

Sensory and Cognitive Aspects of Food Preference



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1. Factors contributing to the formation of food preferences
2. Examples of some of our research into the understanding of food preference and choice

Cultural Preferences

- Taboo or Not Taboo
 - Meat (pork, beef)
 - Spices (garlic)
 - Insects (locus, water beetles, caterpillars)
 - Pets (dogs, cats, horses, donkeys)
 - Primates (monkeys, humans)
 - Offal (liver, kidneys, lungs, tails, tongue, udder, mesentery, spleen, intestines, brain, eye balls, blood, testicles)

Source: Jeremy MacClancy (1992) "Consuming Culture"

What is extremely objectionable in one culture is a delicacy in another. The food preferences which we have are as much an indication of our culture as they are about ourselves. In the book "Consuming Culture," anthropologist Jeremy MacClancy (1992) discusses the historical and cultural reasons for our vast differences in food preferences. For example, while pork and beef are readily consumed in western culture, pork is seen as unfit for consumption by those practicing strict Islam and Judaism. Hindus view cows as sacred animals. British and Scandinavian countries traditionally dislike garlic, a basic cooking component in Southern European cuisine. Consumers from western culture abhor the eating of insects, while they are viewed quite positively in other global areas. Arabic North Africans will munch on locus dumplings, water beetles are consumed in Laos, and moth caterpillars are eaten in South Africa. All sorts of offal combinations are traditionally consumed by some cultures, while thought of as disgusting by others. Monkey brains are a delicacy of Southeast Asians, fish eyes are a measure for good luck among Chinese. Innumerable ways have been created to consume the innards animals, both in the name of exquisite new forms of cuisine or as a tradition.

Cultural Preferences

- Food Attitudes and Beliefs
 - Functional
 - Sustenance, healing, aphrodisiac
 - Ethos
 - SE Asia and Rice
 - Holy Sacrament
 - Avoidance
 - Vegetarianism (religious, healthiness)
 - Food components (additives, fat, sugar)

Source: Jeremy MacClancy (1992) "Consuming Culture"

Foods are preferred for many different reasons. Apart from functional reasons such as a form of sustenance, they can be consumed for a variety of functions. Herbs are added to not only impart taste and increase a dishes shelf life, but are added as remedies. Chicken noodle soup is sworn by some as a cure for cold ailments. Koreans grind up deer antlers, Chinese eat sea-slugs and make tea out of ginseng root as an aphrodisiac.

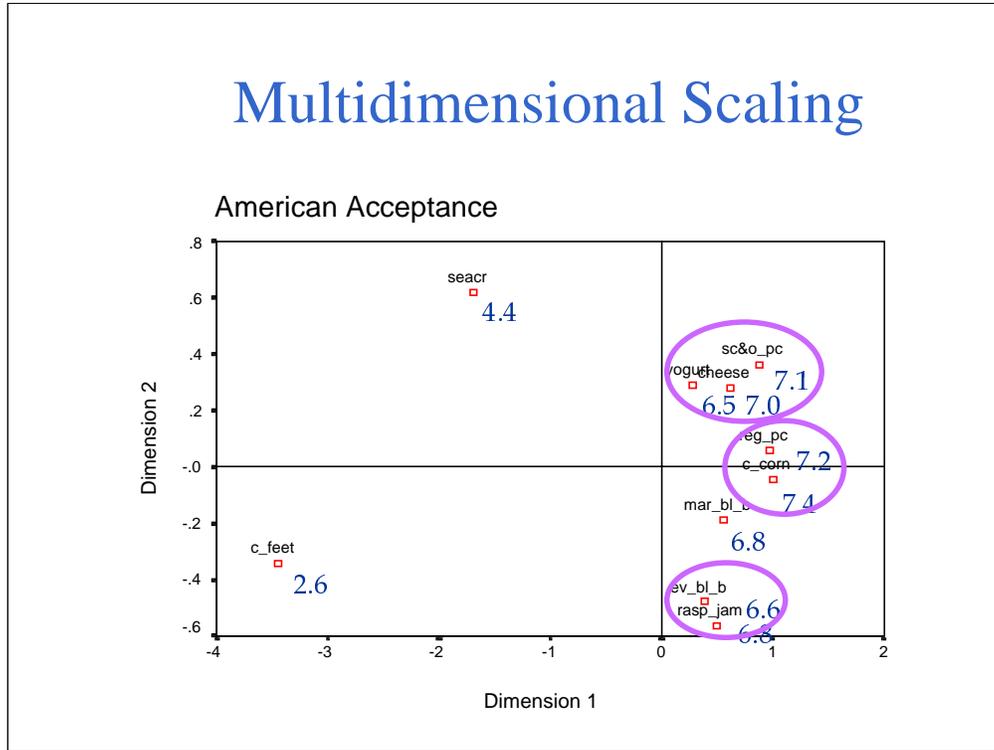
The consumption of some foods in various cultures are a direct result of their ethos. Christians view the Holy Sacrament as the embodiment of Christ. Many Thai view rice as the building blocks by which their bodies are made. The Hua people in Papua New Guinea do not believe in gods and the afterlife. Their ethos is based on food in the form of *nu* the sustaining substance of food that gives vital essence to one's life.

Some food preferences are based on as much avoidance, as selection. Vegetarians may avoid meat, eggs, dairy, or other components as part of their ethos or as a health belief. Other consumers may avoid processed foods or food additives for beliefs in food safety. Other consumers may avoid various natural foods for fear of their food safety.



