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Bayesian approach to assess consumers' brand selection process and identification of brand attributes in a service context

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ABSTRACT

The proliferation of branded products and services within the last decade has made it increasingly difficult for consumers to distinguish and choose amongst various brands. To reduce the complexity when choosing one brand over another, consumers may focus on a small set of a few brands in which they contrast and compare. This study examined the consumer's brand categorization process and brand evaluations using Bayesian statistics. Particular brand attributes within the *Evoked Set* resulting in a significant influence include the consumers' confidence in their ability to evaluate speed of service, taste, price, quality and location of the branded restaurants. Consumers placed restaurant brands in their *Hold Set* due to lack of confidence in evaluating the taste of the products offered, its prices, brand locations and, most likely, not having formed a clear opinion about the brand. For the most part, cognition and confidence predictably predisposed a consumer to place a brand in the *Foggy Set*. Finally, in the case of *Reject Set*, lack of confidence in evaluating a brand, dissatisfaction with a brand and a negative intention to eat at a restaurant were significant factors in placing a brand in a consumers' *Reject Set*.

1. Introduction

The proliferation of branded products and services within the last decade has made it increasingly difficult for consumers to distinguish and choose amongst various brands, and researchers are finding it difficult to understand why a consumer would choose one brand over another. To reduce the complexity in choosing one brand over another, according to Laroche et al. (2005), consumers may focus on a set few brands in which they evaluate and compare before making the final choice. This concept of categorization used by consumers to process information about products, brands or stores has been proffered by many researchers as one option to understand consumer choice information processing (Laroche and Parsa, 2000; Lewis and Chambers, 1989; Brisoux and Laroche, 1980; Narayanan and Markin, 1975; Howard and Sheth, 1969; Howard, 1963). Conceptually, the brand categorization process begins with a dual awareness and unawareness of brands within a competitive set. Consumers seriously consider only a limited number of those brands for which they are aware when faced with the intent to purchase (Laroche and Toffoli, 1999).

Investigators are becoming increasingly curious regarding the thought and choice processes underlying consumers' selection and patronage of retail and service establishments. While factors such as the price-consciousness and physical, and emotional needs have been attributed to why a consumer visits certain establishments, other factors such as consumer's cognitive attitude toward a particular brand and the type of rival brands within the dominant competitive space have been put forth as reasonable explanations for consumers' choices (Laroche et al., 1994).

This study investigates how consumers choose a service establishment and a brand, and attempts to identify significant factors associated with brand attitude and purchase intentions. This research employs a Bayesian analysis method in an attempt to provide a more accurate picture, and possibly a higher predictive power to the statistical model compared to the traditional regression models. Additionally, we investigate the contribution of service attributes and their influence on intention, cognition, satisfaction and confidence. Finally, we discuss insights and strategies for marketers to move brands from one type of awareness set to another set.

2. Literature review

2.1. Brand categorization

It has been empirically shown that consumers behave in different ways within and amongst brand categories while making

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purchase decisions. But little is known regarding how these consumer preferences for brands are formed (Singh et al., 2005; Blattberg et al., 1976). In a typical day, consumers are confronted numerous times with brand selection from a plethora of choices. This process is becoming increasingly difficult and complicated, as the number of new products and brands has increased exponentially in the past few decades. Consequently, information processing techniques and heuristics are becoming increasingly critical. Consumers employ multiple methods of processing brand information, including the use of only a few critical attributes of included products or brands, and rely on personal attitudes, beliefs or perceptions about the brands (Maison et al., 2004; Laroche and Sadokierski, 1994; Bettman, 1979). Some consumers may use categorization methods in processing information about competing products, brands or stores (Laroche and Parsa, 2000; Briosoux and Laroche, 1998; Lewis and Chambers, 1989; Narayanan and Markin, 1975; Howard and Sheth, 1969; Howard, 1963). Several studies have empirically supported the Brisoux–Laroche model (Laroche and Parsa, 2000; Laroche and Toffoli, 1999), which describes a brand categorization process comprised of two types of consumer awareness sets: a *processed set* and an *unprocessed* (*Foggy*) *set*.

Earlier studies concluded that consumers, when faced with multiple brands, use phased strategies (Laroche et al., 2003). Understanding how consumers process information about products, brands or stores, and which attributes play an important role in this process has become a troubling question for researchers to explore (Laroche and Parsa, 2000). Furthermore, understanding the choice-making process involved in a multi-brand universe better helps extend our knowledge of the brand selection processes and purchasing behaviors. Due to the sizeable presence of large corporate franchisors and parent corporations (Lewis and Chambers, 1989) in the restaurant industry, identifying the impact of consumers' selection processes becomes an important research initiative with wide ranging implications.

Finally, Laroche et al. (2003) have presented empirical evidence demonstrating that for purchase decisions consideration sets do exist and they influence consumers' brand choices. Consumers simplify and limit the number of brands they consider due to their limited cognitive capacities and simple economics of information processing, suggestive of cognitive miserliness. Moreover, as noted by other researchers, consumers simplify their evaluation task in two ways: (1) by reducing the number of attributes cognitively processed in evaluation and (2) reducing the number of acceptable brands.

Using restaurants as one of four industry types, Laroche et al. (2003) found that 60.7% of a consumer's decision-making process used a conjunctive rule decision heuristic: in the brand consideration process, a cut-off point on each salient attribute must be met by the brand to be included in the consideration set. Similar to the conjunctive rule, the lexicographic rule explained 39.7% of a consumer's decision-making heuristic; in the case of a tie using the conjunctive rule, a cut-off point on the next most salient attribute must be met by the brand to be included in the consideration set (Laroche et al., 2003).

