Individual differences in the conceptualization of food across eating contexts

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Abstract

Individual differences in food-related knowledge structures were explored by applying schema theory to examine the categories 42 adults used to classify foods across four eating contexts. Food card-sort labels were organized into 12 categories, category salience for each person was evaluated, and cluster analysis was used to identify clusters of participants according to the salience of their categories. Clusters were further evaluated for complexity and consistency of category use across contexts. Seven food schema clusters were identified. Meal/time and Routine categories were the most salient overall and were used by most clusters. Well-being, Person, Source, Convenience, Meal component, and Food group categories varied in salience across clusters. The complexity and consistency of the food categories participants used across the contexts varied among the clusters. This study provided insight about cognitions that may underlie food-choice behaviors. Understanding individuals' food schemas could help nutrition professionals tailor messages to maximize health impact.

Keywords

food schema; food classification; nutrition knowledge; card sort; cluster analysis

1. Introduction

Understanding what people already "know" about food is important for effective nutrition communication (Olson, 1981; Shepherd & Sims, 1990; Worsley, 2002) because people are more likely to accept, integrate, and act on nutrition information that corresponds with their existing knowledge structures (Axelson & Brinberg, 1992; Janas, Bisogni & Campbell, 1993; Miller, Russell & Kissling, 2003; Shepherd & Sims, 1990). Although identification of shared ways of thinking about food and eating within a culture can inform health promotion (Moscovici, 2001; Sobal & Cassidy, 1987;1993), these shared ideas may not capture important individual differences (Cullen et. al., 2002). Better understanding of individuals' food related knowledge structures could improve nutrition education efforts (Axelson & Brinberg, 1992; Campbell, DeVellis, Strecher, Ammerman, DeVellis & Sandler, 1994; Furst, Connors, Sobal, Bisogni & Falk, 2000; Olson, 1981; Worsley, 2002).

Schema theory provides a useful framework for exploring individual differences in food-related knowledge structures. Schemas are used to explain how people store, retrieve, and use

information (Nishida, 1999). Food schemas are generalized collections of knowledge constructed from past experience that contain domain specific multidimensional, interrelated categories of information that are drawn upon to guide and shape behavior in familiar relevant situations (Axelson & Brinberg, 1992; Blake & Bisogni, 2003; Olson, 1981; Ross & Murphy, 1999). Food schemas develop through direct (e.g., eating, preparing) or indirect (e.g., conversation, education) experiences with foods (Nishida, 1999).

Individuals' food schema structures may be ascertained by assessing the different categories they use to classify foods in personally relevant situations. Asking someone to sort foods into personally relevant categories is an approach for understanding how they classify foods. Card sorts are an established method for examining cognitive structures (Spradley, 1979; Weller & Romney, 1988) and have been previously used for exploring schemas (Mohlman, Mangals & Craske, 2004) and food cognitions (Ross & Murphy, 1999). Card sorts, however, have not been used to examine food schemas across different food and eating contexts.

Card sorting is an elicitation method where participants sort sets of items written on cards into piles so that items within piles are more similar to each other than to items in other piles (Weller & Romney, 1988). A successive card sort involves a first stage of sorting into preliminary broad category piles followed by a second stage of sorting into smaller specific category piles. Card sorts are often used to examine which items are placed together in groups (Weller & Romney, 1988). Another approach is to examine the categories people use to group the cards. The latter approach focuses on the types of labels people use to describe the groups and can provide insight into knowledge structures (Ross & Murphy, 1999).

Context is a strong influence on the kinds of categories elicited by exposure to stimuli such as food cards (Barsalou, 1992). To understand the categories salient to an individual for a specific behavioral domain, category use needs to be examined across different contexts. In addition, the first categories that are elicited prime the elicitation of other categories. Therefore, when examining the kinds of categories used in successive card sorts, the first stage of categories have a higher salience to the individual than second stage categories (Barsalou, 1992).

This study builds upon a prior analysis of food schema categories that provided a general framework for individuals' food schemas (Blake, Bisogni, Sobal, Devine & Jastran, 2007). Through a series of card-sort activities participants used many different labels to classify foods. Examination of these labels revealed 12 different food categories (Table 1). Some of these categories were based on personal experiences with foods, including those labeled as Routines, Preference, and Well-being. Other categories were based on the food and eating context, including those labeled as Meal/time, Meal component, Person, Location, Source, and Convenience. One other set of food categories was based on characteristics of food, including those labeled as Food group, Nutrient composition, and Physical characteristics of the food. Further exploration of the use of food categories across different food and eating contexts revealed that participants used context-based and personal-experience-based food categories most frequently. Also, specific categories were used more or less frequently depending on food and eating context (e.g., dinner at home versus lunch at work). These prior results provided a general overview of different food schema categories and their use across different eating contexts. Those earlier findings, however, provided limited information on individuals' personal food schemas.

