How Do Communications between Consumers Construct Brand Value?: Agent-Based Simulation of Market Dynamics

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Prior research on brand equity or brand value has assumed that all products are identical in their functions but different in marketing activities of firms. Although we can assume that products are the same in not only their functions but also their marketing activities, this is the assumption that prior research has paid little attention on. This paper aims to explore how communications between consumers construct brand values endowed to products when all of them are identical in all aspects. At first, our discussion is based on Niklas Luhmann's social system theory to explain the emergence and collapse of brand value. Then, to understand these phenomena, we conduct experiments using an agent-based simulation. As a result, market share of a product which is based on its brand value shows dynamics due to two types of consumers' communications. This is the way we imply the frontiers of brand research by suggesting that the social system theory and agent-based simulation are useful in analyzing and understanding the emergence and collapse of brand values.

Field of Research: Marketing, Consumer Behavior

1. Introduction

Current consumer and marketing research places a high priority on branding. Aaker (1991) captured the interest of researchers by suggesting that brand equity is defined as the marketing effects or outcomes that accrue to a product because of its brand name compared to those that would accrue if the same product did not have the brand name (Aaker, 1991; Ailawadi, Lehmann, and Neslin, 2003).

Two research streams exist in branding. One is customer-based brand equity (Keller, 1993; 1998), and the other is brand identity (Aaker, 1996). The former approaches brand

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equity from the perspective of the consumer and suggests that the different values added by brands result from the consumer's knowledge about these brands (Keller, 1998). This approach has advanced the concept of brand equity. However, this leads to the following unanswered question: why is the consumer's knowledge about the products different from the products themselves? In contrast, research on brand identity focuses on firms' marketing activities and suggests that the various activities based on the particular brand identities of the firms result in consumers having differential knowledge about the products that lead to different brand equities (Aaker, 1991; 1996). Although the difference between brand identity and activities is clearly a significant factor that influences consumers' knowledge, is that really all there is?

This paper implies that consumers can create different knowledge about the same product on their own. In other words, consumers may perceive each product differently based on their communications with other consumers even if the products are the same. Thus, our objective is to explore how the emergence and collapse of a product's brand value resulting in its variable market share can be possible. To achieve this goal, we define two research objectives: to explain the emergence and collapse of brand values based on Niklas Luhmann's social system theory (Luhmann, 1984; 1989; 1990) and to understand this phenomenon through experiments using an agent-based simulation.

2. Literature Review

2.1. Social System Theory

We base our examination of the question on the social system theory developed by Niklas Luhmann (Luhmann, 1984; 1989; 1990). Because of limited space and his vast volume of work, however, we restrict our study to a review of the theory's outline and focus on the four concepts in his social system theory: autopoiesis, communication, reduction of complexity, and structures of social systems.

The concept of autopoiesis is the most important part of Luhmann's theory (Luhmann, 1989; 1990). This originated with Maturana and Varela (1980) who invented it to describe life as a living system. Luhmann applied autopoiesis to social systems that he regarded as autopoietic systems (Luhmann, 1984). Autopoiesis in a social system refers to its operation; a social system operating autopoietically produces all its components, i.e.,

everything that is used as a unit by the system. Thus, the key operational characteristic of an autopoietic social system is the closed manner in which it produces its components by itself; old components produce new ones in the social system. However, that begs the question, what are the components of a social system? Luhmann insisted that they should be communications (Luhmann, 1984; 1989; 1990). Therefore, in the social system, old communications produce new ones.

We consider the reduction of complexity based on the two concepts above. At first, complexity is simply defined as all possibilities in the environment for the social system (Luhmann, 1984; 1989; 1990). In other words, this is regarded as the condition under which each person thinks differently. Therefore, the reduction of complexity can be considered the selection of possibility, and this can be achieved by communications. Communications between two individuals select one possibility from all possibilities. Although this is the way one reality can emerge, communications are no more than events, and therefore, the social system that emerges as a reality cannot help being transient, since communications are its components. The structure of the social system can play an important role when the system continues to exist. The structure of the social system, which is regarded as an expectation, is not temporary but stable to some extent (Luhmann, 1984). In this sense, the structure (the expectation) can reduce the complexity of each person essentially thinking in different ways. So far, as the social system consists essentially of communications alone and it self-produces everything that is used as a unit by the system, its structure can be rebuilt by communications.

2.2. Assumptions about the Consumption System and Brand Value

Since Luhmann's theory refers to four key concepts in general statements (Luhmann, 1984; 1990), we must apply them to the specific context, for example, to consumption. To do this, we make the following four assumptions based on the four key concepts described above.