Building on prior research, this study examines how consumers make a decision when selecting a specific brand when equally competitive multiple brands are available. More significantly, it demonstrates that consumers categorize a multitude of brands into several groups by way of their brand attitudes and purchase intentions, capturing consumer goals, perspectives and situations as necessary variables relative to their judgments. This underscores recommendations offered by Ratneshwar et al. (2001) who suggested that the significance of a product to the perceiver is a function of both the person and the situation. Several studies have examined the categorization process in multiple brand situations (Ratneshwar et al., 1996; Sujan and Bettman, 1989) and the relationship between consideration sets and categorization (Loken, 2006; Ratneshwar et al., 1996). But while researchers examine the extent of features common and uncommon to multiple brand contexts, few studies have started with the top down approach that is articulating intentions and benefits sought by the individual consumer in a particular consumption situation.

While our first objective is to identify the existence of consumer brand categorization processes in hospitality context, our second objective is to identify the factors that have significant and important associations with brand attitudes and purchase intentions when a consumer is aware of and evaluates a particular brand among multiple brands. The third objective is to examine the effect of consumers' psychological attributes (attitude, cognition, confidence and intention to purchase) when a consumer is considering the brand in a decision-making situation.

2.2. Brisoux and Laroche's model

The model presented by Brisoux and Laroche (1980) on brand categorization (Fig. 1) consists of four sets of cognitive awareness. The complete awareness set consists of two major sets: a *processed set* and an *unprocessed set* (*Foggy Set*). The *unprocessed* (*Foggy*) *set*, as the name indicates, is not further processed in making brand evaluations. Thus, consumers are only concerned with the *processed set* which is further divided into three different subsets: the *Evoked Set, Hold Set* or the *Reject Set*.

The brands in the *Evoked Set* have attitudinally positive evaluations and are considered with an intention to buy in the consumers' *consideration set* when making a purchase decision. Brands in the *Hold Set* are not considered as prime alternatives, and are capable of holding positive, neutral or negative attitude perspectives. Brands in a *Hold Set* can be best described as best alternatives to the brands under consideration in the *Evoked Set*.

For example, the price of a product may induce a negative attitude for a brand within normal purchase occasions but that brand could be saved for special occasions; similarly, attitudes may not yet have been formed to like or dislike a brand. Such brands are held in the *Hold Set*.

The last set is the *Reject Set*, which contains definitely unselected brands because of negative attitudes towards that particular brand or other reasons. Empirical studies (Laroche et al., 2005; Laroche and Parsa, 2000; Briosoux and Laroche, 1998) suggest that differences between consideration and non-consideration sets and the brand categorization process can be used effectively to understand the relationship between these sets and consumers' attitudes and intentions to purchase a brand.

Numerous researchers have tested the association between consumer satisfaction and purchase intention with service and

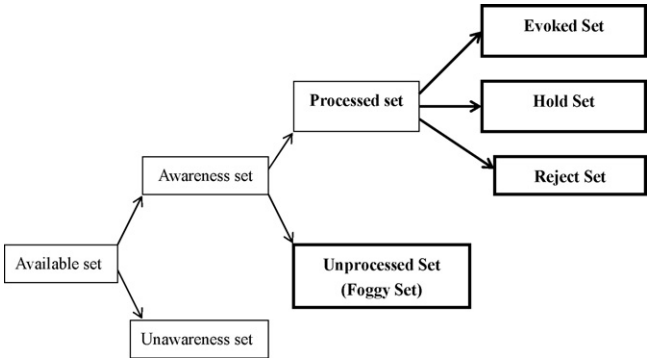

Fig. 1. Brisoux and Laroche's brand categorization model (1988).

product quality as the independent variables (Bou-Llusar et al., 2001; Kennedy et al., 2001). Lovelock (1983) and Shostack (1977) demonstrated that a physical good's product quality and service quality could impact consumers' purchase intentions. The service quality literature, too, demonstrates that service quality could influence purchase intentions and eventual customer satisfaction (Boulding et al., 1999; Zeithamal et al., 1996; Cronin and Taylor, 1992). Additional research has proven that product quality is an important aspect of the purchasing decision (Boyer et al., 2006; Malone et al., 1987).

Much of behavioral intention and purchase behavior research has focused on the "mere measurement" effect and the predisposition to purchase a product due to increased accessibility of cognitions about the product category and accessibility of brands in the consideration category (Loken, 2006; Morwitz and Fitzsimons, 2004). Moreover, when consumers are asked whether they prefer a certain behavior, that questioning process itself may increase the probability of preferring that particular behavior (Loken, 2006; Spangenberg and Greenwald, 1999), in some instances. Perhaps as an attempt to understand underlying antecedents of the purchase intentions, researchers have also examined consumers' attitude towards brand. These attitude studies, particularly implicit brand attitudes that may be unconscious and automatic, may be useful to further explore consumer purchase intentions (Loken, 2006; Maison et al., 2004; Bargh, 2002; Shapiro, 1999). Many studies have focused on the development of robust measurement techniques to assess unconscious and automatic processing (Brunel et al., 2004) by consumers in making brand choices.

Ratneshwar et al. (1996) assert that the process of manifesting a given goal impacts the consumers' consideration set, and that the boundaries of these goals can be malleable contingent upon situational or personal goals. Consumers are most likely to compare alternative brands simultaneously rather than evaluating one brand at a time, and this, too, may predispose alternative framing lenses (Mantel and Kardes, 1999).