The objective of the present study was to examine individual differences in food categories used to classify foods for different eating contexts. The food categories a person used were expected to reflect the individual's food schema structure. The focus of the analysis was on identifying clusters of individuals who used similar food categories and relationships between clusters and household and individual characteristics.

2. Methods

This study explored individual differences in the use of food categories without imposing preconceived conceptualizations or classification systems (Axelson & Brinberg, 1992). Eight steps were used to identify individual differences in food schema structures represented by these food categories (Figure 1). Similar procedures have been used in prior studies (Guest & McLellan, 2003; Miller, Warland & Achterberg, 1997; Miller et. al., 2003).

2.1 Participants

Forty-two adults living in Upstate New York were purposively sampled (Kemper, Stringfield & Teddlie, 2003). The sample included 21 men and 21 women ranging in age from 20 and 61 years. Thirty-three participants identified themselves as White, and 9 as Black, Hispanic/Latino, or multi-ethnic. Twelve participants reported a high school degree or less, 26 reported some college, and 4 reported bachelor's degrees. Participants worked full-time or part-time in non-managerial, non-professional jobs, but had different eating contexts and schedules. Twenty-seven participants lived with a spouse or partner, 11 lived alone, and four lived with relatives or unrelated adults. Half of participants had at least one child younger than 19 years living at home. Twenty-six participants reporting household incomes less than $40,000, with five of these reported less than $10,000. Participants varied in their responsibilities for household food management. This study was part of a larger project investigating situational eating of adults. The project was approved by the University Committee on Human Subjects (UCHS) Institutional Review Board (IRB).

2.2 Data Collection

This analysis reports results from an in-depth interview that included card-sort activities. Three trained interviewers conducted all interviews at times and in locations chosen by participants. Interviews were audio-tape recorded and transcribed verbatim.

A set of 59 food cards was developed from a pilot study (Murphy & Lassaline, 1997). This set of food cards represented foods and drinks commonly consumed among the pilot sample, and the researchers added foods and beverages of interest to nutrition professionals (e.g., tofu) (Maurer, 1996). Food cards were designed to represent several levels of categorization, including subordinate-level categories (e.g., french fries), basic-level categories (e.g., potato), and superordinate-level categories (e.g., vegetable), to elicit as many category labels as possible during card-sort activities (Murphy & Lassaline, 1997).

An interview guide was used that included a structured card-sort protocol and open-ended interview questions. Participants sorted food cards four separate times for four different contexts: 1) no context defined; 2) their most common non-work eating context with family or friends; 3) their most common work eating context; and 4) their most common eating alone context.

First, participants sorted the food cards with no context defined (open food card sort). Participants were presented with the set of 59 food cards and asked to sort these cards into piles that made sense to them (first stage). They were then asked if piles could be split into any other piles (second stage). Participants were asked to label each food card pile using their own words (e.g., "breakfast foods" or "foods I like").

Second, starting with the participant's non-work eating context, a series of open-ended questions were asked to gain an understanding of the participant's experience of the context and to help the participant place themselves in this context before sorting the next set of food cards. As in the open food card sort, participants were asked to sort the set of 59 food cards into piles that made sense to them, to further split these initial piles if possible, and to label the

card-sort piles using their own words. This entire process was repeated for the work context and then again for the alone context. Figure 2 depicts and example of one participants' food card-sort labels.

2.3 Data Analysis

Participants in total produced 991 food card-sort pile labels. These labels were pooled across all four card-sorting contexts and qualitatively classified by the researchers into 12 different categories (Table 1). These categories were identified by grouping labels with similar meanings using interview transcripts to guide interpretations. The detailed process is described elsewhere (Blake et. al., 2007). The researchers then conducted a preliminary qualitative grouping of participants' general orientations toward food in different eating contexts based on use of categories.