Assumption 1:

The consumption system is an autopoietic and social system.

Assumption 2:

The components of the consumption system are communications between consumers.

Assumption 3:

Communications between consumers transfer the difference of product choices and can select a possibility by acceptance or rejection of a particular product.

Assumption 4:

The brand value as the structure of the consumption system can be only determined by the autopoietic operation of the consumption system.

2.3. Autopoiesis of the Consumption System: Bandwagon and Snob Effects

To describe communications produced sequentially (the autopoietic operation of the consumption system) more concretely, let us review the work of Leibenstein (1950). While he identified three external effects on utility, two of them, the bandwagon and the snob effects, are especially important in this paper. The third effect, the veblen effect, refers to the differences in prices and therefore is outside the scope of this paper.

First, by the bandwagon effect, Leibenstein was referring to the fact that one person buys because another is buying the same thing (Leibenstein, 1950, p. 183). This implies that existing demands produce similar follow-on demands, and these demands continue to increase as long as consumers keep reacting positively to the increase of demand (Leibenstein, 1950, chap. 3). Because the bandwagon effect is a nonfunctional one (one in which the demand for a product is not due to its quality), we can consider this effect as one of the functions of communications. More specifically, a consumer may decide which product to choose by communicating with other consumers provided that products in a market are of the same quality. Therefore, a chain of communications with the bandwagon effect produces increasing demands for a certain product, which means the emergence of the brand value added to the product.

Second, let us consider the snob effect. By this effect, Leibenstein meant the phenomenon in which the individual consumer’s demand is negatively correlated with the total market demand (Leibenstein, 1950, p. 199). Although the snob effect is similar to the bandwagon effect in that they are both nonfunctional effects on consumer product choices and imply that existing demands can influence subsequent ones, the former differs from the latter based on the impact of the previous demands; the bandwagon effect is positive while the snob effect is negative. Therefore, we can infer that the

functions of communications with the snob effect are different from those of communications with the bandwagon effect. A chain of communications with the snob effect decreases demands for a certain product, which means the collapse of the brand value added to the product.

2.4. Threshold Model

Thus, we can see that the autopoiesis of the consumption system has two types of communications: those with the bandwagon effect that lead to the emergence of the brand value and those with the snob effect that trigger the collapse of the brand value. However, this leads to the unresolved question, “when do the two communications occur?”—a limitation of Leibenstein’s (1950) discussion. To answer that question, we will review the threshold model (Granovetter, 1978; Granovetter and Soong, 1986).

Granovetter (1978) developed the threshold model to describe collective behaviors in societies such as diffusions of innovations, strikes, and voting. In this model, each individual is assumed to have a personal threshold of whether or not to adopt the behavior of the group. This suggests the time when a consumer will start communications with the bandwagon effect. In other words, a consumer starts communications with the bandwagon effect when he or she observes that the number of others who choose the same product is greater than that consumer’s personal threshold. Furthermore, the threshold model assumes that each individual has a different personal threshold. This assumption indicates how a chain of communications with the bandwagon effect is possible: consumers with different thresholds choose the same product at different times.

Although the threshold model can formalize the communications with the bandwagon effect, it does not cover communications with the snob effect (Delre, Jager, and Janssen, 2007). However, not only the bandwagon effect but also the snob effect should be formalized, since we are attempting to explain the emergence of the brand value by communications with the bandwagon effect as well as the collapse of brand value by communication with the snob effect.

Thus, we have assumed that consumers have a second threshold in addition to the bandwagon threshold described above, that is, the snob threshold. Two separate thresholds allow us to distinguish the two types of communications and identify when

they will occur. Consumers start communications with the bandwagon effect and choose the same product as others when the number of people choosing it is larger than their own bandwagon thresholds. In contrast, they start communications with the snob effect and switch to other products when the size of the group choosing the same product is greater than their own snob thresholds.

This provides a framework to explain how the brand value endowed to a product can emerge and collapse through two aspects of consumers' communications, that is, communications with the bandwagon effect and those with the snob effect. The interplay of these communications is related in a complex manner due to the different thresholds in a market in which the same products exist. This is the mechanism of the emergence and collapse of the brand value in the consumption system.

3. Methodology

3.1. Agent-based Simulation

We use an agent-based simulation to understand the process of brand value emergence and collapse. This type of simulation makes it possible to model autonomous systems in which agents only interact locally but a global phenomenon can emerge. So, the agent-based simulation can be applied appropriately to the consumption system as an autopoietic system. According to Epstein and Axtell (1996), we require the three components described below: environment, agent equipment, and rules for communications between agents.

