

# SIGNS OF MARKETING IN VIRTUAL REALITY

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**Abstract:** Interactivity provides marketers with the means to deliver virtual realities custom designed for and by each consumer. With the help of computer-assisted marketing, consumers can form virtual societies and cultures. Consumers can be the architects of their virtual realities by selecting attributes. However, computers can assist the design of custom virtual realities, filling in details according to consumers' outlines and generating details according to the probabilities of consumer experience. In actual reality, objects do not occur isolated from other objects. Knowing the simultaneous occurrences of attributes, one can construct a virtual reality that evokes a sense of actual reality when it is imaginary. Marketers can calculate conditional uncertainty to discover which attribute signs have common preference among consumers and which have limited or idiosyncratic preference. This measure reveals predictability of one sign given a previously selected sign or assortment, and predictability of consumer characteristics from sign choice within assortment contexts. With this information, marketers can construct targeted virtual realities of signs that include consumption object icons or brands.

Virtual reality bases its appearance primarily on a particular kind of sign: the icon. The characteristic of this kind of sign is its physical or tangible resemblance to what it stands for, its referent. For example, a photograph of the Empire State Building is an icon of that structure, which has an actual, physical presence in an actual space. The icons of virtual reality may stand for actual objects, but they may also stand for imaginary objects or persons.

Actual realities contain other types of signs as well: indexes and symbols. An index acquires its meaning from contiguity or close association with its referent. A symbol acquires its meanings arbitrarily through convention and consistency of use. A copy of *The Wall Street Journal* may be an index of a successful business executive. The colors red, yellow and green on traffic lights are symbols with strictly conventional meanings. This article will refer to icons, indexes and symbols generally as the symbolic environment.

Many virtual realities would not be complete without indexes and symbols in addition to icons. A virtual city, for example, might seem odd without store signs, kiosks or billboards. Further, most objects consumers use have visible brands. Consumers have grown so accustomed to such indexes and symbols that they may not think of putting the signs into the virtual realities. Yet they would sense that the virtual reality was incomplete even without knowing specifically what was missing.

Despite their lack of detailed recall, consumers can be the architects of their own virtual realities. Just as an architect designed the Empire State Building before it became an actual reality, consumers can design the appearances of their own virtual realities by selecting attributes, dimensions, styles,

colors and other characteristics. However, just as computers assist the design of everything from buildings and production equipment to baseball bats, computers can assist the design of custom virtual realities.

As computers assist in the construction of virtual realities, they can fill in the detail according to consumers' outlines. The computer can generate the details according to the probabilities of consumer experience. With New York as a model, the icons of specific buildings, cars, even trees and birds have greater probabilities of occurring than other icons have in the consumer's New York experience. With Tokyo as a model, the probabilities are different. Similarly, the probabilities of indexes and symbols are different.

However, virtual reality can be more than just a representation of a tangible, actual reality. Tokyo and New York City are more than their infrastructures. Each city is populated by millions of people who give the cities their social and cultural characters. The physical cities are only artifacts of the people who have acted upon that environment. Structural signs are not enough to construct a virtual reality. Effective virtual realities will be those that better represent social and cultural locations that are meaningful to consumers. Meaningful signs create intangible social and cultural reality.

Societies and cultures have intangible qualities that are correlated to outward signs. Members of societies and cultures recognize their environments through presence or absence of signs. The same quality may have different outward signs in different societies or cultures. To many outsiders, a courteous New Yorker is an oxymoron because New Yorkers do not exhibit the same signs of courtesy that outsiders exhibit. Courtesy is an intangible quality that has different operational

definitions in different cultures. Cultures may agree that they value courtesy but disagree on how to recognize that value. The operational definitions that are signs of such intangible qualities constitute social and cultural locations. The signs must be congruent with signs of physical locations for effective virtual realities.

### **Actual, Virtual and Internal Reality**

The distinctions among actual, virtual and internal realities lie in the natures of the sensory inputs and in the subjects' control over the reality. For most people, an actual reality of New York City will have inputs to the five senses. The sights, sounds, smells, tastes and touches originate externally to the subject. Actual reality occurs, of course, in real time. The subject cannot replay the actual reality in order to perceive a different set of inputs. The number of inputs will generally be too great for the subject to process. Therefore, perceptual screens--physiological, psychological and cultural--select a manageable number of inputs for interpretation. Each input is a unit of cultural reality interpreted according to learned patterns.