In the situation of multiple brand comparison occasions, consumers tend to rate a favorite brand less positively than they would if they were in a single brand evaluation setting (Posavac et al., 2004; Hsee and Leclerc, 1998), thereby affecting purchase intention.

Related to purchase intent is the confidence construct, which arguably has the capacity to play a major role in predicting intentions to buy (Laroche et al., 1996). Confidence, as a construct in the present context, relates to the consumer's certainty of making a judgment on the quality of a particular brand and knowing that judgment is correct (Laroche et al., 1996, p. 115). This confidence can be related to the overall brand or to the security in one's ability to judge the brand with surety. Laroche et al. (1996) echoing researchers in psychological literature, explains that confidence can be considered a dimension of attitudes, citing empirical evidence of a positive confidence–intention relationship, and confirming confidence as being one of the determinants of purchase intention. Cognition, or brand recognition, then, must precede confidence, in order for that consumer to be able to establish any confidence level to begin with. Thus, confidence influences intentions to purchase.

Based on this model and prior results, the current study establishes that a consumer chooses from four categorization sets in mind when selecting a brand (*Evoked, Hold, Reject and Foggy Sets*). Moreover, we illustrate how brand attitudes, purchase intention and brand attributes, including service and product quality, are important factors in the brand categorization process. This brand categorization process is influenced by various product attributes as well as service attributes.

3. Bayesian statistics

To analyze the current data, a Bayesian approach was selected. Contrary to the *frequentist analysis*, Bayesian analysis uses subjective probabilities in a formal and mathematical way, and it considers objective as well as subjective factors to arrive at the model outcomes (Siegel, 1997, pp. 155–156). In the current study, consumers' evaluation of product and service attributes in a service scenario is an important consideration to understand the brand evaluation process, and suggests the usage of analyses such as the Bayesian analysis technique. This approach allows the "... benefits of exact sample results, integration of decision making, 'estimation', 'testing' and model selection, and a full accounting of uncertainty." (Rossi et al., 2005). Results provided by the Bayesian analyses are based on the actual data not on the distribution of estimators, thus the quality of the data is not lost in estimating models using distributions, as is the case in traditional modeling estimates.

But the Bayesian approach has certain limitations. Some of the negative aspects of this approach include: "... (i) formulation of priori; (ii) requirement of a likelihood function; and (iii) computation of various integrals required in Bayesian paradigm." (Rossi et al., 2005, p. 4). Rossi et al. (2005) also stated that unlike the econometric models that impose constraints on parameter space "'... Bayesian can deal with lack of identification through informative priori."

Allenby (1990) showed that Bayesian models are more parsimonious than traditional classical regression tests in understanding consumer preferences. According to Allenby, "Classical tests lack a natural metric for testing non-nested hypotheses, and superior models in which the hypotheses are special cases are typically built." In addition, classical models assume that both Type I and Type II errors are equally important which may or may not be case in understanding consumer brand preferences. Especially in case of large data sets, classical models often reject most hypotheses (models), giving false results. If one chooses to use fit statistics to identify the best models from classical tests, they only provide rank ordering of the models which may or may not be significant. Bayesian statistics were "argued to be either equal or superior to classical procedures in terms of objectivity, ease of fuse, and ease of interpretation," (Allenby, 1990).

According to Clyde (1999), "In regression models, such as generalized linear models, there is often substantial prior uncertainty about the choice of covariates to include. Conceptually, the Bayesian paradigm can easily incorporate this form of model uncertainty by building an expanded model that includes all possible subsets of covariates. In Bayesian model averaging, predictive distributions or posterior distributions of quantities of interest are obtained as mixtures of the model specific distributions weighted by the posterior model probabilities. A major difficulty in implementing this approach is that the number of models in the mixture is often so large that enumeration of all models is impossible and some type of search strategy is required to determine a subset of models to use. In the case of an orthonormal design, some computationally simple approximations to the posterior model probabilities are introduced." Thus, it is clear that the Bayesian method provides better designed experiments and testing strategies and more meaningful inferences by utilizing all available information such as prior knowledge and collected data. As computational technologies have evolved, the Bayesian method was found to provide solutions clearly and more accurately for complex and multidimensional hypotheses. According to Rossi et al. (2005), the Bayesian method is more suitable for decision-making analysis when the decision path is more complex, as in the case of brand categorization. Therefore, the Bayesian method is deemed to be most effective and appropriate for the current study. Recently, Jen et al. (2003)

have effectively used Bayesian statistics for studying consumers' purchase frequency.

3.1. Brand selection process

To test the Brisoux–Laroche model of brand categorization using the Bayesian approach, 16 Quick Service Restaurant (QSR) brands were chosen. To test consumers' attitudes towards restaurant brands, purchase intentions and demographics, a survey instrument was adapted from the study of Laroche and Toffoli (1999). The questionnaire contained 17 pages of close-ended questions measuring frequency of usage, attitudes, intentions and opinions about 16 fast-food restaurant brands, ethnic self-identification, lifestyles and other demographic information to measure consumers' brand attitudes. Sixteen quick service restaurant brands were selected; the five restaurant brands with the lowest awareness were dropped due to the model's requirement of using recognized restaurants. Respondents were aware of over 90% of the selected 11 QSRs. Restaurant choices included: Burger King, Domino's, KFC, Manhattan Bagels, McDonalds, Mighty Taco, Pizza Hut, Subway, Taco Bell, Tim Horton's and Wendy's, all of which are franchised restaurants that include various food categories such as pizza, hamburger, Mexican, bagels, and chicken and product categories of breakfast, lunch, snack, dinner and late-night eating occasions.