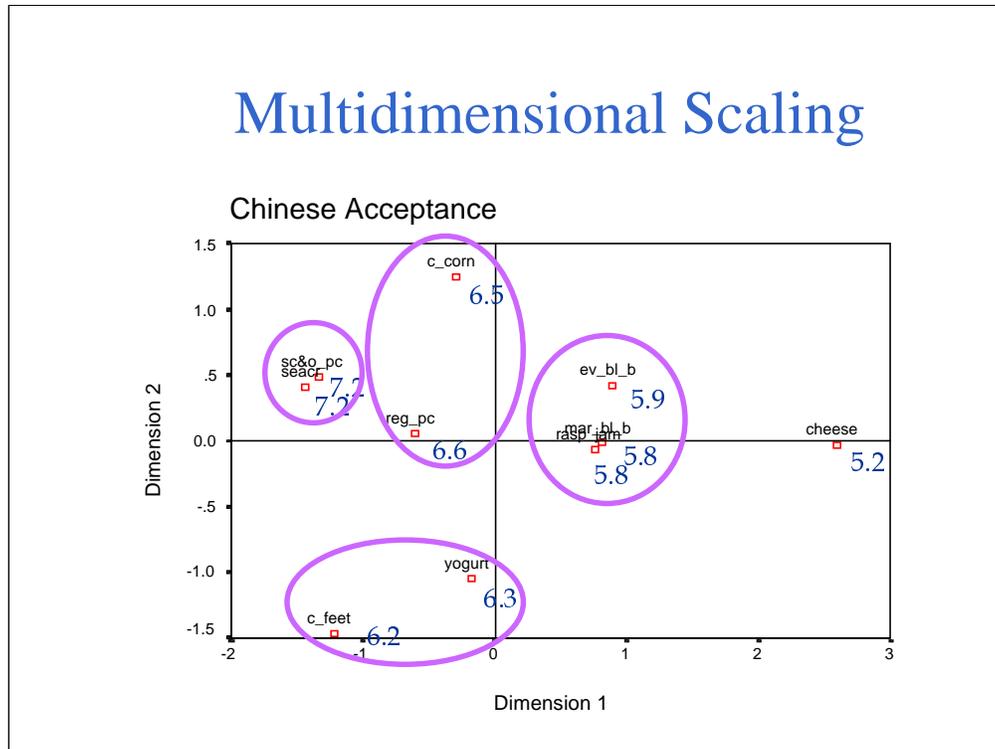
The puffer fish (*fugu*) is consumed in Japan for its delicacy and euphoric effects. Strictly trained chefs carefully prepare the fish into only the smallest strips of skin, ovaries, liver or intestines. These components contain tetrodotoxin, hundreds of times more toxic than strychnine or cyanide. This neuro-toxin can cause complete neuro-paralysis and death. In spite of the skill of these special chefs, over 300 Japanese are reported to die each year from *fugu* poisoning.

Multidimensional Scaling



Food preferences can be measured by collecting ratings from hedonic scales. Hedonic, from the root word “hedonistic,” is a measure of liking or acceptance. Ratings by a group of consumers to a variety of foods can be displayed in maps such as this. The further apart the foods on the maps the more different the hedonic ratings. On a nine-point hedonic scale (the higher the score the more liked) this map shows how American college age students rated potato chips (reg_pc) and caramel corn (c_corn) the highest, and fried chicken feet (c_feet) the lowest.

Multidimensional Scaling



Chinese students of the same age had very different food preferences. Here chicken feet scored the highest and sharp cheddar cheese the lowest in liking.

It is clear to see that these differences are very distinct. However, being to measure liking and to understand the reasons behind liking are vastly different.

Development of Food Preference

- Unlearned Factors
 - Innate preferences (liquids and soft foods, bland flavors, sweetness)
 - Innate aversions (sourness, bitterness)
- First Impressions
- Visual Associations

Source: Bernard Lyman (1989) "A Psychology of Food"

To understand the factors underlying food preferences, one must go back to the roots for preference formation. Infants have innate preferences for sweet, bland flavors and liquid, soft foods. They also avert to sour and bitter tastes.

These innate qualities seem to be shared by all humans. However, from the beginning (perhaps even prenatal) there are initial impressions that affect our preferences. Visual associations give rise to visual cues that affect later preference. The stages of early child development such as oral sucking and biting give rise to new experiences. Pleasant or unpleasant experiences may be associated with different sensory stimuli.



Development of Food Preference

- Rewards
- Acquired Food Aversions

Source: Bernard Lyman (1989) "A Psychology of Food"

As a child develops, food plays an important role in our psychological and well as our physical development. Food may become a power tool for parent and child resulting in experiences and association which could lead to preferences. Specific foods may become associated as a reward. Foods can become associated with cognitive processes such as thoughts, images, and ideas. They may also be associated with emotional feelings.

Our long-term preferences are based on both likes and dislikes. These likes and dislikes are the result of integrated qualitative experiences (negative and positive). If a first impression is negative and subsequent experiences are positive, the degree of liking may only slowly increase. Conversely, a positive first impression, followed by a negative will result in fairly rapid loss of hedonics.

Our learning is a life long process. Traditional learning theory suggests that if enough positive rewards are given (e.g. praise to eat cooked liver) and no negative experiences occur, then repeated exposure will result in eventual liking. However, in the case of food preferences, the sense of taste can become a constant negative factor (e.g. bitterness sensitivity). Therefore, the sensory aspects of foods are as important as the psychological (cognitive) aspects. That is ... reward only works when the food falls within acceptable bounds.

A different process occurs in the case of acquired food aversions. Here a negative association may be created with a food intolerance or reaction. While few aversions are truly associated with illnesses, many are from conditioned responses such as an association to some unpleasant experience.



Development of Food Preference

- Incidental Learning
 - Familiarity and Exposure
 - Novelty

Source: Bernard Lyman (1989) "A Psychology of Food"

Most food preferences are acquired through incidental learning processes. These include repeated exposures that result in familiarities to foods. Familiarity accounts for many preferences tied to culture or family. We tend to like the foods which we are familiar. Conversely, David Peryam (1963) showed how low levels of exposure do not alter preference.

Children tend to dislike novelty or new foods. Novelty foods evoke fear and apprehension. However, novelty foods can also evoke curiosity. Foods that are slightly or moderately novel can actually be preferred, especially among individuals seeking the stimulation from new experiences. Therefore, personality types can be important factors in creating food preferences.