Technology limits the sensory inputs that virtual reality can provide. Current technology permits accurate presentation of visual and auditory inputs but limits ability to present accurately inputs to the other three senses. The combination of sights and sounds, however, signifies a context that includes the other three senses. Therefore, the subject's interpretation includes mentally completing the context according to cultural expectations, providing the missing sensory inputs that belong to the context. This virtual reality can occur not only in real time, but also in replay, permitting the subject to perceive different inputs, interpret different cultural contexts and complete the contexts with different sensory expectations. Further, virtual reality permits creation of potential contexts, which do not exist actually, based upon cultural expectations.

Imagination, or internal reality, has no external sensory inputs. The subject creates an entire context mentally. The subject has complete control over context. Indeed, whereas the subjects in actual reality and virtual reality interpret signs according to context, the subject in internal reality begins with context and selects signs that belong to the context. The signs may be drawn from episodic memory of an actual context or an expectation of a potential context. The subject begins with an interpretation and selects the sensory inputs and context that signify the interpretation. This process can solve a fundamental communication problem. Marketers can utilize this process in developing and executing effective communication strategies for achieving a specific response.

### **Origin of Virtual Reality**

The topic of virtual reality usually refers to a sign system external to consumers that consumers interpret to be a representation of a possible reality. However, consumers' interpretations of the external system depend on congruence with an internal system. Clearly, people do not store actual objects in their minds; they store representations. When people draw upon their memories to reconstruct a situation, they draw upon an internal virtual reality. When people daydream, they construct internal virtual realities from possible configurations of a sign system. The difference between internal virtual reality, i.e. imagination or daydream, and external virtual reality is that the external is tangible. Therefore, more than one person can experience the external virtual reality simultaneously. Imagination is intrapersonal or reflexive communication; external virtual reality is interpersonal communication.

Language and other human sign systems utilize the original internal virtual reality. Every time someone speaks of an object or situation not actually present, that person refers to virtual reality. The interpretation of the listener is also a virtual reality, often different from that of the speaker. The utility of language as a code is founded on the ability to refer to realities that are not actual. Signification carries the possibility of lying (Eco 1976). The referent of any sign, even an icon, is an abstract entity that is a cultural convention (Eco 1976).

An icon of the Empire State Building stands for the set of all entities that physically resemble the sign. That set, as far as one might know, contains one concrete object located in New York City. However, the set may also contain a recently constructed concrete object in Las Vegas, Nevada. In fact, the icon signifies an abstract entity in the sense that it stands for the set of all possible, rather than actual, occurrences of objects that physically resemble the icon. Since the possibility exists for such an object to occur in the Amazon jungle, the icon of the Empire State Building stands for that abstract entity as well.

The meaning of a sign is not connected to a corresponding object. Signs are cultural units that signify cultural reality that is virtual, not actual. The sign, when transmitted, represents the virtual reality of the transmitter. When received, the sign stands for the virtual reality of the receiver. To the extent that the transmitter and the receiver share a cultural reality, the sign signifies that shared virtual reality. However, because of different relationships between the transmitter, the receiver

and their cultural context, no sign will signify the same virtual reality. Some significance will be idiosyncratic.

Signs signify not only the relationships between the ostensible referents and persons, but also the relationship between persons and context. An icon of the Empire State Building may signify a pleasant, sunny day and a polite cab driver, or it may signify a miserable, rainy day and a rude cab driver. The icon may represent the good time a couple spent visiting New York City, or the bad time they spent. The icon could stand for their disagreement over whether they spent a good or a bad time. Shared personal or cultural relationships with certain signs means shared virtual realities evoked by those signs.

### Signs and Reality

For the New York resident, New York is familiar and Tokyo is foreign though understandable. For the Tokyo resident, the converse is true. Not only will icons be familiar or unfamiliar. Cultural and social indexes are likely to be similarly familiar or unfamiliar since a successful Tokyo businessman, for example, is not likely to read *The Wall Street Journal*. (*The Asian Wall Street Journal* is likely to be unfamiliar in New York.) Many symbols, however, are likely to be as familiar in New York as in Tokyo and thousands of other locations.