3.2. Consumers' awareness sets

Four different awareness sets from the Brisoux–Laroche model were measured by four questions. For the *Evoked Set*, the question "From the following fast food restaurants, indicate which fast food restaurants you would consider going to next time. Mark all the appropriate ones." was asked. The *Reject Set* was measured by asking, "indicate those you definitely do not consider eating at." The *Hold Set* was measured by asking respondents to indicate the fast food restaurant they "have formed an opinion of, but cannot say whether or not they would be willing to eat at." Finally, the *Foggy Set* was measured by asking which restaurants they "have not yet formed an opinion about." These responses were coded as dummy variables, 0 or 1.

4. Consumer psychological attributes and brand selection

A nine-point semantic differential scale was used for each of the 11 brands to measure brand cognition, confidence, overall satisfaction, intention to buy and the evaluation of several attributes of brand, including service speed, variety of menu, taste, friendliness, price, quality of food and location. For example, the intention to buy at the provided list of QSR brands was measured by a scale ranging from 1 (do not intend to eat there) to 9 (intend to eat there).

4.1. Brand cognition

A measure of attitudes toward the selected brands, was measured on a nine-point scale by asking the question, which referred to brands respondents had previously heard of, "to what extent do you feel you have enough information to make an informed judgment about whether or not to eat at the restaurant?" (1 = no information at all and 9 = a lot of information).

4.2. Brand confidence

Confidence relates to the consumer's certainty of making a judgment on the quality of a particular brand and knowing that judgment is correct (Laroche et al., 1996, p. 115). Referring to brands respondents had previously heard of, overall confidence in brand evaluations was measured with a nine-point scale by asking respondents "With respect to those fast-food restaurants which you have heard of, please indicate how confident you are about your evaluation of those restaurants") (1 = not confident at all and 9 = very confident).

Overall satisfaction: a measure of "satisfaction with a particular restaurant brand" was measured on a nine-point scale (1 = very unsatisfactory and 9 = very satisfactory).

4.3. Intention to buy

For each of the 11 quick service restaurant brands, intention to purchase was measured with a nine-point scale by asking respondents "With respect to those fast-food restaurants which you have heard of, please rate how strongly you intend to eat at those restaurants" (1 = do not intend to eat there and 9 = intend to eat there).

Attributes: For a discussion of attributes (service speed, variety of menu, taste, friendliness, price, quality of food and location), replicated from a prior study, please see Laroche and Toffoli (1999).

4.4. Brand satisfaction

Brand satisfaction was measured with a nine-point scale assessing all the participating QSR brands using 1 = very unsatisfactory and 9 = very satisfactory.

4.5. Sample

Data was collected from heavy users of QSR between the ages of 19 and 25. It was a self-administered survey conducted at a large public university in the Northeastern United States. Students were chosen for this study specifically because consumers in the age group of 19–25 are considered as the 'heavy users' of quick service restaurants, and a significant percentage of (77.4%) of the participants from this study definitely fall in this age range (Table 1). Respondents have participated in this study voluntarily and a limited number of small candy bars were distributed at all sessions. Finally, 465 usable surveys are included in the data analysis for model testing purposes. The respondents were predominantly female (71.8%) with 26.7% of the sample represented by males. Over 90% of the respondents are undergraduate students and most students lived off campus, with a self-reported annual house income of $10,000–70,000. Over 60% of respondents visited QSR at least once every 2 weeks.

5. Results from the two models tested

5.1. Consumers' psychological factors and brand categorization process

To identify the influential factors in brand categorization process, a Bayesian multivariate Probit model was used for each of the four awareness sets with binary choice information; *Evoked, Reject, Hold* and *Foggy Sets*. These choices depend on the brand evaluations and they are correlated mutually with the reasoning that one brand is included in both an *Evoked Set* and *Hold Set*. Consumers are considering a brand to purchase ($Z_1 = 1$) when the utility obtained by the brand evaluations is greater than zero ($u > 0$). On the other hand, consumers reject ($Z_2 = 0$), hold ($Z_3 = 0$) or forget (*Foggy Set*) ($Z_4 = 0$) a brand when the utility is less than zero ($u \leq 0$). Therefore, the multivariate Probit model is applied for comparing the effects of covariates on each set and the Gibbs

Table 1
Demographic information of the sample

	Frequency (n)	Percent
Age		
Under 19 years	26	5.6
19–25	360	77.4
26–35	56	12.0
36–45	15	3.2
46–55 years	2	0.4
Student status		
Freshman	27	5.8
Sophomore	105	22.6
Junior	161	34.6
Senior	140	30.1
Graduate	7	1.5
Specific Status	17	3.7
Ethnicity		
African-American	38	8.2
Asian-Pacific Islander	17	3.7
Caucasian	354	76.1
Hispanic	19	4.1
Native American	8	1.7
Other	19	4.1
Resident status		
On-campus	60	12.9
Off-campus	398	85.6
Gender		
Male	124	26.7
Female	334	71.8
Frequency of visiting QSRs		
Several times a week	90	18.0
Once per week	112	22.4
Once every 2 weeks	102	20.4
Once per month	83	16.6
Once every 2 months	30	6.0
Once a quarter or less	47	9.4
Income		
Under $10,000	38	8.2
$10,000–19,000	55	11.8
$20,000–29,000	37	8.0
$30,000–39,000	68	14.6
$40,000–49,000	63	13.5
$50,000–59,000	59	12.7
$60,000–69,000	47	10.1
$70,000 and over	75	16.1

sampler method is used to estimate the model with the default value in R program (Table 2).

