First, we provide a semiotic triangle theoretical framework and some results on the dynamic effects of social network advertising. The study hence serves to expand our understanding of the dynamic effects of social network advertising. It suggests that semiotic theory is applicable to social network advertising. The results have specific implications for both researchers and advertisers that are related to the social network marketing strategy.

Second, this study builds a mental interaction mechanism through the semiotic triangle. The study offers the insight that users' mental activity is a measurable factor in the effects of social network advertising. Therefore, the findings help advertisers building the mental interaction mechanism between users and social network advertising to improve the effects of social network advertising.

This study also offers an explanation of dynamic nature for the effects of social network advertising. This study offers novel insights because it identifies the semiotic triangle through which social facilitation in social network translates into a user's behavioral response at different periods of time in social network advertising (Zajonc, 1965). This study may help us better understand users' motivations underlying the group influence in social network advertising.

## 8. Limitations and future research

This study has some limitations and leaves several questions for future research. First, this study used the number of signs to simplify the semiotics. Although current semiotic quantitative literature mostly adopts this method (Kabuto, 2014; Mingers and Willcocks, 2014; Pan et al., 2014; Hunter, 2016), the conclusion may bring a misunderstanding that the more types of signs an advertisement has, the more effective it will be. Future research may pay more attention to the meaning process between the signs and users. Second, we used social network movie data as an empirical sample. Whether the findings can be generalized to other products is unknown. Future research should introduce different products to try to reach universal conclusions. Finally, we used only

social network communication as a dependent variable. Future research should consider business performance as an additional dependent variable.

#### Appendix A. Description of categories

Category	Explanation	Unit	Description
Symbol	A symbol has a relationship purely through the habit of its association.	Image, totem, etc.	An image is an artifact that depicts visual perception. A totem is a spirit being, sacred object or symbol that serves as an emblem of a group of people. The relation between the sign and its object depends on the habit of its association.
Index	An index indicates the state of the object.	Pure text, pure word, pointer, etc.	A pure text is a text that can express meanings of an object directly. The relation between the sign and its object will show as a causal relationA pure word is a text that can express meanings of an object directly. The relation between the sign and its object will show as a causal relationA pointer is not similar to the object but indicates the state of the object directly.
Icon	An icon is a sign that resembles or imitates an object in some way.	Cartoon text, variant word, scale-model, etc.	A cartoon text is a text using painting technique. It is not a pure text. It is a type of two-dimensional illustration. It can resemble or imitate an object in some way.A variant word is a word with decorative or decorative meanings. It is not a pure text. It has some variant or artistic form of the text.A scale model is a physical representation of an object, which maintains accurate relationships between all important aspects of the model.

## Appendix B. A sample poster on Sina microblog

【#北京爱情故事# 晒电影票赢礼品】电影《北爱》已于2月13日14时全国公映，晒出你的电影票，谈谈你将要去看电影的期待或已经看完的感受，我们送周边礼品啦！【规则】发布微博：#北京爱情故事#+ 晒电影票+ 想说的话 + @电影北京爱情故事直播，名额：10人。

2014-2-13 18:09 来自 专业版微博

收藏 | 转发 16 | 评论 26 | 赞 23

Semiotics Text

Sharing 16 · Reviews 26 · Praise 23

Text:↵

The movie named *Beijing Love Story* was shown in Mainland China on February 13 at 2:00 p.m. Please take out your movie tickets and talk about what your expectations or feelings were. The rules are as follows: first, please post “Beijing Love Story”+ Tickets+ Words you want to say+@ official microblog “Beijing Love Story”. Then you have the opportunity to receive a gift. Second, we will randomly select 10 posts from the comments. We will then publish the people’s name on a new post. Third, if you have the opportunity to appear in the post, you can get the gift from any cinemas showing the movie. When you go into the cinema, you can show the comments record to the staff of cinema, and then the staff can give you the gift.↵

Index:↵

Number: 9↵

↵

Symbol:↵

Number: 10↵

Icon:↵

Number: 9↵

↵

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