The colors red, yellow and green on traffic light are familiar symbols around the world. People generally agree on the meanings for red and green, although the meaning of yellow seems to vary. A brand, when attached only to a specific product or category, can be an index of that product. Coca-Cola is a familiar index, as are McDonald's, Mercedes and many other global brands. The meanings of global brands as symbols, however, may not be universal even with, or especially with, the use of global campaigns. The signs that surround a brand in its marketing communications may be understandable globally, but not universally familiar and without universal meaning. Interactivity in virtual reality offers a remedy discussed below.

Icons not only signify possible occurrences of what they resemble, they also signify possible occurrences of an actual location or an intangible quality as well. In other words, icons can also serve as indexes and symbols. Further, attributes of icons, the tangible aspects, can serve as symbols. The Empire State Building is an index of New York City. However, its architecture stands for not only for a particular period in America, but also for the intangible qualities of an American attitude during that time period.

An icon does not signify itself. Since most brands share no physical resemblance to any actual referent, most brands can only serve as indexes or symbols. The brand IBM, for example, shares a physical resemblance only with itself. No matter how often the brand may be reproduced, each reproduction signifies itself among every other reproduction and all possible reproductions. As indexes, brands acquire meaning from contiguity with an actual referent. The brand IBM may occur contiguous with a corporation or piece of equipment, but it does not resemble the corporation or equipment. As symbols, brands acquire meaning from arbitrary association with an actual referent that may be tangible or intangible. Therefore, the brand IBM can signify business experience.

In some cases, a brand can be an icon as well as an index and a symbol. An icon of the Rock of Gibraltar, for example, signifies an actual referent and all possible occurrences. However, a specific icon of that actual referent is also an index of Prudential Financial, selected as a symbol to signify permanence and durability. An icon of the late Harlan Sanders is an index of KFC, formerly Kentucky Fried Chicken, and a symbol of genuineness. Merrill Lynch uses an icon of a bull as an index because of its symbolic value to convey the arbitrary but conventional meaning of bullish. Except in cases such as Colonel Sanders, the founder of Kentucky Fried Chicken, icons as brands have no inherent association with the product or service. They are part of the arbitrary, conventional sign system that constitutes a social or cultural reality.

In actual reality, objects do not occur isolated from other objects. Where one observes a skyscraper, one probably will observe other structures. The probable attributes of those objects depends upon the location. Where one observes a certain kind of animal, tree or land form, one will probably observe other kinds of animals, trees or land forms. The probabilities of occurrence depend upon location. If one knows the simultaneous occurrences of various attributes, one can construct a virtual reality that evokes a sense of actual reality when, in fact, it is imaginary. One can create the familiar place the consumer has never seen before.

Icons of objects that are unique in actual reality do not have probabilities of simultaneous occurrence. When a replica of the Sphinx and a pyramid appeared in Las Vegas, Nevada, no replica of the Nile River appeared nearby. However, indexes and symbols derive their meanings from probabilities of simultaneous occurrence and consistency of use. By using the probabilities, marketers can create virtual realities with meanings that are predictable to specific groups of consumers.

With virtual reality, marketers may recreate actual locations when appropriate. Marketers may also create new social and cultural locations not based upon physical proximity or actual location. Art Deco architecture and palm trees may evoke Miami to a virtual culture. Whether that Miami is actual or imaginary is irrelevant. Consumers' perceptions of simultaneous occurrence probabilities of signs and their meanings are what is relevant. Attributes of icons that consumers have never observed in actual reality still convey cultural meaning. The imaginary virtual Miami signifies those abstract cultural qualities.

### **Virtual, Interactive and Online Experience**

Virtual reality is distinct from interactivity or online experience. Any experience is interactive--whether actual, virtual, online or offline--otherwise the experience has no meaning. The nature of the experience depends upon the subject of the experience. The interaction between the subject and the environment determines the nature of the experience. How the environment comes to the subject is irrelevant. The subject's interpretation of the environment determines its reality. Marketers can influence the subject's interpretation, however, by placing signs within the context of specific other signs.

A printed version of the Land's End catalog is interactive in the sense that the reader responds to the models, the clothing and the words in the catalog, giving meaning to those elements. The photographs are icons that signify potential occurrences. Although the models are not the reader, the models can signify congruity with or completion of the reader's self. Alternatively, the models can signify the reader's reference group, i.e. the reader's social environment or location. The reader produces significance through psychological and emotional interaction with the catalog. Further, the reader can interact physically with the catalog to change clothing styles by turning the page.