Comparison of individuals is difficult when using an unconstrained card-sorting task because some people make many piles (splitters) and others fewer piles (lumpers) (Schensul, LeCompte, Nastasi & Borgatti, 1999; Weller & Romney, 1988). To systematically compare individuals, a scoring system specific to these data was developed to capture the overall salience of each category type for each participant. Salience of a category type was determined using the relative number of food card-sort labels representing each food-category type in each card sort and the stage the labels were used. As described above participants were asked to sort the cards into piles that made sense to them. These piles represent the first stage. They were then asked to split these piles into smaller groups if possible. These split piles represent the second stage (Guest & McLellan, 2003; Miller et. al., 1997; Miller et. al., 2003; Novak & Gowin, 1984).

The researchers determined the salience of each of the 12 food-category types for each participant across all four card sorts (Blake et. al., 2007). Four levels of salience were used to distinguish between food-category type use for each participant and corresponding scores were assigned (Table 1). The higher scores indicated a higher level of salience. A score of 4 was assigned if at least half of the labels used in a given card sort represented this category type, and if these were used more frequently in the first stage of classification. A score of 3 was assigned if at least half of the labels used represented this category type and these were used more frequently in the second stage of classification. A score of 2 was assigned if less than half of the labels used represented this category type and these were used more frequently in the second stage of classification. A score of 1 was assigned if less than half of the labels used represented this category type and they were only in the second stage of classification. When a category type was on the border of two different salience levels, the researcher used the interview transcripts to interpret participants' intent and assign either the higher or lower level of salience. Salience scores were assigned to each food-category type for each of the four food card-sort contexts. Salience scores for each category type were then pooled across all four food card-sort contexts with possible values for each category type ranging from 0 to 16. Each person had a pooled score for each category type.

Comparison of this scoring system to a count of category types used by each participant had an overall Pearson correlation of 0.82. The four-level scoring system was chosen as a better representation of category type salience because it allowed flexibility in assigning scores based on the interpretation of participants' intents when sorting and labeling food cards. To confirm the reliability of the scoring system, a second researcher independently scored food card-sort labels for salience. Intraclass correlations averaged 0.88 and ranged from 0.68–0.96 for the twelve food-category types. The researchers reviewed and discussed scoring discrepancies and scores were revised accordingly (Guest & McLellan, 2003; MacQueen et. al., 2001; Miller et. al., 1997; Morse, 1997). The average of the revised scores was used in subsequent analyses.

Cluster analysis is a multivariate statistical technique designed to identify relatively homogenous clusters of cases based on inter-subject similarity (Aldenderfer & Blashfield, 1984; Henry, Tolan & Gorman-Smith, 2005). The cluster analysis literature is divided about whether or not to statistically standardize data to mean of 0 and standard deviation of 1 (z-scores) (Aldenderfer & Blashfield, 1984; Wirfalt, Mattisson, Gullberg & Berglund, 2000). The data for this project were analyzed using both standardized and unstandardized scores. Comparison of results using standardized versus unstandardized scores yielded similar results. Therefore, to preserve differences between participants that might be useful discriminators of unidentified groups, unstandardized scores were employed (Aldenderfer & Blashfield, 1984; Milligan, 1996; Wirfalt et. al., 2000).

Hierarchical clustering techniques agglomerate objects into groups beginning with the most similar and progressing until all objects are linked. Non-hierarchical clustering techniques group objects into a predefined number of non-overlapping clusters. To capitalize on the strengths of both hierarchical and non-hierarchical clustering techniques, a multi-step approach was used in the current analysis (Aldenderfer & Blashfield, 1984; Henry et. al., 2005).

First, pooled salience scores were analyzed hierarchically with Ward's method using squared Euclidian distances (Aldenderfer & Blashfield, 1984; Henry et. al., 2005; Miller et. al., 1997; Miller et. al., 2003). The clustering of participants at different levels was compared, and a range of possible final cluster solutions was identified (Schneider & Roberts, 2004). Second, K-means non-hierarchical cluster analysis was performed for each possible cluster solution, and results were compared to identify the "best" cluster solution (Henry et. al., 2005; Schneider & Roberts, 2004). The final cluster solution was chosen using one-way ANOVA, examination of cluster centers for homogeneity, and comparison to the preliminary classification to identify meaningful clusters (Aldenderfer & Blashfield, 1984; Henry et. al., 2005; Schneider & Roberts, 2004).

The final step in the analysis involved characterizing clusters by the complexity and consistency of food category use. Complexity was assessed in terms of number of different categories used (Olson, 1981). Consistency of the use of categories across contexts was described as either consistent or inconsistent. In addition, food category use was examined by reviewing the exact wording of food card-sort labels and transcripts for quotes related to specific food categories.