Emotion Relationships to Food Preferences

- Aroma-Memory
- Physiological
 - Emotions can illicit thirst or hunger
- Psychological
 - Reduce Undesirable or Extend Desirable Emotions
 - Angry, Bored, Frustrated - Crunchy
 - Sad, alone - Soups
 - Love - Gourmet foods

Source: Bernard Lyman (1989) “A Psychology of Food”

Aroma stimulation s are hardwired into the the memory processing center of the brain. Memories are stronger for events with emotional experiences. Therefore, emotions can be closely related to aromas and food preferences.

In addition to aroma-memory associations, there are both physiological and psychological reasons for food preferences. Physiologically, emotions can accentuate thirst or hunger causing indirect associations.

Psychologically, food preferences may be formed which help reduce undesirable or extend desirable emotions. Examples of these direct effects is the preference for crunchy foods (i.e. snacks) when one is angry, bored or frustrated. Soups have also been reported as related to being sad or lonely. Further, wine and gourmet foods have been associated with the emotion love.



Perception and Food Preferences

- **Food Pleasure Equation**
 - Pleasure = Sensory Stimulation x Caloric Stimulation
 - Sensory Stimulation
 - Hedonic Solutes (salt, sugar, MSG, 5' Nucleotides, acids)
 - Hyde's Dynamic Contrast (time intensity change)
 - Roll's Effect (variety = eat more)
 - Caloric Stimulation
 - Overall energy (stomach: 2nd oral receptor system)
 - Protein/fat/carbo

Source: Steve Witherly (1995) "Why Humans and Kids Like Junk Food"

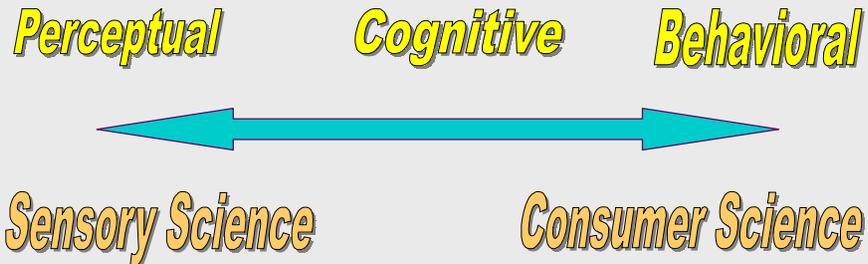
Steve Witherly, a sensory professional and nutritionist, has proposed a two factor "pleasure equation" where preference is related to both sensory stimuli and caloric stimulation.

Dr. Witherly also suggests that preferences are increased for foods which have high levels of "hedonic solutes" (taste enhancers like sucrose, salt and MSG), a variety of different stimulation, and temporal differences in their sensory profiles.

He also proposes that caloric sensory in the stomach are able to "sense" protein, fat and carbohydrates. This stimulation is immediately relayed to the pleasure center of the brain. The resulting theory suggests that caloric stimulation is as important as sensory stimulation in developing some food preferences.

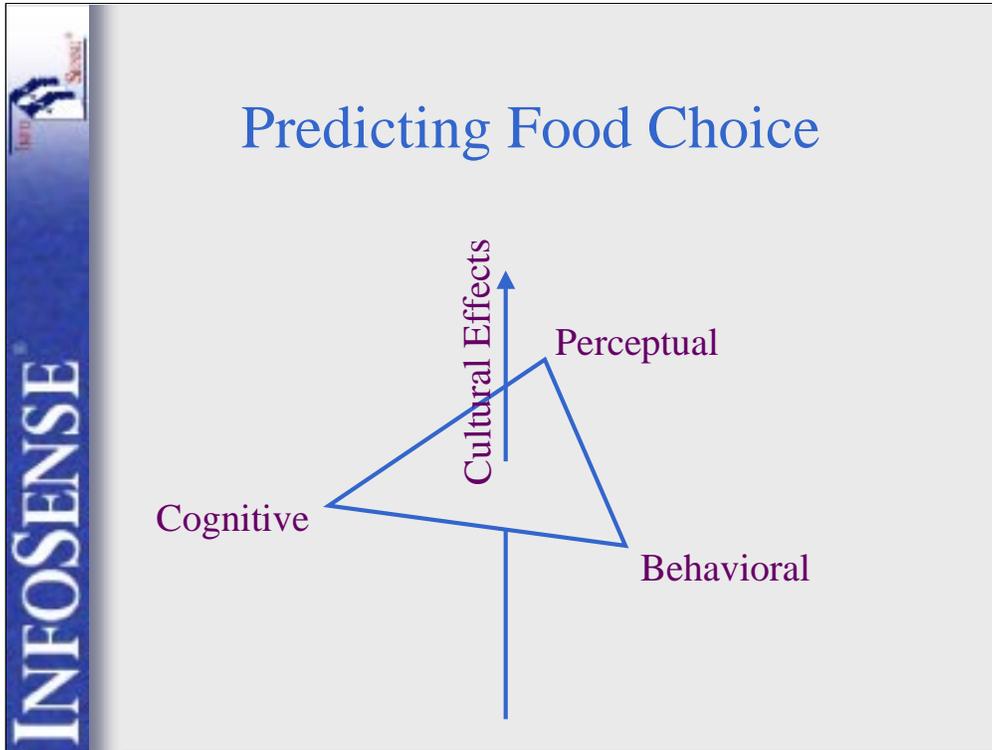
The prime example is the ice-cream effect. Here you have lactose or sucrose for sweetness, fat for mouthfeel and a cold-warm, melting change in the mouth. This has both high sensory stimulation and caloric stimulation. If you substitute (for example) a non-fat, low calorie ice-cream, the secondary caloric stimulation would be decreased and preference would be decreased. So even if this product passes the sensory taste test, the caloric test fails and pleasure is not maximize. This help support a preference for the "real thing."