The online catalog offers more opportunities for physical interaction. The reader not only can select different styles on different pages, but different colors, clothing combinations, and even different models or the reader herself on the same page. However, the online catalog does not constitute a virtual reality simply because it arrives to the subject online and offers greater opportunity for interaction. If the subject interprets the online catalog to be a virtual reality at all, the interpretation will likely be a virtual reality of an actual catalog. To elicit a more complete sense of virtual reality, the catalog would have to offer environmental contexts, both natural and social,

within which the subject would probably encounter specific clothing combinations.

### **Assortments**

Researchers generally refer to meaningful combinations of attributes as variables. However, when those attributes are consumption objects or possessions, consumer researchers have called the combinations assortments (Alderson 1957), bundles (Green, Wind, and Jain 1972), constellations (Solomon and Assael 1987), chains (Kehret-Ward 1987) and complementarities (Holbrook and Lehman 1981; Solomon and Englis 1994). In these combinations, objects are indexes and symbols. Each is a unit of meaning within a syntax of context.

The meaning of each unit may be small, contributing little by itself to a virtual reality. Isolated choices are but unrelated fragments of a reality. Signs must form a coherent pattern before they are more than a collage (Leymore 1975). A dictionary is not a novel even though the dictionary contains all the words of a novel. Elements of consumers' symbolic environment presented independent of occurrence probabilities will not form a virtual reality, but merely a catalog. Even a domestic decor that might be described as postmodern garage sale has a structure. The elements form a structured system such that any change in any one of the elements changes consumers' interpretations of the virtual reality.

When acquiring products, consumers often select from among functionally equivalent objects based upon some attribute that is only symbolically significant (Lowrey et al. 2001). In that sense, functionally equivalent objects constitute a distinct paradigmatic class. The distinct symbolic attributes of objects within the class offer consumers a choice of meanings. These attributes may be actual differences that have become symbols, or they may be pure symbols, such as the different brands attached to parity products. Consumers combine selected attributes from selected classes to define their symbolic environments. They construct their social and cultural locations with products as icons or indexes and brands as symbols.

Marketers can assist consumers in creating virtual social and cultural locations that feature more than just icons of actual environments. With consumer databases, marketers can calculate the probabilities of bundles, constellations or chains. Some chains may be intuitive. If a consumer uses a toothbrush, for example, one would expect a high probability

of toothpaste use. Other combinations are not so obvious, such as an observed probability of Kentucky Fried Chicken users to be heavy eye makeup and nail polish users (Tigert, Lathrope, and Blegg 1971). Tracking the probabilities allows marketers to keep the virtual environment current, such as when Kentucky Fried Chicken later became associated with denim, camping and TV Guide (Aaker 1991).

The above studies concern a specific brand of fried chicken, but the associated products were unbranded, entire paradigmatic classes, i.e. generic objects. For any other specific brand, consumers can build the object context through virtual shopping, the act of selecting virtual products without risk. In a game-like situation, consumers can build the entire virtual environment, not only of associated products, but of peripheral and incidental products as well. Consumers can put fried chicken on the kitchen table, eye make-up in the bathroom, blue jeans in the closet and a swing set in the back yard. Through virtual reality, consumers can choose the products that belong in any context, from staying at virtual home watching soap operas to fly fishing in virtual Wyoming.

The process is dynamic, with continuous data collection and analysis. The research is unobtrusive--researchers need not visit consumers' houses to look through closets--and will likely reveal ideal rather than actual contexts. The ideal context is that which consumers perceive to be the correctly constructed context. The actual context is that in which consumers find themselves. If the consumer has chosen all the objects actually correct for a given context, the ideal and the actual will be congruent. However, through object selection in virtual reality, consumers can edit contexts to eliminate compromises or mistakes in actual object selection. In other words, consumers can construct their dream worlds, their ideal virtual realities.

### **Brand Consumption**

So far in this discussion, virtual reality has allowed consumers to construct a world of objects around a single branded product. The objects are part of a structured system. However, brands constitute another level of structured system. Given a context of a structured system of objects that are parity products, virtual reality allows consumers to select the associated brands. With brands as a structured system, a change in any one brand will affect how consumers perceive the context.

Further, since brands can be either indexes or symbols, the virtual reality need not comprise a virtual warehouse of

objects. The brand stands not for a product, but for a distinguishing aspect of a cultural entity. It stands for a certain quality or unique value proposition. The brand is an index of the quality or value. But in parity situations especially, any product in the paradigmatic class, i.e. product category, will have nearly the same inherent qualities as all others in the class. Each will be a paradigm example.