Clusters were also examined in relationship to the personal and household characteristics of participants. Mean differences in age and years of education were compared among clusters using analysis of variance. Chi-square analysis was used to compare the clusters for gender, ethnicity, living situation, and presence of any children in the household.

The hierarchical cluster analysis results indicated a range of five to eight possible final cluster solutions. The k-means non-hierarchical cluster analyses indicated that a seven cluster solution yielded clusters with statistically significant representations of categories and clusters with the highest levels of homogeneity based on comparisons of cluster centers. The cluster centers, which indicate the mean salience scores for food categories for each cluster, represent groupings of participants based on dominant orientations toward one or more of the food categories (Miller et. al., 1997). Substantial agreement was found between the two clustering methods used in this study, confirming the stability of the classification (Henry et. al., 2005). The contingency coefficient is a measure of the degree of association based on the chi square. The seven cluster final solution closely corresponded to the preliminary clustering of participants carried out by two researchers having a statistically significant contingency coefficient of 0.89.

3. Results

This cluster solution procedure identified seven different food schema clusters (Table 2). There were significant differences between these clusters in the salience of Routine, Meal component, Preference, Well-being, Person, Source, Convenience, and Food-group categories ($p < 0.05$). There were no significant differences between these clusters for the salience of Meal/time, Physical characteristics, and Nutrient composition categories. The Meal/time category was the most salient category overall and was used by most participants in most of the card-sort contexts. The Routine category was highly salient to participants in all clusters except the Cluster 6. Well-being, Person, Source, Convenience, Meal component, and Food group categories varied in salience across clusters. Physical characteristics and Nutrient categories were much less salient than all other categories. There were no significant differences between clusters for age, gender, ethnicity, living arrangement, children in the household, or years of education. However, these clusters varied in food category complexity and consistency of use across contexts.

3.1 Food schema Typologies

Cluster 1—The nine participants in the Cluster 1 were oriented toward their personal food and eating habits and used Routine and Meal/time categories almost exclusively in all card-sorting contexts. They differed from others in using very few other categories and had simple and consistent card-sort patterns. Many of these participants did not elaborate beyond Routine or Meal/time, even with prompting, and stated that this is just the way they think about food and that there really was no other way to sort the cards. They used labels such as "foods I usually eat," "once in a while," "one time per month," or "never eat."

Some of these participants explained that food was not particularly important to them. Other participants in this cluster described being overwhelmed with work, family, and other obligations leaving little time for thoughts about food. All of the participants in Cluster 1 described well-established routines for eating that kept things simple, allowing them to focus on other more important concerns.

Cluster 2—Four participants were included in Cluster 2. These participants were oriented toward their personal experiences with foods, in focusing on personal preferences, the perceived personal health value of foods, and how foods made them feel, both physically and emotionally. Members of this cluster had complex, inconsistent sorting patterns. They frequently used labels such as "healthy," "unhealthy," "allowed on my diet," "refreshing and cleansing," or "mood elevations."

Two participants in Cluster 2 were concerned with their weight and talked about foods in terms of "allowed" versus "not allowed" on their diets. These same participants also mentioned overall health quality of the foods but in reference to their personal diet plans. One focused on personal preferences and the negative health aspects of different foods. She used labels such as "guilty pleasures" and "evil desserts." One other participant was focused on how foods made her feel physically and what she ate in certain emotional states.

Cluster 3—Three participants in Cluster 3 had complex, inconsistent card-sorting patterns. Cluster 3 participants frequently used a variety of different context-based food categories (Table 2) including Person, Location, Source, and Convenience. These participants were distinctly different from all other participants in that they were more oriented to the needs and preferences of other people present in different food and eating contexts. They frequently used labels that referred to other people when sorting food cards such as, "boss's food," "husband's snacky things," or "kids food."

One single man in Cluster 3 reported that he was particularly focused on the needs and preferences of close friends and family members when they came to eat at his home. A woman in Cluster 3 explained that she often felt constrained by the needs and preferences of her son and husband. A third participant was a single woman who traveled extensively for her job and lived away from home half of the year. Oriented toward the context of the eating setting, she distinguished between foods she would usually eat when alone, foods she would eat with company, and foods she would eat if her children were visiting.

Cluster 4—The two participants in Cluster 4 had complex, inconsistent card-sorting patterns. Cluster 4 participants were oriented toward where food was obtained. They frequently used labels such as "homemade," "food from home," "restaurant food," or "take out."