Understanding Food Preferences



Magni Martins (1998) “Sensory Science is the Link Between Hard Science and Soft Science.”

These evidence suggest that the understanding of food preferences is a complex endeavor. It requires an understanding of factors influencing perception, and cognitive and behavioral processes. This bridges the field of sensory and consumer science. Sensory science is the field of study used to measure, evoke and evaluate foods can be measured using the basic senses. It links the hard sciences of chemistry, biochemistry, and physics to the soft sciences of psychology, sociology and anthropology (Martins, 1998).



Understanding of consumer behavior requires an understanding of cognitive and perceptual processes. How cognitive “perceptions” about a product (e.g. expectations) driven by extrinsic factors such as brand image, attitudes, and habits will influence sensory perceptions. These processes will in turn affect behavior. As food preferences develop for an individual, the sensory and cognitive factors are influenced by cultural factors (i.e. extrinsic factors). In this way, culture drives the relationships between cognition , perception and behavior.

To successfully develop products for markets, researchers need to understand these complex relationships that drive behavior leading to consumer choice.

Gift Market

Forty-Eight Perfect Cherries on the Market Shelf in Japan - \$150 US



As an example, consider this box of 48 perfect cherries being sold for \$150 US in a Tokyo shopping center. Under what situations might one prefer to purchase these cherries? What would be the attitudes and behaviors of the consumer. What would be their wants and needs? What past experiences might lead to this type of a preference?

If some one purchases these cherries, what might be the expectations associated with this product? What might be the expected taste profiles,

Cherries like this are purchased in Japan for gift giving. These cherries are expected to be a very specific uniform color and flavor.

In recent years food has become a fashionable gift in Japan. Trends such as fads and fashions influence preferences.

Food Preference Trends



Japanese Food Trends

- Western Style Foods
 - Meats, Higher Fat, Dairy
- Convenience Foods
 - Fast Food, Processed, Frozen, Microwavable
- Health Awareness
 - Additives, Safety

Source: USDA - FAS Attaché Reports

European Food Trends

- “Authentic” Flavors and Textures
 - Berry & exotic fruits
 - Ethnic aromas and flavors
- Healthy
 - “Bio” (natural, not genetically modified)
 - Prebiotics (e.g. dietary fiber)
 - Probiotics (e.g. *lactobacillus*)

Source: Food Technology (January, 1999)

Food Preference Trends

- Fads and Fashions
 - Boredom, Novelty and Familiarity Trilogy
 - Psychological Needs
 - affiliation and distinctiveness
 - Utility Needs
- Customs
 - Established fashions based on established utility needs

Source: Bernard Lyman (1989) "A Psychology of Food"

Fads and fashions are the result of individual behavior which is influenced by interactions with others (collective behavior). Food preference trends usually involve a cycle of boredom in the familiar giving rise to a need for novelty food experiences. After repeated trial of these foods the novelty wears off and becomes familiar. The whole cycle is then repeated in a search for novelty.

Some individuals have a psychological need for new stimulation. These individuals are often trend setters, especially when they are viewed by others as higher in status or on the "inside." Other individuals have a psychological need to be accepted by those in higher status or to be not left on the outside. Further, they may have a need to belong to a distinctive group with a feeling of self importance.

Fashionable behaviors are often accelerated by the media through advertisements, indirect marketing or news broadcasts.

Pacific Rim Cross-Cultural
Hedonic Scale Usage



**Lue-Lih YEH,
P.Chompreeda, K.O. Kim H.
Rimkeeree, N.J.N. Yau, D.S. Lundahl**

IFT 1998 Annual Convention

Atlanta, GA USA

June, 1998

Using Foreign Nationals Residing in the USA as Panelists



Can we use foreign nationals residing in the USA as a predictor of the preferences in their respective countries and cultures?

Adaptation to Western Culture Asian to Western Food Acceptance

<i>Source of Variance</i>	<i>Test</i>	<i>Chinese</i>	<i>Korean</i>	<i>Thai</i>
Food Type	F-value	46.99	39.76	25.28
	(dfn, dfd)	(5, 677)	(5, 655)	(5, 708)
	Sig.	***	***	***
Residence by Food Type	F-value	2.37	1.14	0.67
	(dfn, dfd)	(5, 672)	(5, 649)	(5, 703)
	Sig.	**	NS	NS
Time in US by Food Type	F-value	1.41	0.85	0.3
	(dfn, dfd)	(35, 642)	(35, 620)	(35, 673)
	Sig.	NS	NS	NS

The answer is yes and no.

In these research results differences are observed for food types, however in most cases there are no differences among food preferences between consumers (university students) residing in the US or their native country. In addition, among consumers residing in the US, there are no significant differences between residence time in the US (as a student) and food preference.

The case of Chinese however gives a word of caution. The Chinese students used in this study were a mix from the mainland and Taiwan, whereas the students in their native country were all residing in Taiwan. These groups did differ in preferences.

Measurement of Food Preferences



Four Hedonic Scale Types

Standard 9-Point Category

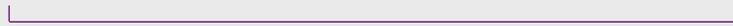
Dislike Dislike Dislike Dislike Neither Like Like Like Like
 Extremely Very Much Moderately Slightly Nor Dislike Slightly Moderately Very Much Extremely

No-Extreme 9-Point Category

Dislike Dislike Dislike Dislike Neither Like Like Like Like
 Very Much Very Moderately Slightly Nor Dislike Slightly Moderately Very Very Much