Therefore, all branded objects in the class are the same cultural entity with nearly the same inherent qualities or semantic features of the class. However, through marketing, brands acquire the additional significance: arbitrary qualities or values that distinguish consumers rather than products. As symbols, brands signify those qualities. Through consumption, brands transfer significance to consumers. Finally, brands become indexes of consumers rather than of products, signifying consumers as cultural entities.

Each brand in the structured system gives additional information about the consumer. However, consumption of any brand does not occur in isolation. Brands interact in a syntax of significance. If one knows that a person consumes Coca-Cola, one knows very little about that person. With each additional brand consumed, one learns more about the person according to the qualities the additional brands signify. A great number of people may consume several of the same brands along with Coca-Cola before choices diverge. In the past, marketers could often find that pursuing divergent groups was not cost-effective. Consumer choices in virtual reality allow marketers to follow divergent choices until they become completely idiosyncratic and unpredictable.

Although marketers cannot be certain of consumer choices in constructing virtual realities, they can approximate choices by reducing uncertainty. A first-order approximation of consumer choice is based upon the probability of any single consumer choosing any single sign for a symbolic environment. A second-order approximation is based upon the probability of any consumer choosing a second sign given the choice of a first sign. The process continues through third-order, fourth-order and so on until subsequent probabilities indicate insignificant additional meaning, i.e. small sign value, to consumers.

Amazon.com provides an example of using first-order approximation. For any given title selected, they recommend other titles chosen by purchasers who selected the first title. They would be using second order approximation if they listed additional titles chosen by those who had selected two other specific titles. If Amazon.com were to use higher-order

approximations based on a database of all purchases, they could determine the assortments or bundles that consumers would probably select. By putting these complementary titles on web pages, they could stock consumers' virtual libraries.

### **Brand Meaning**

Brands become consumer signifiers rather than product signifiers because of the qualities brands signify to consumers. Tide does not signify any specific container of laundry detergent. Nor does it signify all possible containers of laundry detergent. The brand is an index of laundry detergent because consumers observe a significant probability of Tide occurring contiguous to laundry detergent. But consumers may observe a higher probability of the brand contiguous to other symbolic elements in advertising that is not contiguous to laundry detergent. The brand acquires meaning from that symbolic context. Tide, then, signifies a unique quality no other brand can claim, a quality not found within the container. Further, the brand signifies all possible occurrences of that quality, or all possible cultural entities to which the quality applies. Those cultural entities are consumers.

However, the strength of a single brand to construct a virtual reality is no greater than the strength of a single product ingredient to clean laundry. Each brand as a component or ingredient makes a virtual reality more or less effective. Combinations of brands convey greater meaning than isolated brands. As discussed above, marketers can learn which brands form bundles meaningful to various consumer groups simply by analyzing probabilities of occurrence within the bundles that consumers choose. However, marketers can also assist consumers in constructing bundles by learning what brands mean and combining brands with similar meanings.

Consumers may not be able to articulate verbally the meaning of a brand. However, consumers can reveal associations by putting brands onto icons and contexts in virtual reality. Consumers may not be able to tell what quality a brand signifies, but they can indicate how they recognize that quality when they see it. In fact, for building brand meaning in virtual reality, verbal expression of meaning is often less useful than other symbolic expressions. If consumers give a verbal expression of meaning, marketers must still choose nonverbal elements to construct a virtual reality that evokes the meaning. When consumers give the nonverbal elements, all that remains is the proper arrangement of those elements.

Through something as simple clicking on symbols seen on their screens, consumers can select what they perceive to be

the semantic features of a brand. Since brands begin as indexes of products, one can expect consumers to associate a brand with a product. However, the selected symbols will reveal abstract qualities that brands signify as well. The symbols that consumers select will be the indexes and signs of the abstract quality. The set of consumer responses will yield probabilities of occurrence for each symbol selected and reveal consumer agreement.

Occurrence probabilities allow one to distinguish common responses from idiosyncratic responses for single brands, thus revealing agreement on brand meaning. Additional data manipulation allows one to discover idiosyncrasy and commonality of meaning among brands. If one finds that brands across product categories share similar meanings, those brands may constitute a bundle. For example, if consumers click on the icon of an oak tree for several brands across categories, one may have found a bundle or a complementarity. Further investigation would reveal whether higher order approximations are similar. One need not know what the oak tree icon signifies to consumers, only that consumers associate the icon with certain brands.