The model is as follows:

$$u_{ij} = W_i'\gamma + \upsilon_{ij} \quad \text{where} \quad \upsilon_{ij} \sim N(0, \Sigma)$$
$$z_{ijk} = \begin{cases} 1 & \text{if} \quad u_{ij>0} \\ 0 & \text{otherwise} \end{cases} \qquad (1)$$
$$\text{consumer } i = 1, \ldots, n \text{ brand } j = 1, \ldots, m \text{ set } k = 1, \ldots, l$$

where z_{ijk} is the ith consumer's choice for brand j and set k; u_{ij} is the ith consumer's latent preference for brand j; W_i is the covariates matrix that consists of different attitudes to each brand j; υ_{ij} is an error term.

The results of multivariate Probit model estimation show there are apparent differences among the four sets in Table 2. For *Evoked Set*, all four covariates, cognition, confidence, satisfaction and intention to eat have a positive association with the consideration set choice. Satisfaction (0.3285) and intention to eat (0.8399) have relatively large and significant coefficients which mean that the higher consumers' satisfaction and intention to eat at a particular brand, more likely consumers would consider that brand in the selection process. Furthermore, the results included in the *Evoked Set* illustrate the highest intention to purchase a brand among the all four sets.

In the *Hold Set* and *Foggy Set*, some coefficients are significant but all are close to zero. Thus, a consumer is likely to put the brand in the *Hold Set* or *Foggy Set* due to low cognition, confidence, satisfaction and intention to eat at the brand or having an unclear opinion about the brand. This indicates that consumers put this particular brand into a *Hold Set* when they have a negative or neutral opinion about a brand, but do not reject it because of some possible benefits such as possible future price discounts. While the coefficient of cognition (0.1279) is significant and positive, perhaps the brand is retained in the *Foggy Set* due to lack of salient information. Thus, if a consumer has enough information about the brand resulting in a positive attitude, the brand may possibly be moved into the consideration set.

The results, reflected by the coefficients in the *Evoked Set*, have a more straight forward interpretation: positive coefficients suggest a positive evaluation of the brand, due to the clarity of the attitude about the brands within this set. A word of caution is necessary here. The reader should heed advice and notice that positive coefficients in the *Hold*, *Foggy* and *Reject Sets* are coded so that a positive coefficient really represents a negative interpretation of the brand evaluation.

In the *Reject Set*, consumers are more likely to reject the brand due to their strong intention to not eat at this brand and because of their higher dissatisfaction (note the positive coefficient of 0.5298 in the *Reject Set* from our data analysis results). So, consumers are more confident about rejecting brands in this set (−0.0485), demonstrated by the negative coefficient. The coefficient of satisfaction (0.5298) in the *Reject Set* is larger than the coefficient of satisfaction (0.3285) in the *Evoked Set*, reflecting that a consumers' satisfaction with a brand is actually weaker than their dissatisfaction with a brand during the decision process.

These results indicated that the brands in the *Evoked Set* are more likely to be preferred by the consumers. From a managerial perspective, a brand contained in the *Reject Set* requires the effort of increasing customer satisfaction; if the brand is in the *Foggy Set*,

Table 2
Comparison of assumptions for the Gibbs multivariate Probit and regression models

(1) Gibbs sampler method for multivariate Probit model

This estimation method requires specification of prior distribution for the coefficients, γ, and the error variance, Σ. These prior distributions are as follows:

$\gamma \sim N(\bar{\gamma}, A^{-1})$ where A = prior precision matrix
$\Sigma \sim \text{IW}(\text{nu}, \text{V})$ where nu = d.f. for IWishart and V = location parameter for IWishart

For the estimation, the used prior mean of each γ is zero, the prior precision matrix A is set to be $0.01I$, the degree of parameter for Inverted Wishart prior distribution, nu, is set to be $(p-1)+3$, and the location parameter for Inverted Wishart prior distribution is set to be nu $\times I$.

(2) Gibbs sampler method for multivariate regression model

The prior distributions are required to estimate coefficients, β and the error variance matrix, Σ. The required prior distribution is as follows:

$\beta|\Sigma \sim N(\bar{\beta}, \Sigma \otimes A^{-1})$ where A = prior presicion matrix
$\Sigma \sim \text{IW}(\upsilon_0, V_0)$ where υ_0 = d.f. of for Σ and V_0 = location parameter for prior on Σ

For the estimation, the used prior mean of each β is zero, the prior precision matrix A is set to be $0.01I$, the degree of parameter for Inverted Wishart prior distribution, υ_0, is set to be 3, and the location parameter for Inverted Wishart prior distribution is set to be $\upsilon_0 \times I$.

Table 3
The estimated coefficients from the multivariate Probit model using consumers' psychological attributes in brand categorization process

	Cognition	Confidence	Satisfaction	Intent to buy
Evoked Set				
Coefficient	0.2137	0.0284	**0.3285**	**0.8399**
Standard error	0.1083	0.0486	0.1627	0.3969
t-Value	1.9723	0.5826	2.0177	2.1160
Hold Set				
Coefficient	**0.0254**	0.0216	**0.0536**	**0.0647**
Standard error	0.0123	0.0139	0.0206	0.0203
t-Value	2.0493	1.5539	2.5906	3.1840
Foggy Set				
Coefficient	**0.1279**	**0.0995**	−0.0470	0.0145
Standard error	0.0373	0.0307	0.0253	0.0191
t-Value	3.4256	3.2345	−1.8578	0.7582
Reject Set				
Coefficient	0.0694	**−0.0485**	**0.5298**	**0.7302**
Standard error	0.0404	0.0397	0.2137	0.2901
t-Value	1.7262	2.5167	2.4789	2.5167

the company is confronting an awareness issue and the job becomes one of communication frequency and brand salience about the brand.