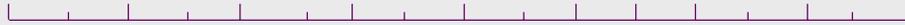
Unstructured Line Scale

Dislike Like
 Very Much Very Much



Structured 17-point Line Scale

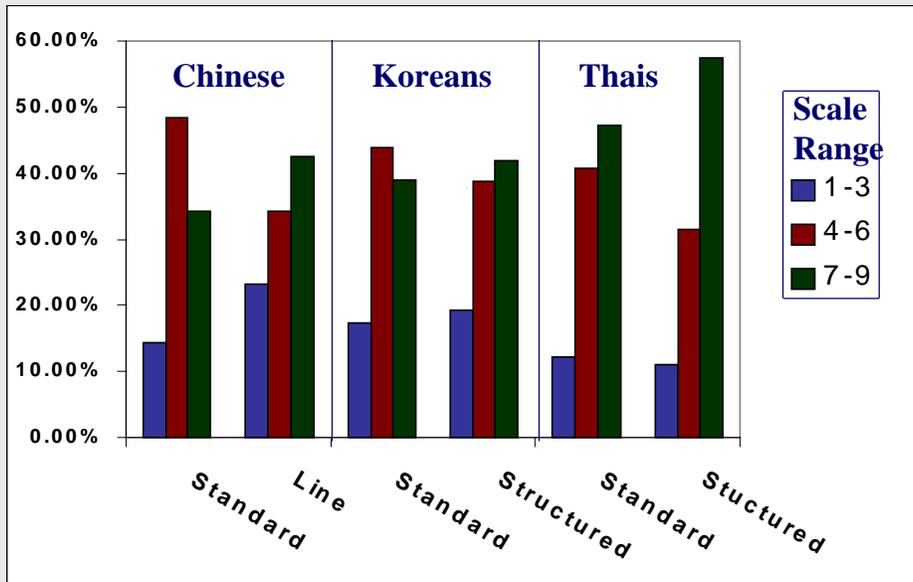
Dislike Dislike Dislike Dislike Neither Like Like Like Like
 Very Much Very Moderately Slightly Nor Dislike Slightly Moderately Very Very Much



Key biases in central tendency and liking scale end affinity observed where using the standard 9-point hedonic scale translated directly into Chinese, Thai or Korean.

Attempts to improve this for different cultures has shown that the unstructured and highly structures line scales reduce these biases.

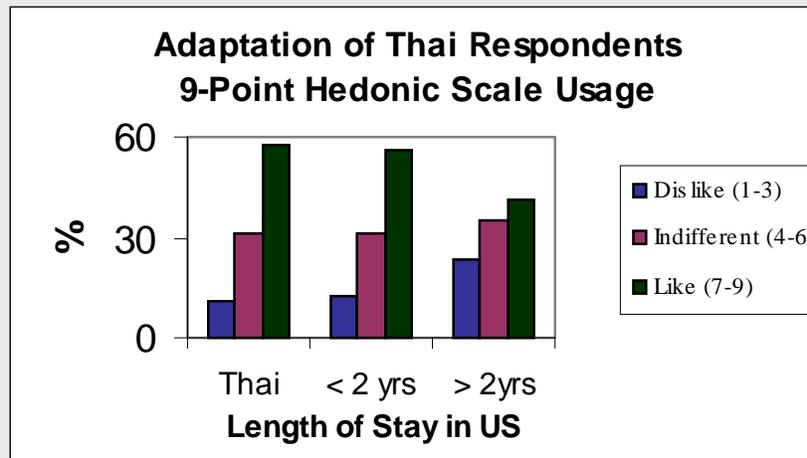
Effectiveness of Different Scales



Note: All Scales Transformed to a Range of 1 to 9

Among students residing in their native countries, central location was minimized with the use of the unstructured or structured line scales.

Adaptation to Western Culture Rating Scale Usage



While basic preferences are fairly consistent, some cultures (e.g. Thai) adapt rapidly to Western culture ways of responding (less upper scale liking affinity).