### **Global Brand Meaning**

The above techniques reveal what associations consumers may already have with brands. However, marketers are also concerned with influencing brand associations. With global brands, one would want a brand to evoke the same association in all markets. Whether the brand will stand for a concrete quality of the product or an abstract quality of the consumer or culture, the communication challenge would be the same; one would have to select the best approximation of symbols to convey the desired meaning. This is the Level B communication problem Weaver (1963) introduced.

In this situation, one would not seek to discover the meaning of the brand. Rather, one would seek to establish or reinforce meaning by discovering the symbolic context in which to place the brand. One already would know what a brand could mean in the global market. For each market, one would repeat the process discussed above. Consumers would reveal how they recognize a certain quality by clicking on the contexts, indexes and signs that represent that quality to them. Including the chosen symbols in composing the symbolic context of the brand would result in meaning transference from the symbols to the brand. The symbolic context would signify the brand, which then would become a symbol of the context (Leymore 1975).

The same brand in different markets can have different symbolic contexts but the same meaning. In fact, with distinct cultural contexts, the brand will convey more effectively the same association. As discussed before, different symbols constitute the familiar urban and rural settings in virtual reality for the Tokyo and the New York resident. In the same way, different symbols will convey a specific quality to those residents. The New York resident might understand the settings familiar to the Tokyo resident, but the settings would be foreign. The Tokyo resident might understand symbolic context familiar to the New York resident, but the context would be foreign. Not only the physical location, but also the cultural location constitutes virtual reality.

The approach discussed here permits a global consumer or brand culture to develop across local cultures. Products as objects often carry cultural meanings. Their concrete attributes and functional consequences carry cultural value. Brands have unlimited latitude of meaning because they have no functional consequences proceeding from concrete attributes. Brands have tangible, concrete appearances, but no function except as signifiers. Therefore, brand meaning can cross cultural lines when product meaning cannot. Although McCracken (1990) limited the meaning transfer model to local cultures and to products rather than brands, the product is merely a vehicle for the brand in the transfer process. Through brand consumption, consumers transfer meaning to themselves, defining themselves as cultural entities.

When consumers select elements for the symbolic context, they begin the process of meaning transfer that will ultimately return to themselves. The process is reflexive since one asks consumers to assist in constructing messages to themselves. If one wants a brand to mean "wisdom," for example, one asks consumers to select symbols they recognize as signifying that quality. Placing the brand within the context of the symbols that consumers selected transfers the meaning, "wisdom," to the brand. Brand consumption transfers the meaning to consumers, who recognize the meaning because they selected the symbolic elements for the context.

Humans do not convey ideas directly. Rather, they convey the sights, sounds and other tangible elements that stand for ideas to others (Cleveland 1986). Since different local cultures may recognize the quality, "wisdom," in different ways, a brand would require different elements to construct the symbolic context. The process would be the same in each culture, with consumers selecting the elements within their cultures that signified "wisdom." Just as one uses different words to express

the same concept in different linguistic communities, one must use different symbolic elements in different symbolic communities. Consumers should not have to learn that an icon of an owl signifies "wisdom" before they can transfer that meaning to the brand and then to themselves.

Language is only part of consumers' symbolic environment. The significance of other signs varies across cultures. Although some cultures may share meanings of some signs, one needs to be wary of false cognates. Signs that appear similar or seem to have similar use may, in fact, have distinct meanings. The signs of one culture may appear familiar, even understandable, to another culture and still be a foreign system. Selecting domestic signs for the same quality in each cultural environment can create brands that are globally local. Ultimately, successful brands become global elements in a global symbolic community.

## METHODS

Information theory provides a useful mechanism to determine the approximations of sign occurrences. Marketers can calculate conditional uncertainty in discrete noiseless systems (Shannon 1963) to discover which signs have common preference among consumers and which signs have limited or idiosyncratic preference. This measure can reveal the predictability of one sign given that a consumer has selected another sign or an assortment of other signs. With some data manipulation, the measure can also reveal the predictability of a consumer characteristic from the choice of a sign in the context of an assortment of other signs.