Participants in Cluster 4 gave descriptions of foods that often centered on their location at the time of consumption. These participants described wanting different foods and felt constrained in their food choices by locations, in particular work locations. Participants in Cluster 4 developed strategies to overcome these contextual constraints, like making extra food at dinner the night before in order to bring it to work the next day or leaving work on errands to get food from preferred restaurants.

Cluster 5—The nine participants in Cluster 5 had complex sorts but they varied in their consistency. Seven participants had inconsistent sorts, but two were fairly consistent across contexts, using similar food categories in three of the four contexts. Participants in Cluster 5 were oriented toward ease, accessibility, and cost in different food and eating contexts. The complex sorting strategies used by these participants included numerous other categories like Well-being and Preference. Participants in Cluster 5 differed from others in their emphasis on the convenience of different foods. They used labels like "quick and easy," "if available," "too expensive," and "packable" to describe foods.

Four Cluster 5 participants described choosing foods based on their ease of preparation, particularly in reference to work lunches and evening dinners. Another participant was very focused on using both time and money wisely. Three participants described foods in terms of portability and feasibility in different settings.

Cluster 6—Seven participants were included in Cluster 6. These participants were oriented toward characteristics of the meal, including meal time and Meal components. All of the Cluster 6 participants frequently used labels like "appetizer," "main dish," "side dish," and "dessert" when classifying foods.

Four Cluster 6 participants had simple and consistent card-sorting patterns. These four were classified in Cluster 6 both in the preliminary grouping and in the k-means cluster analysis. The other three participants had complex and consistent card-sorting patterns and had been classified in Cluster 7 in the preliminary grouping. While these three participants frequently used the Meal component category, they also occasionally used the food-group category when sorting food cards. Examination of card-sort labels and transcripts revealed that these three participants used Food group categories along with Meal component categories in the context of a meal. For example, they used "meat" and "main dish" interchangeably to describe the main component of their dinner meal. The Cluster 6 participants differed from Cluster 7 participants in their emphasis on the context of the meal versus the intrinsic properties of the foods.

Cluster 7—The eight participants included in Cluster 7 tended to have complex, consistent card-sorting patterns. These participants were oriented toward the origin and properties of foods in general, especially food groups but also physical characteristics and nutrient

composition. They frequently used food labels like, "bread", "grains," "fruits and vegetables,", "dairy," or "meats."

Cluster 7 participants were oriented toward intrinsic properties of foods in various ways. Two participants had simpler card sorts using mainly Routine and Meal/time categories. With prompting, these participants were able to further sort the card-sort piles using food groups, but they did not ascribe any personal or contextual relevance to these food group labels. Another Cluster 7 participant tried to incorporate foods from different food groups when cooking because of prior training as a cook. Three other Cluster 7 participants talked about health during the interviews and used the Food group category when sorting food cards, however, they did not ascribe health values or personal relevance to their labels. Two other Cluster 7 participants had complex card-sorting patterns and used both Food group and Nutrient composition categories. These two participants discussed personal health concerns and linked these concerns to the Food group and Nutrient categories. These two participants were oriented toward characteristics of the foods that made them more or less healthful regardless of personal health needs and feelings, which made them different from participants in Cluster 2 who focused on personal well-being.

4. Discussion

The findings of this investigation provide insight about individual differences in food schema structures. Unique features of this study are the combined use of repeated card-sorting activities to elicit food categories, open-ended interviewing to define food and eating contexts and determine food category meanings, and clustering of individuals based on food-category use.

The identification of seven food schema clusters in this study demonstrates the variation in food schema structures among participants having similar socioeconomic status and living in the same culture and geographic area. These findings are consistent with those reported in other studies of food (Cullen et. al., 2002) and health related beliefs (Weller & Baer, 2002). A study of food beliefs and consumption of fruits, juice, and vegetables in three different ethnic groups found more within- than between-group differences, suggesting that individual factors may be more important influences on food choice than ethnicity (Cullen et. al., 2002). Furst et. al. (2000) also proposed that people have personally operational food classifications that are embedded in a nested set of social and cultural classifications. The individualization of food schema structures is consistent with models of food choices that emphasize unique construction of food choice based on a person's interpretation of influences and life course events and experiences (Devine, Connors, Bisogni & Sobal, 1998; Furst, Connors, Bisogni, Sobal & Falk, 1996).