A Theory for Food Choice



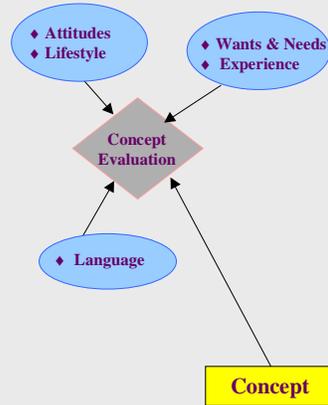
Asian Sweetener Study



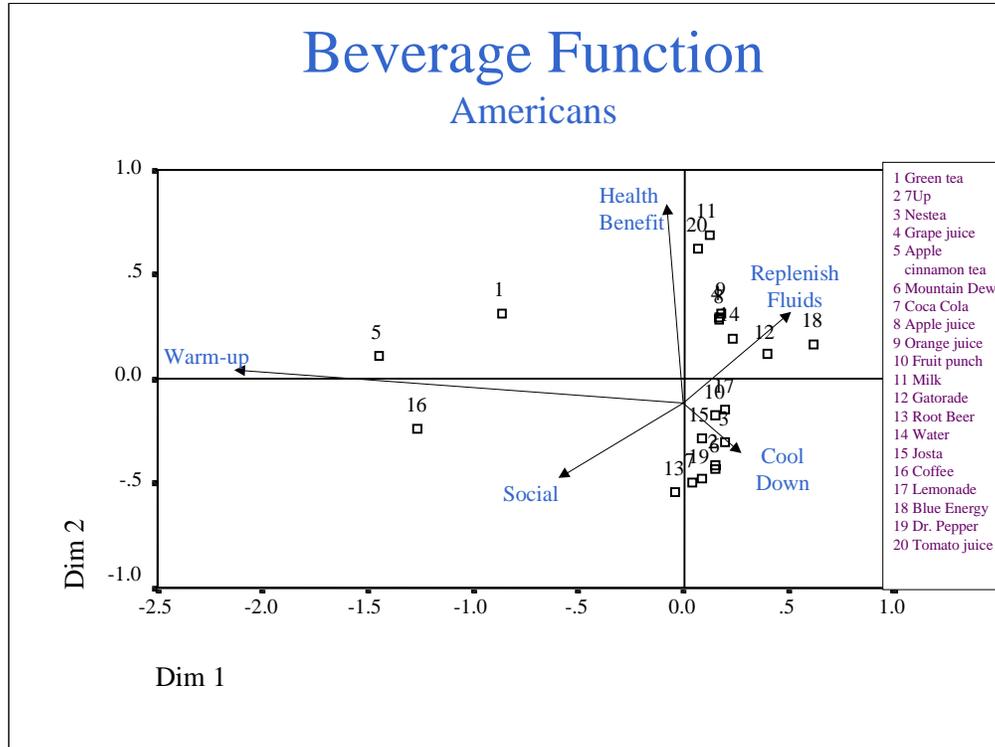
Seo-jin (Silvia) Chung

Oregon State University
M.S. Graduate Student
Home Country: Korea

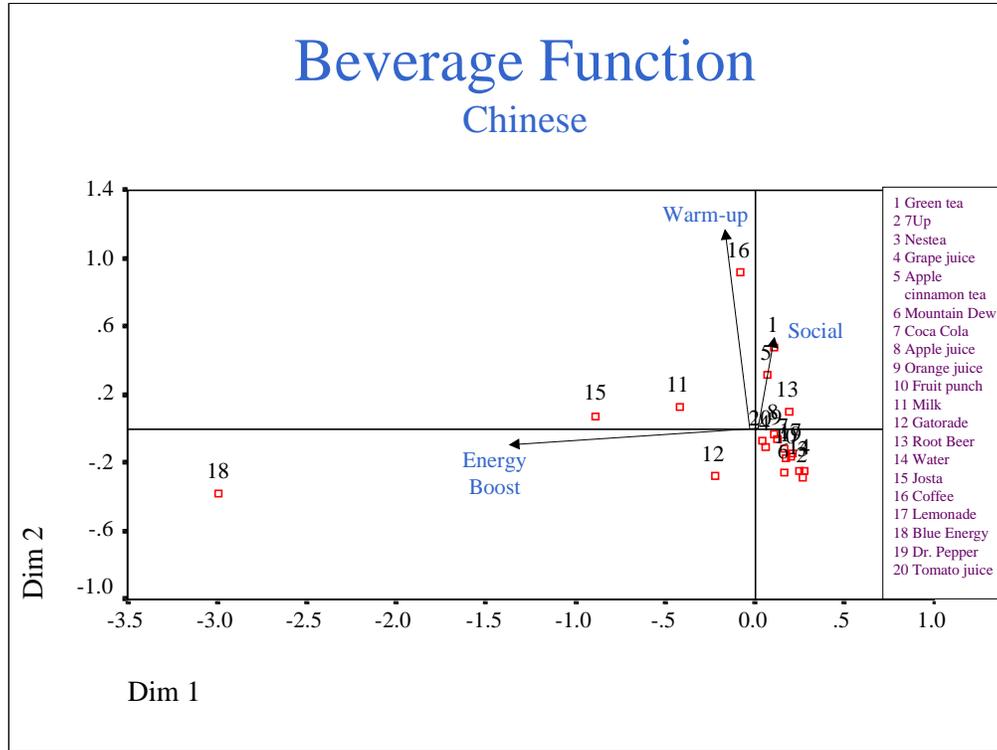
Consumer Choice Model



There are basically four elements of products that manufacturing companies can control: concept, physical product/package, price, and availability. Product trial is driven by the expectations created by a product concept, as well as its price and availability. When a consumer evaluates a product concept from its package, advertisement, and promotional materials, cultural extrinsic factors create expectations for product liking, fulfillment of wants and needs, sensory qualities, and price. Cultural extrinsic factors include language, consumer attitudes, lifestyle or habits, wants and needs, and experience with brands within a product category.



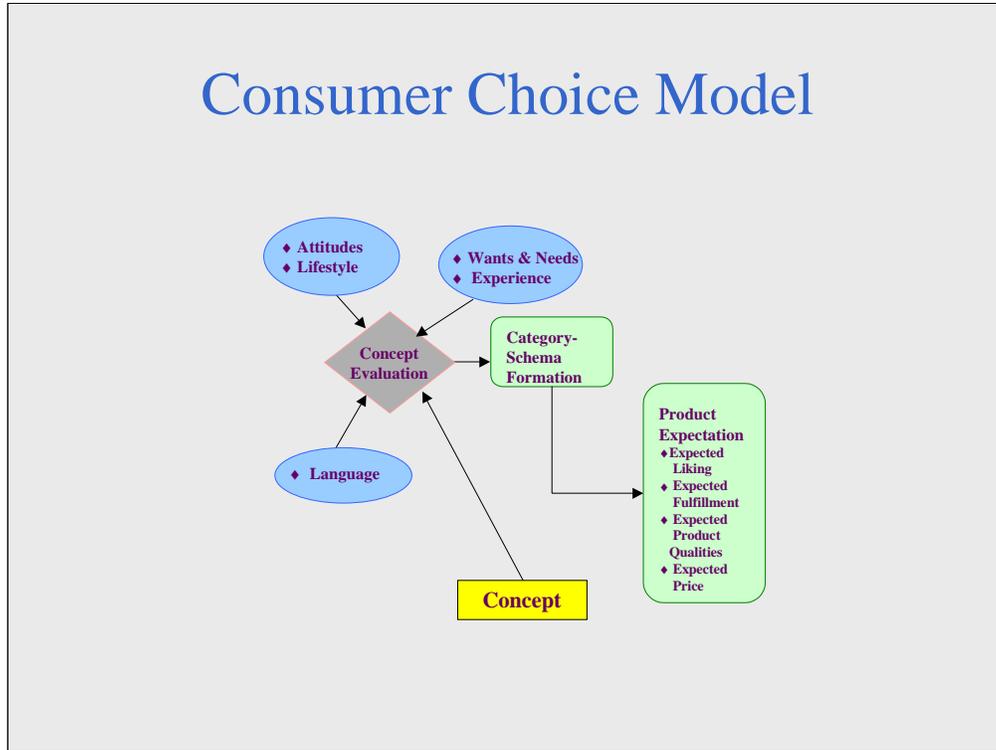
As an example, consider the evaluations of American consumers (native USA) to twenty different beverage brands or product categories in terms of functionality. Here products were separated in terms of warm-up, having a health benefit, replenishing fluids, social interaction and cooling down. Teas and coffee were consumed to warm-up; milk and tomato juice for their health benefits; and Gatorade and Blue Energy to replenish body fluids. A number of products were consumer predominantly to cool down.