The measure of uncertainty, which Pennington (forthcoming) discussed in detail, derives from probability of occurrence within a context. Uncertainty is inversely related to probability. The measure is the average number of systematic guesses one would have to make to find the correct attribute. In a simple example, discovering a single correct square on a chessboard (64 squares) requires six systematic guesses. With fewer choices, uncertainty is reduced. The higher the predictability, the lower the average number of systematic guesses. Predicting the symbolic elements for constructing virtual reality is more complicated than discovering a square on a chessboard, but the principle is the same.

When applied to psycho-linguistic research, this technique was the methodological foundation of semantic space theory (Osgood, Archer, and Miron 1962). Richins (1994b) recommended using the technique to discover meanings of possessions, and Pennington (1999) demonstrated its utility in

discovering brand meanings. Applying the technique to constructing virtual reality is an extension of the same process. In the study of product or brand meanings, the product icons or brands are the independent variables. In the semantic space study, the independent variables were words that signified concepts common to all cultures. Where products and brands are common to multiple cultures, the study is essentially the same in that one seeks to discover the cultural meanings of signs that signify cultural concepts. Unlike the semantic space study, virtual reality studies do not require translation and back translation of stimulus signs. However, one may want to translate response signs in some situations.

Without manipulation, the data set may not yield much information concerning responses. With each respondent as a case and stimulus signs as independent variables, one can determine the frequency of specific responses and whether the responses were significantly different. That information may be interesting, but not useful. However, using SAS to manipulate data sets, response signs, stimulus signs or respondents can become either independent or dependent variables. Which are independent and which are dependent depends on what one wants to discover.

In constructing virtual reality, one needs to predict a specific sign, given that another sign or group of signs has already occurred. In this case, the stimulus sign is the independent variable, and the response sign is the dependent variable. The uncertainty measure is based on the number of subjects who responded with specific signs. The lower the measure for each successive sign, the higher the predictability. A high uncertainty value means many subjects gave the response to many stimuli; the sign may be useful in many symbolic contexts. If an equal number of subjects gave each specific response to each stimulus, the uncertainty would be the base-two logarithm of the number of responses.

If a specific response occurs only with a single stimulus, the uncertainty value is zero. When one knows the stimulus, one also knows the response. Therefore, an uncertainty value of zero for a response means that subjects gave the response to a single stimulus. However, the uncertainty value would also be zero if a single subject gave the response to a single stimulus. To eliminate idiosyncratic responses, then, one needs to specify minimally acceptable frequencies.

When one wants to discover sign meaning, one must first decide whether to look for convergent or divergent meanings. Osgood, Archer and Miron (1962) looked for convergent meanings. Pennington (1999) looked for divergent meanings.

If one wants to discover which signs have similar meanings, as in which brands from different categories might be complementary, one looks for convergent meanings. If one wants to find the distinctions between brands within a category, one looks for divergent meanings. The uncertainty measure distinguishes between the two types of meaning. Low uncertainty generally means divergent meaning; high uncertainty generally means convergent meaning.

When looking for either divergent or convergent meaning, one needs to know the predictability of the stimulus, given a known response. In this case, the response sign is the independent variable and the stimulus is the dependent variable. The measure is based upon the number of subjects who gave specific responses to specific stimuli. For example, using various icons as stimuli, if subjects give the response word, "wisdom," only for an icon of an owl, the uncertainty measure for the word will be zero. As above, the use of the word by a single subject with a single stimulus also yields an uncertainty of zero. Therefore, if one wants to eliminate idiosyncratic responses, one needs to specify minimally acceptable frequencies.

However, if one finds the same response, "wisdom," for an icon of an open book, an oil lamp and several other stimulus signs, the uncertainty measure of the word increases. Given the response, one has several possible stimulus choices with apparently convergent meaning. If an equal number of subjects associated the word with all stimuli, the uncertainty would be the base-two logarithm of the number of stimuli. However, this result would also occur if only a single subject used the same word with all stimuli. A specific frequency limit would not eliminate this problem since it could not distinguish between the response of one subject and those of other subjects. Large numbers of variables make constructing a contingency table impractical and visual inspection laborious at best. Fortunately, further manipulation yields uncertainty as a measure of idiosyncrasy in responses.

To discover idiosyncratic responses, one needs to know the predictability of the subject given that a specific response or group of responses has occurred. In this case, response sign is the independent variable and subject is the dependent variable. The measure is based on the number of stimuli to which each subject gave a specific response. If only a single subject gave the response to any number of stimuli, the uncertainty will be zero. When one knows the response, one knows the subject. If all subjects gave the response to an equal number of stimuli, the uncertainty would be the base-two logarithm of the

number of subjects. This would occur if each subject gave the response either to a single stimulus or to all stimuli.