The summary of the data presented in Table 2 indicates that only satisfaction (0.3285) and intention (0.8399) have a significant impact on a consumer's *Evoked Set*. Cognition (0.0254), satisfaction (0.0536) and intention (0.0647) have a significant influence on a consumer's *Hold Set*. Only cognition (0.1279) and confidence (0.0995) significantly impact a consumer's *Foggy Set*. Confidence (−0.0485), satisfaction (0.5298) and intention (0.7302) significantly impact a consumer's *Reject Set*.

5.2. Product and service attributes in the brand evaluation process

The Bayesian multivariate regression model is estimated to find affective and significant brand attributes in each set on our four dependent psychological variables: cognition, confidence, satisfaction and intention to eat. The current study uses multivariate regression technique to estimate a distribution for our four dependent variables because they are not distributed independently; the variables are mutually correlated significantly at the 0.01 levels in each set. Meanwhile, the Gibbs sampler method is used to estimate the model with the default value in R program (Table 3).

The multivariate regression model for each set is as follows:

$$Y_{ij} = X'_{ij}B + E_{ij} \quad \text{where} \quad E = [\varepsilon'_{ij}] \text{ and } \varepsilon_{ij} \sim N(0, \Sigma) \quad \text{consumer } i = 1, \ldots, n \text{ brand } j = 1, \ldots, m \tag{2}$$

where Y_{ij} is a matrix of the ith consumer's response to four dependents variables when brand j is included in the set; X_{ij} is a matrix of multiple attributes which consists of speed, variety of menu, taste, friendliness, price, quality and location; B is a matrix of coefficients; E_{ij} is a matrix of an error term.

The results of the multivariate regression are shown in Table 4. When the brand is included in the *Evoked Set*, service speed, taste, price and location significantly affect all four of our dependent variables: cognition, confidence, satisfaction and intention to eat. Thus, the faster the speed, the better the taste of the food, the lower the price and the closer the location all add up to predispose a consumer to consider this brand when selecting amongst all QSR brands.

These variables also play an important role in the categorization process, as satisfaction and intention to eat both influenced the categorization process from the Bayesian model results. Additionally, menu variety and server friendliness significantly affects cognition while the quality of food has a significant effect on satisfaction.

When the brand is in the *Hold Set*, taste and location have a significant effect on all four dependent variables. Taste, especially, has high coefficients on all our dependent variable measures, thus suggesting that taste is significant even while the brand is being categorized. Service speed, taste, quality of food and location influence cognition and satisfaction; only taste and location have significant effects on the intention to purchase and confidence on the brand.

When the brand is contained in the *Foggy Set*, predictably most factors are not significant and the coefficients are smaller than other sets because a consumer has not formed an obvious attitude about the brand. Nevertheless, the evaluation of the food is also important in the *Foggy Set* and menu variety has a significant effect on cognition. These results can be interpreted with the same meaning as in the previous model. Thus, brands in the *Foggy Set* must increase their recognition to consumers if they aim to move from the *Foggy Set* to the *Consideration Set*.

For the brands in the *Reject Set*, the taste and quality of food influence intention to eat. Speed of service, price, quality of food and location significantly influence a consumer's cognition; that is, price and quality of the food illustrate a significantly negative influence. Taste, friendliness of employees and quality of food significantly influence consumer satisfaction. Speed of service and quality of food significantly influence confidence, and food quality has a significant influence on all four dependent variables (confidence, cognition, intention to eat and satisfaction). In addition, as witnessed in our previous results, intention to eat and satisfaction have important influences on the categorization process, mandating that managers of QSRs pay close attention to taste and quality of food to increase satisfaction and purchase intentions. Consequently, when the most of the proposed factors are satisfied, the consumer considers the brand in the decision-making process. In particular, service speed, taste, quality and location are key factors that influence a consumer's evaluation of the brand and the brand selection process. Thus, in summary, for QSRs, food quality, speed and location are critical success factors in the intense competition with other brands.

The combined results from Tables 2 and 3 can be summarized as below:

Evoked Set

- Consumer confidence in brand evaluation is affected by: speed, taste, price, quality and location.

Table 4
The estimated coefficients of the multivariate regression model using product and service attributes of QSR brands