In comparison, Chinese from the mainland of Greater China separated the same 20 products differently. Blue Energy, Josta, milk and Gatorade were expected to function as an energy boosting beverage; tea and coffee as a social beverage; and coffee to warm up.

These cultural factors are a reflection of the differences in schemas that these products exhibit. Different wants and needs would be expected to be satisfied by purchasing any of these products. Those difference are driven by attitudes, behaviors and habits and the experiences used to place a product into a given schema (e.g. cool down or social interaction beverage).

Consumer Choice Model

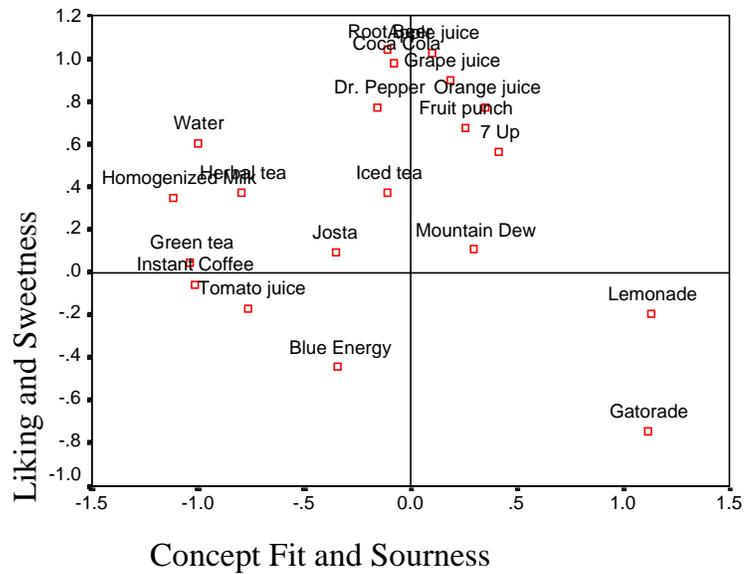


This process for evaluating products and concepts results in placing a concept into a category-schema. Research has shown that human subjects may switch among category schemas as more is learned about a product concept, taking the easier cognitive path (Stayman, D.A., Alden, D.L. and Smith, K.H., 1992).

Category-schemas give rise to expectations about products. Expectations are generated about a product that the product will be liked, what sensory qualities comprise a product and what wants and needs might be fulfilled. It also sets an expected price against the category-schema and value placed on the product.

Beverage Expectations

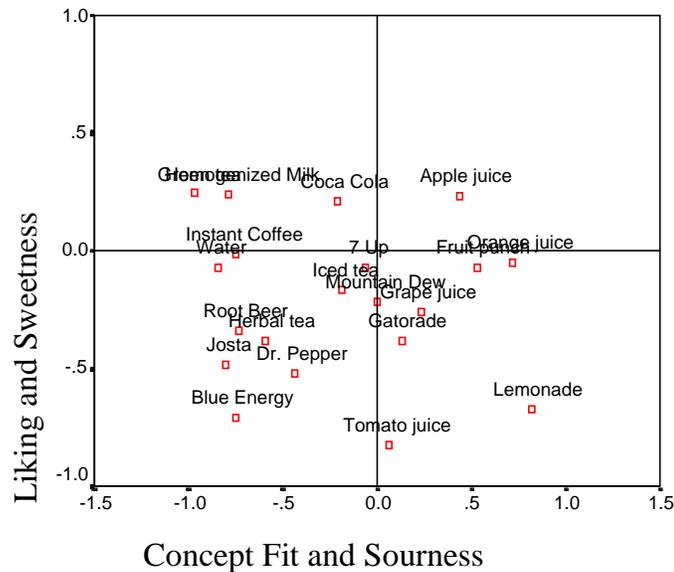
GROUP: 1 American



Following the same example, consider American consumer respondents and their respective expectations for these same 20 beverages. Gatorade and lemonade were expected to be sour and fit the concept “lemon-lime flavored sports beverage.” Most of the colas and fruit juice drinks were expected to be sweet and liked. Tomato juice and Blue Energy were expected to be not liked, less sweet and to not fit the concept.