The techniques described above are only the simplest analyses possible using information theory. Other analyses are more complex, yet not difficult to execute with modification instructions written for SAS. For example, one may not want to know whether a response came from a single subject, but rather from all subjects with a common characteristic. Using the technique for identifying idiosyncratic responses, one can determine whether a response came only from subjects living in Tokyo or any other geographic location coded into the data set. In this case, one looks for the uncertainty of subject characteristic given a specific response or set of responses. One can investigate the symbolic environment around any subject characteristic or set of characteristics. Alternatively, using the technique to find meaning, one can determine the uncertainty of a response or set of responses given a subject characteristic or set of characteristics.

Further, information theory can be a source of stimuli for more detailed data collection. One can determine which brands consumers perceive to be binary opposites, and use the results as either stimuli or responses in further research. For example, if Marlboro is rugged and Camel is smooth, one can determine which elements constitute the symbolic environment of each. This is a variation of the semantic differential technique using nonverbal signs. Combining this technique with factor analysis will reveal which elements subjects perceive as most strongly conveying specific associations.

### IMPLICATIONS

Consumption of any brand occurs within a context of other brands and objects. Virtual realities appear more real to consumers when they include signs that consumers perceive to be appropriate. A single sign in isolation will not suffice to create a virtual reality. An icon of the Empire State building will not appear to be New York City, although it may be an index of the city. Often, consumers recall actual realities inaccurately. They recall the features and attributes that they expect according to a sense of probability. Although consumers cannot construct the parts of their actual realities constructed by others or by nature, they can select the features they perceive and retain. Essentially, they construct virtual realities out of the elements of actual realities.

However, consumers do actively construct much of their actual realities through selecting possessions that are

meaningful. Various objects have public and private meanings for consumers (Richins 1994a). The objects with which consumers surround themselves express their identities, distinctions and associations. Objects with private meanings stand for how consumers perceive themselves. Objects with public meanings stand for how consumers want others to perceive them.

Possessions are indexes and symbols of specific types of people. Consumers select different signs depending upon context of situation and the types of subjective, objective and reflexive persons consumers wish to be. In a sense, objects are stage props that allow the audience to know something about the character. Consumers use objects with private meanings to define themselves individually. They use objects with public meanings to define themselves within an assortment of other consumers.

In addition to objects as icons and indexes, consumers surround themselves with symbols having arbitrary and conventional meanings fixed by consistency of use. Language is perhaps the most obvious example. However, within the context of consumption, brands are symbols that often do not signify any tangible distinction in the products to which they are attached (Pennington 2000; Duncan and Moriarty 1997). Instead, they stand for some abstract quality consumers want to associate with themselves. Consumers select a brand for the attribute, quality and characteristic it expresses. However, they generally do not consume brands in isolation any more than they use words in isolation.

Assortments refine meanings. Changing a single object or brand can change the meaning of the assortment in consumers' perceptions (Lowrey, Englis, Shavitt, and Solomon 2001; Alderson 1957; Haire 1950). Marketers can distinguish target groups according to their selections of signs within the context of an assortment of other signs. The technique involves determining the approximations of signs among consumers with specific characteristics. For example, given the selection of Brand X and Brand Y, the female consumer may select Brand Z and the male consumer may select Brand A.

Further, by reversing the process, marketers can establish a sign value for a brand by placing it within a context of icons, indexes and symbols. With signs that a consumer or group of consumers uses to stand for an attribute, characteristic or quality, marketers can transfer the meanings of those signs to a brand. However, different consumers or consumer groups will convey the same attribute with different signs, depending on location and culture. With interactive marketing, marketers

can discover which signs are appropriate for which consumers. Although the signs surrounding a specific brand may vary, the meaning of the brand can be universal.

With this information, marketers can construct targeted virtual realities that comprise consumption object icons and brands as signs. Marketers can learn how to increase the value or improve the assortment of specific signs in virtual reality. The increased value or improvement lies in the meanings consumers attach to the combinations. Interactivity provides marketers and advertisers with the means to deliver virtual realities custom designed for and by each consumer. With the help of computer-assisted marketing, consumers can form virtual societies and cultures.

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