Dependent variables	Independent variables			
	Confidence	Intent to buy	Satisfaction	Cognition
Evoked Set				
Speed	**0.1756** (0.021)	**0.1180** (0.023)	**0.1169** (0.017)	**0.2144** (0.025)
Menu	0.0076 (0.019)	0.0295 (0.021)	−0.0175 (0.016)	**0.0726** (0.024)
Taste	**0.0994** (0.028)	**0.5624** (0.029)	**0.4694** (0.024)	**0.1702** (0.033)
Friendliness	0.0117 (0.021)	−0.0568 (0.024)	**0.0517** (0.019)	**−0.0841** (0.026)
Price	**0.0668** (0.019)	**0.0608** (0.020)	**0.0432** (0.015)	**0.0991** (0.022)
Quality	**0.1418** (0.025)	**0.1906** (0.027)	**0.2830** (0.021)	−0.0428 (0.030)
Location	**0.1398** (0.014)	**0.1582** (0.015)	**0.0643** (0.012)	**0.1395** (0.016)
Hold Set				
Speed	0.0162 (0.046)	0.0190 (0.043)	**0.1291** (0.032)	**0.2774** (0.049)
Menu	−0.0217 (0.045)	0.0684 (0.043)	0.0376 (0.032)	0.0890 (0.048)
Taste	**0.1454** (0.054)	**0.6870** (0.050)	**0.5216** (0.037)	**0.2998** (0.056)
Friendliness	0.0327 (0.055)	0.0120 (0.050)	0.0233 (0.038)	−0.0766 (0.058)
Price	**0.1606** (0.050)	0.0566 (0.045)	0.0221 (0.035)	−0.0117 (0.052)
Quality	−0.0670 (0.058)	0.0922 (0.054)	**0.2630** (0.041)	**−0.2997** (0.060)
Location	**0.1275** (0.032)	**0.1313** (0.030)	**0.0640** (0.022)	**0.1433** (0.034)
Foggy Set				
Speed	**0.2379** (0.078)	−0.0095 (0.066)	0.0898 (0.054)	0.1447 (0.091)
Menu	0.1862 (0.073)	**0.1908** (0.062)	0.0230 (0.050)	**0.2823** (0.085)
Taste	0.1607 (0.091)	**0.5682** (0.078)	**0.5859** (0.063)	0.2508 (0.108)
Friendliness	0.0275 (0.098)	**−0.2333** (0.084)	−0.1184 (0.068)	−0.0690 (0.116)
Price	0.0064 (0.082)	0.1411 (0.069)	0.1421 (0.056)	−0.1268 (0.096)
Quality	−0.1038 (0.105)	**0.3751** (0.089)	**0.2189** (0.072)	0.0412 (0.122)
Location	**0.1947** (0.055)	0.1309 (0.048)	0.0530 (0.038)	0.0637 (0.066)
Reject Set				
Speed	**0.1113** (0.039)	0.0093 (0.027)	0.0683 (0.024)	**0.3648** (0.042)
Menu	−0.0034 (0.037)	0.0623 (0.026)	0.0042 (0.024)	0.0374 (0.040)
Taste	−0.0666 (0.045)	**0.3021** (0.032)	**0.3046** (0.029)	−0.0075 (0.049)
Friendliness	−0.0681 (0.047)	0.0352 (0.033)	**0.1374** (0.030)	−0.0909 (0.052)
Price	0.0028 (0.041)	0.0558 (0.029)	0.0219 (0.027)	**−0.1185** (0.046)
Quality	**−0.1156** (0.048)	**0.1538** (0.034)	**0.3480** (0.031)	**−0.2515** (0.053)
Location	**0.1065** (0.026)	0.0507 (0.019)	0.0127 (0.017)	**0.1653** (0.029)

- Consumer intention to eat at selected QSR brand is affected by: all attributes were significant with the exception of the menu variety and friendliness of employees.
- Consumer satisfaction with the particular restaurant brand is affected by: all attributes were significant with the exception of the menu variety.
- Consumer cognition of restaurant brands is affected by: all attributes were significant with the exception of the quality of the food.

Hold Set

- Consumer confidence in brand evaluation of QSR brands is affected by: taste, price and location.
- Consumer intention to eat is affected by: taste and location.
- Consumer satisfaction with the particular restaurant is affected by: speed, taste, quality of food and location.
- Consumer cognition is affected by: speed, taste, quality of food and location.

Foggy Set

- Consumer confidence in brand evaluation of selected QSR brands is affected by: speed and location.
- Consumer intention to eat at a selected QSR brand is affected by: menu variety, taste, friendliness and quality.
- Consumer satisfaction with the particular restaurant is affected by: taste and quality of food.
- Consumer cognition of a restaurant brand is affected by: menu variety.

Reject Set

- Consumer confidence in brand evaluation of a selected QSR brand is affected by: speed, quality and location.
- Consumer intention to eat at a selected QSR brand is affected by: taste and quality.
- Consumer satisfaction with a particular restaurant brand is affected by: taste, friendliness and quality of food.
- Consumer cognition of restaurant brands is affected by: speed, price, quality and location.

6. Conclusions and implications

This study examined the consumer's brand categorization process and brand evaluations in QSRs settings using the Bayesian approach. While this study did not underscore a top-down or bottom-up approach, our results confirm that consumers, when faced with the decision of choosing a QSR from multiple food categories, use a categorization process of brands based on brand attributes. Our results imply that consumers' evaluations influence not only their attitudes toward but confidence levels in a brand, and their intent to purchase that brand as well.

In case of the *Evoked Set*, satisfaction with a given restaurant and an intention to eat at the restaurant create the most significant influence on a given consumers' choice. In other words, consumers use that cache of brands from which they will ultimately make the purchase decision. Particular brand attributes within the *Evoked Set* that resulted in a significant influence include the consumers' confidence in their ability to evaluate speed, taste, price, quality

and location of the branded restaurants. Surprisingly, relative to consumers' intention to eat, variables which did not exhibit a significant influence include menu variety and the friendliness of the employees at the restaurant. Further exploration into this topic could explain this phenomenon. Typically, consumers do not anticipate friendly service at quick service restaurants but would rather prefer to have faster and convenient service to meet their busy life styles. If consumers prefer to have a friendly service, they may most likely to visit casual dining restaurants where employee friendliness is an important service attribute but not anticipated at quick service restaurants.