3.2. Environment

At the start of the simulation, each agent (or virtual consumer) lives in one of $n \times n$ squares. Thus, the virtual world has n^2 agents. The edges of the world in which the agents live are eliminated by closing the array like a torus, so that every agent has the same environment and the same number of neighbors.

Agents can choose one of two alternative products (product *x* or product *y*), which are identical except for their colors. This is analogous to all products being the same except for their names. Moreover, each agent is assumed to initially choose one product at random, or more specifically, that the market share of each product is nearly equal at the

start of the simulation.

The final environmental setting concerns time. We define time as discrete (i.e., t = 1, 2, …). Each agent can choose only one product through communications with the bandwagon effect or the snob effect in each period.

3.3. Agent Equipment

Each agent (i = 1, 2, … n^2) is assumed to have a fixed bandwagon threshold BT_i and a fixed snob threshold ST_i assigned at random. They are also assumed to have the ability to communicate with the eight neighbors who live in the adjacent squares.

3.4. Communications between Agents

First, we assume that agents can use both the information about their neighbors' product choices (i.e., the network share of product x: NS_x) and the information about the market shares of the products (i.e., the market share of product x: MS_x) in their communications. However, they can obtain the information in the previous time period (i.e., at t – 1) because the simulation time is discrete and an agent can act only once in each period. Thus, the agents have access to two items of information at time t – 1. We define $NS_{t-1,x}$ as

$$NS_{t-1,x} = \frac{\sum_{j=1}^{8} C_{t-1,j,x}}{8}, \tag{1}$$

where $C_{t-1,j,x}$ is the product choice of agent j who is one of the neighbors of agent i at time t – 1.

We define $MS_{t-1,x}$ as

$$MS_{t-1,x} = \frac{\sum_{i=1}^{n^2} C_{t-1,i,x}}{n^2}, \tag{2}$$

where $C_{t-1,i,x}$ is the product choice of agent i at time t – 1.

Second, agents are assumed to start communications with the bandwagon effect using the information about $NS_{t-1,x}$ directly. Agent i is assumed to start communications with the bandwagon effect in period t when the parameter $B_{t,i,x}$ is equal to 1, where

$$B_{t,i,x} = \begin{cases} NS_{t-1,x} \geq BT_i \rightarrow 1 \\ otherwise \rightarrow 0 \end{cases} . \quad (3)$$

Similarly, agent *i* is assumed to start communications with the snob effect in period *t* when the parameter $S_{t,i,x}$ is equal to 1, where

$$S_{t,i,x} = \begin{cases} NS_{t-1,x} \leq BT_i \rightarrow 1 \\ otherwise \rightarrow 0 \end{cases} . \quad (4)$$

Finally, we formalize the product choice of agents at period *t*. The starts of communications with the bandwagon and snob effects are controlled by Eqs. (3) and (4), respectively, but these do not include the information about the market shares of the products ($MS_{t-1,x}$), which can be obtained by agents. Each agent can consider $MS_{t-1,x}$, as well as $NS_{t-1,x}$, when deciding to choose a certain product. Thus, the product choice of agent *i* in period *t*, $C_{t,i,x}$, is a function of $MS_{t-1,x}$ and $NS_{t-1,x}$,

$$C_{t,i,x} = f(MS_{t-1,x}, NS_{t-1,x}) . \quad (5)$$

Equation (5) can be further developed by introducing $B_{t,i,x}$, $S_{t,i,x}$ and two parameters α and β that depend on $MS_{t-1,x}$. Agent *i* chooses product *x* in period *t* when $C_{t,i,x}$ is equal to 1, where

$$C_{t,i,x} = \alpha \cdot B_{t,i,x} + \beta \cdot S_{t,i,x} , \quad (6)$$

and

$$\alpha = \begin{cases} MS_{t-1,x} \leq a \rightarrow 1 \\ otherwise \rightarrow 0 \end{cases} , \quad (7)$$

$$\beta = \begin{cases} MS_{t-1,x} > a \rightarrow 1 \\ otherwise \rightarrow 0 \end{cases} , \quad (8)$$

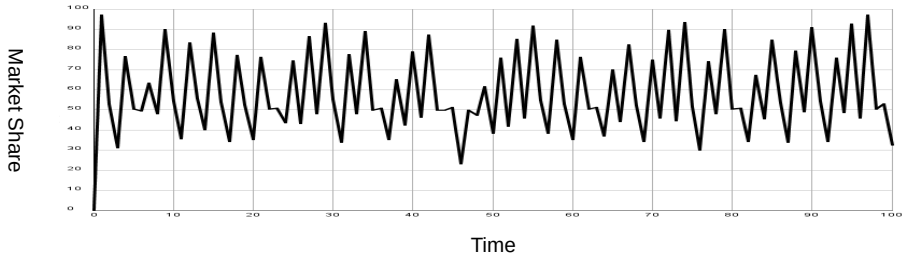
where *a* is a fixed parameter assigned at random.