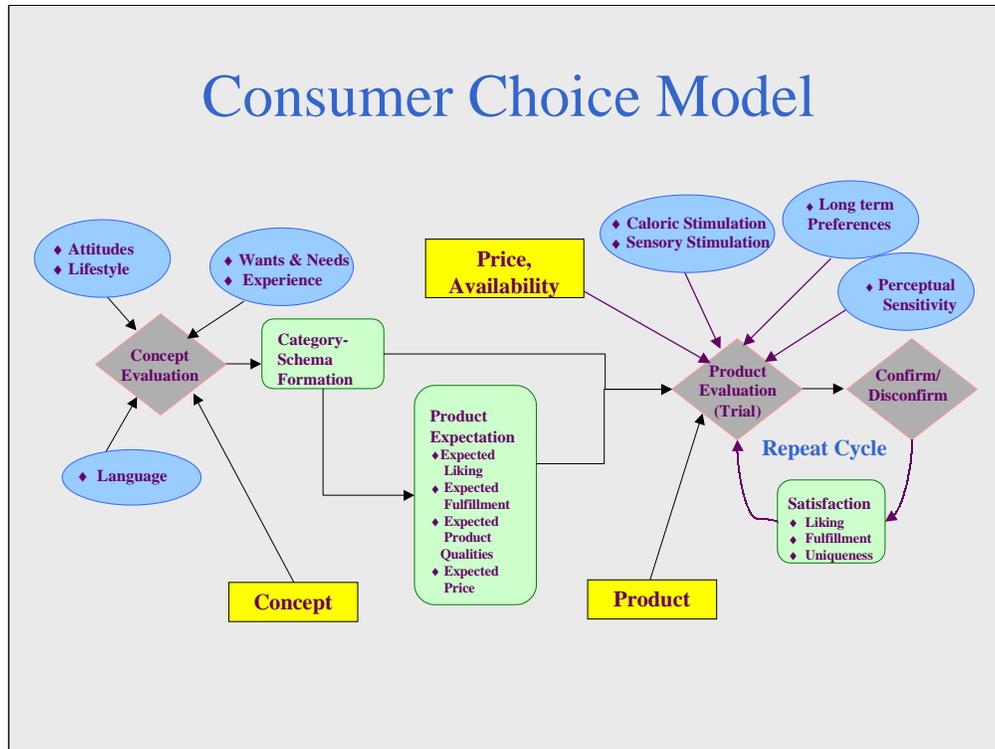
Beverage Expectations

GROUP: 2 Chinese



On the other hand, Chinese expected only lemonade to be sour and fit the concept “lemon-lime flavored sports beverage.” Coca-cola, milk, apple juice and green tea were expected to be sweet and/or liked. Root beer, herbal tea, Josta, Dr. Pepper and Blue Energy were expected to be not liked as much, to be less sweet, not fit the concept and to not be very sour. Tomato juice clustered out as more sour than Blue Energy.

These expectation differences follow directly from the different category-schemas into which these products fall. Products with less culturally defined category schemas (e.g. Gatorade) do not show as strong a relationship to these expectations and map into the middle.



If expectations are high, the product is available, and price expectations are met then a product will be tried. Once tried, caloric and sensory stimulation, perceptual sensitivities and long term preferences are involved in the evaluation of the product.

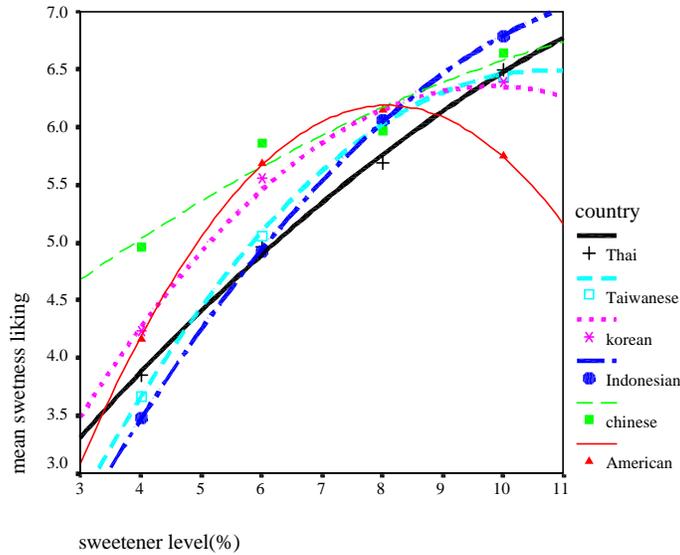
Long term preferences can be thought of in terms of ideal points. An ideal point is the sensory profile of a product most liked. If a product is expected to be liked, then the expected sensory profile will be similar to the ideal point. If the product is not expected to be liked, then the expected sensory profile will be dissimilar to the ideal point. A product meeting the expectations will likely achieve high satisfaction when tried.

In addition to long term preferences and related ideal points, sensory properties not expected can enhance satisfaction. Such is the case in terms of novelty foods. Here “novelty factors” outside of the expected create new preferences. Research has shown that product acceptance is often higher when expectation and evaluation experience is moderately incongruent.

The pleasure equation proposed by Witherly (1994) fit into this model. When sensory stimulation is high (solute stimuli, time-intensity change and sensory variety) then new experiences that fit most of the expectations can add to product satisfaction. In addition, the caloric stimulation side of this equation can contribute to non-sensory factors that drive satisfaction.

Satisfaction could then lead to repeat trial if a product remains available, at an expected price, and expectations remain constant. Products may fail for many reasons including the dynamic change in today’s markets that can quickly drive down expectations, change availability or affect price.

Lemon-Lime Flavored Drink Sweetness Liking Differences



In the case of this example, American consumers had a different ideal point for sweetness for this beverage than Thai, Taiwanese, Chinese from the mainland. Whereas Americans tend to like many products sweeter than Asian consumers, there was a reversal in this case. This is because they expected the product to be less sweet. While they were not given a concept statement, the flavor of the product was similar to that of popular sports beverage. It is believed that most of the American consumers recognized this distinct beverage flavor and changed their schema and expectation for lower sweetness.



Food preferences are formed by many complex processes, beginning from our innate preferences to many learned through our life long experiences and associations. Incidental learning, associations and memory give rise to long term preferences. When a product concept is evaluated, cognitive processes involve the placement of a product into a category-schema. This in turn results in the development of expectations. Expectations give rise to the likelihood that a product will be chosen and evaluated. Once tried, the sensory properties of a product are perceived and compared against the long term preferences and expectations. A product that has expectations different from an ideal point can result in a positive or negative incongruent confirmation. A negative (or positive) incongruent evaluation (against expectations) will result in lower (higher) satisfaction. A moderate incongruent positive comparison can result in the most preferred product.

Preference is as much a reflection of ourselves, as our family and culture. These factors set many of our attitudes, behaviors, wants and needs, and experiences. Individual factors such as psychological effects create differences in how consumers respond to the need to be stimulated with new experiences or to belong to groups and to follow cultural trends such as fads and fashions.

Through the understanding these complexities, we can better predict what are the wants and needs of consumers in response to the dynamic processes involved in food choice.