While placing a restaurant brand in a *Hold Set*, consumers' cognition, satisfaction and intention have played important roles. Consumers placed restaurants in their *Hold Set* due to lack of confidence in evaluating the taste of the branded restaurant, its prices, restaurant locations and likely, not having formed a clear opinion about the brand. It is not rejected, however, for the similar reasons.

Regarding the placement of restaurants in the *Hold Set* and their intention to eat, consumers were again unsure about the taste of the food and a given brand's location. Restaurants were placed in the *Hold Set* due to consumer satisfaction (presumably low) relative to the speed of service, again taste, the quality of the food and restaurant location. Relative to a consumers' cognition about the brand, speed, taste, quality of food and location appeared to be questionable, as might be expected.

While primarily cognition and confidence predictably predisposed a consumer to place restaurants in the *Foggy Set*, they seemed to be included in the *Foggy Set* for much of the same reasons restaurants were placed in the *Hold Set*. In addition to speed and location observed in the *Hold Set* confidence observations, consumers were also unsure about the taste of the food, and thus perhaps, unwilling to risk an internal reference point for taste. Menu variety, employee friendliness and quality of the food accounted for a consumers' lack of intention to eat, while, as in our prior mentioned *Hold Set*, taste and quality of food impacted consumer satisfaction with a given restaurant.

Finally, in case of the *Reject Set*, lack of confidence in evaluating a restaurant brand, dissatisfaction with a restaurant and a negative intention to eat at a restaurant were significant factors in placing a restaurant in a consumers' *Reject Set*. Quality of food contributed significantly to consumers' ability to evaluate a brand (negative coefficient), an intention to eat a given brand, the lack of satisfaction in eating at the brand (restaurant) and the cognition (negative coefficient) of the brand. Clearly, poor food quality alone is enough to place a brand in the *Reject Set*, followed closely by taste, speed and location. Price contributed significantly to consumer cognition only, suggesting that price wars in the industry may not be where the battle is really won.

Our study demonstrates that QSR consumers give higher priority to product quality than employee friendliness, in this study, suggesting employee friendliness to be a possible surrogate for service quality in QSRs. However, our findings suggest service speed to be the more important factor in the brand categorization process. Satisfaction and intention to eat are the key influences on a consumers' short list of restaurants from which to choose. Dissatisfaction, lack of confidence in the ability to evaluate a brand, and a negative intention to eat (due to brand attributes) are the most decisive factors in placing a restaurant in the *Reject Set*. Thus, these findings strongly support the positive relationship between a consumer's attitudes and the brand attributes. Unlike its predecessors, this research employs a Bayesian analysis in an attempt to provide a more accurate picture and possibly a higher predictive power to the statistical model. Additionally, we investigate the contribution of service attributes and their influence on intention, cognition, satisfaction and confidence.

6.1. Managerial implications

Managerial implications include the knowledge that the higher a given consumer's satisfaction, the higher the intention to purchase. In order for consumers to even consider a given restaurant, that is, for the restaurant to be placed in the *Evoked Set*, brands must score at an acceptable level for attribute salience. Intention to eat has proven to be significantly correlated with a brand being placed in both the *Evoked Set* and *Hold Set*; empirically, a high correlation also exists with actual purchase behavior. Brand managers focused on moving consumers from the *Foggy* and *Hold Sets* to the *Evoked Set* regarding intention to eat might want to spend less effort on menu variety and concentrate their efforts on the taste of the food offering (0.5624) and quality of the food (0.1906) which, as demonstrated in our *Hold*/*Foggy Sets* held corresponding coefficients regarding taste of (0.6870)/(0.5682). Corresponding coefficients regarding taste and quality of food in the *Reject Set* were (0.3021) and (0.1538).

From a managerial perspective, a brand contained in the *Reject Set* requires an all out effort of increasing customer satisfaction; if the brand is in the *Foggy Set*, the company is confronting a general awareness issue first, and the job may well be one of communication frequency and brand salience about the brand. Brands in the *Hold Set*, while demonstrating significant coefficients on cognition (awareness), satisfaction and intention, were sufficiently close enough to zero that even general comments would be speculative at best.

6.2. Suggestions and limitations

While this study considers two separate models for discovering the brand evaluation and brand categorization process, the two models are related to each other and can be estimated by the hierarchical model. Therefore, for future research, these two models might be better tested simultaneously.

Second, the proposed Brisoux–Laroche model is divided into four awareness sets and with the presupposition that brands should be included in one of four sets during the categorization process. However, in reality, these four sets are not mutually excluded and thus, there exits the possibility of multiple responses for the four sets and perhaps even an interaction between two or more sets. For example, people can consider a brand in both the *Evoked Set* and the *Hold Set* (for example, a consumer may have considered Wendy's in both the *Evoked and Hold Sets* simultaneously when negative media report surfaced in late 2005 describing the incidence of a human finger in Wendy's chili). To overcome this problem, the multivariate Probit model is used, but it is nonetheless difficult to justify a brand being included in the *Evoked, Foggy* and *Hold Sets* simultaneously, for example. Thus, in future studies, it will be advantageous to specifically explain the relationship between sets.

In the multivariate regression, there are probably correlations between the independent variables even though the correlations between dependent variables are explained. Future studies may consider a model where these relationships or interaction effects are included.

To measure the brand evaluation, the current study used only one question for each construct variable (cognition, confidence, intention to eat and satisfaction). Additionally, one question items may not fully capture the multidimensionality of the construct. Future research should include a more robust measure of each of the constructs.

Finally, the sample data and student respondents were comprised of restaurants within the Northeastern region of the United States. Prior to extrapolating to populations and areas outside of this region, this study should be replicated with a more representative sample.

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