4. Discussion

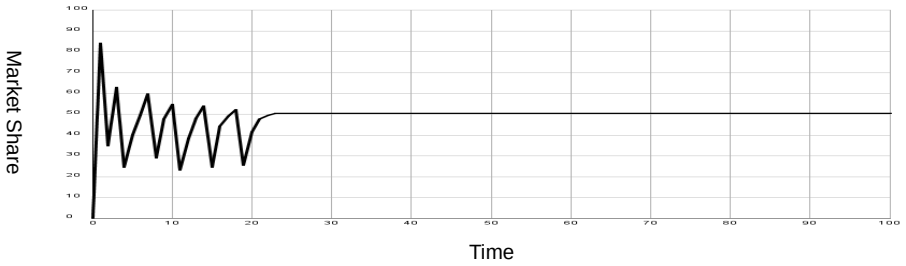
We simulated a virtual world with 400 agents (i.e., $n = 20$) and observed each simulation for 100 time increments. Figures 1 summarize the results for typical runs.

Figure 1: Simulation Results

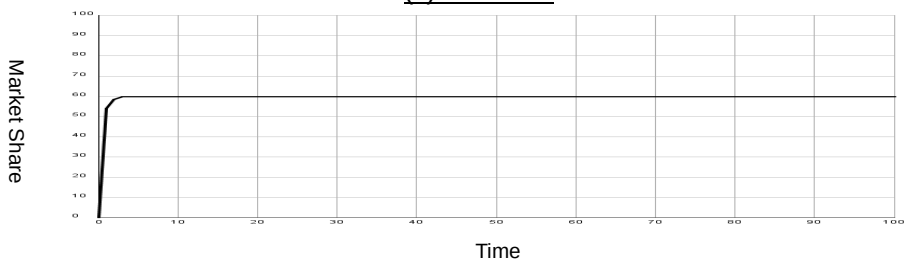
(a) Pattern 1



(b) Pattern 2



(c) Pattern 3

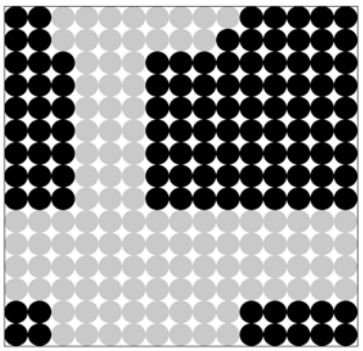


Note: In each figure, only market share of product *x* is depicted.

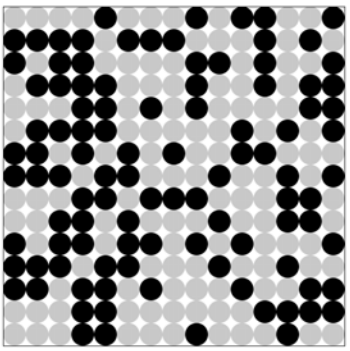
First, since all agents have different bandwagon thresholds, each agent chooses a certain product at a different time (see Figure 1 (a) and a part of (b)). In other words, one agent with a lower bandwagon threshold chooses earlier, and second agent with a higher bandwagon threshold does not choose the same product at the same time as the first agent. Increasing the number of agents who choose the same product, however, changes the conditions around the agent with the higher bandwagon threshold. Then that agent decides to switch to the product because $MS_{t-1,x}$ exceeds the agent's personal bandwagon threshold. This implies that the number of consumers who are impressed by a product, and the brand value of the product itself, can increase gradually. It is through the chain of communications with the bandwagon effect that the brand value can emerge in the consumption system.

Figure 2: Situations of Agents' Choices

(a) In Equilibrium



(b) Not In Equilibrium



Note: In the figures, black circles show agents who choose product *x* and gray circles show agents who choose

Second, while it is true that the brand value added to a product can emerge by communications with the bandwagon effect, it cannot continue to be stable. The typical results of each simulation show that the market share of a product sometimes decreases (see Figure 1 (a) and a part of (b)). Since each agent has a different snob threshold, he will abandon a product at a different time. This implies that each consumer evaluates a product lower because it is chosen by too many others to a different extent than all other consumers. If a chain of communications with the snob effect occurs, the brand value added to the product will collapse in the consumption system.

Third, we can observe the equilibrium of market share. Figure 1 (c) and a part of (b) clearly depict this situation. So, we further check the situations of consumers' choices at an arbitrary time and compare the situation in equilibrium with that not in equilibrium. As shown in Figure 2 (a), when in equilibrium, agents who choose the same products are locked-in spatially. In contrast, Figures 2 (b) demonstrates that agents who choose the same products are dispersed geographically when not in equilibrium. This implies that the emergence and collapse of the brand value is determined partly by spatial conditions. More specifically, consumption system cannot function well when communications with bandwagon effect and snob effect do not occur due to constant consumers' choices in particular areas. Although this finding is beyond our prediction, it would provide the interesting research subjects

5. Conclusion

We demonstrate that the brand value of a product can emerge and collapse spontaneously through consumers' communications. Even if the same products exist in a market, a chain of communications with the bandwagon effect adds the brand value to a certain product, while a chain of communications with the snob effect reduces it. This is expected to provide a new perspective to branding research. In other words, branding can be achieved not only by a firm's activities as suggested by the research on brand identity, but also by autopoietic communications in the consumption system. This also implies that the social system theory is a promising basis for research into consumer behavior and marketing. We suggest that it is also useful for simulating consumer behavior. Agent-based simulation in particular is expected to provide more insight into the dynamics of consumer behavior at the aggregate level.

Even so, our discussion is somewhat limited. First, we lack an empirical test to reveal the emergence and collapse of the brand value. Although we cannot test the validity of the phenomenon with a simulation because it is a mere analogy of the empirical world, it is challenging to collect concrete data about the phenomenon and test the empirical validity of it. Second, we focus on only one side of the marketing system (the consumption system). However, we should also consider the general marketing context, that is, exchanges or communications between consumers and firms. By considering not only consumers' communications but also firms' activities, we can conclude that the brand value is the structure of the marketing system. To demonstrate this concept more clearly, we should develop the model to also include the marketing system.

References

Aaker, D.A. 1991. *Managing Brand Equity: Capitalizing on the Value of Brand Name*, The Free Press, New York.

Aaker, D.A. 1996. *Building Strong Brands*, The Free Press, New York.

Ailawadi, K.L., Lehmann, D.R., and Neslin S.A. 2003. "Revenue premium as an outcome measure of brand equity," *Journal of Marketing*, vol. 64, no. 4, pp. 1-17.

Delre, S.A., Jager, W., and Janssen, M.A. 2007. “Diffusion dynamics in small-world networks with heterogeneous consumers,” *Computational & Mathematical Organization Theory*, vol. 13, no. 2, pp. 5-12.

Epstein, J.M. and Axtell, R. 1996. *Growing Artificial Societies: Social Science from the Bottom Up*, The MIT Press, Massachusetts.

Granovetter, M. 1978. “Threshold models of collective behavior,” *American Journal of Sociology*, vol. 83, no. 6, pp. 1420-1443.

Granovetter, M. and Soong, R. 1986. “Threshold models of interpersonal effects in consumer demand,” *Journal of Economic Behavior & Organization*, vol. 7, no. 1, pp. 83-99.

Keller, K.L. 1993. “Conceptualizing, measuring, and managing customer-based brand equity,” *Journal of Marketing*, vol. 57, no. 1, pp. 1-22.

Keller, K.L. 1998. *Strategic Brand Management: Building, Measuring, and Managing Brand Equity*, Prentice Hall, New Jersey.

Leibenstein, H. 1950. “Bandwagon, snob, and veblen effects in the theory of consumer’s demand,” *Quarterly Journal of Economics*, vol. 64, no. 2, pp. 183-207.

Luhmann, N. 1984. *Soziale Systeme: Grundriß einer allgemeinen Theorie*. Suhrkamp Verlag, Frankfurt, translated by Bednarz, J. Jr. and Baecker, D. 1995, *Social Systems*, Stanford University Press, California.

Luhmann, N. 1989. *Ecological Communication*, Polity Press, Cambridge.

Luhmann, N. 1990. *Essays on Self-Reference*, Columbia University Press, New York.

Maturana, R.H. and Varela, F.J. 1980. *Autopoiesis and Cognition: The Realization of the Living*, D. Reidel Publishing Company, Dordrecht.