The study findings support the idea that people use different fundamental bases for food classification (personal-experience-based, context-based, or food-based). Each of the seven food schema clusters demonstrated a focus toward one of the three bases of classification identified in an earlier report, although there was some overlap in the use of food categories (Blake et. al., 2007). Clusters 1 and 2 used more personal-experience-based food categories. Clusters 3, 4, 5, and 6 used more context-based food categories. Cluster 7 used more food-based categories. These findings suggest that while there are between-person commonalities in food classification, individual differences occur within those larger themes.

In spite of the many differences across the seven food schema clusters, a commonality among most participants was the salience of Meal/time categories in their sorting of the food cards. The Meal/time (e.g., breakfast, lunch, dinner) food-category type represents common culturally shared labels used to organize thinking about food and eating and for communication between individuals (Bisogni et. al., 2007; Furst et. al., 2000). Meals have also been described as time

markers, playing an important role in how people organize and remember their days (Meiselman, 2000).

Another shared category across most participants was the Routine food category (e.g., usually eat, sometimes eat, never eat). The common use of labels in the Routine category emphasizes the self-awareness that individuals have of their personal patterns in food choice and the importance of these typical ways in their lives. These findings are consistent with conceptual models of food choice and classification that emphasize an individual's construction of food choice (Bisogni et. al., 2007; Furst et. al., 1996; Furst et. al., 2000) and the development of routines to simplify food choice (Connors, Bisogni, Sobal & Devine, 2001).

Clusters 2 and 7 shared the use of traditional food-group categories in their card sorts (e.g., "fruit", "meat"). Cluster 7 participants did not ascribe personal or contextual relevance to the Food group category. In contrast, when the participants in Cluster 2 used Food group labels, they frequently personalized those labels with qualifiers such as "pasta and bread group I avoid" or "starches that give stored energy." Individuals in Cluster 2 may have more fully integrated food groups into their food schemas while those in Cluster 7 were merely aware of their existence (Barsalou, 1992). This distinction in cognitive structures related to food group labels may help explain why many studies have failed to demonstrate strong relationships between nutrition knowledge and behavior (Axelson & Brinberg, 1992; Worsley, 2002). Individuals with different food schemas may be demonstrating similar performances on knowledge assessment measures because knowledge assessment tools assess awareness or recognition but not the integration of this awareness with personal constructions of foods (Worsley, 2002).

One perspective on food choice proposes that people construct their understanding of food based on life-course experiences and various contextual influences (Furst et. al., 1996). While nutrition knowledge may affect an individuals food choices other considerations including aspects of the food (e.g. taste), aspects of the environment (e.g. social setting) and aspects of the person (e.g. food identity) may be more influential (Axelson & Brinberg, 1992; Bisogni, Connors, Devine & Sobal, 2002; Booth, 1994; Meiselman & MacFie, 1996; Shepherd, 1999). The findings presented here suggest that people differentially weight these considerations by the categories they use to classify foods.

This study provided insight about individual cognitive differences that may underlie food-choice behaviors in a sample of 42 employed adults living in one geographic region of Upstate New York. However, these results may not be generalizable to other people living in different areas, times, or situations. The limited number of food cards and the card-sorting tasks used to explore individuals food schemas are not perfect substitutes for real-life food and eating contexts (Meiselman, 1992). Other food categories and different clusters may have emerged in a study using different elicitation techniques (e.g. metaphor elicitation, laddering) or different sets of cards (Christensen & Olson, 2002). Also, other clusters may have emerged in a different sample or in different food and eating contexts. Future studies with other populations of interest to public health professionals such as working parents, single mothers, adolescents, or adults with type 2 diabetes mellitus might provide valuable insights into the range of different food schemas and aspects of food schemas that are shared within a given population. An understanding of culturally shared food schema would be valuable for the development of population targeted "healthy eating" programs.

Cluster analysis attempts to identify unknown patterns in the data by imposing patterns on the data, and different clustering techniques can yield different cluster solutions (Aldenderfer & Blashfield, 1984). This study attempted to overcome this limitation using previously tested validation techniques (Aldenderfer & Blashfield, 1984). However, confirmation of these clusters requires future follow-up investigation using larger, population based samples (Henry

et. al., 2005). Current findings suggest that intra-individual variation in food schemas is greater than contextual or other between-subject sources. Future studies with larger, population based samples would allow for an exploration of the sociological (e.g. social stratification, life-stage) or psychological (e.g. extraversion, anxiety proneness) predictors of this intra-subject variation.

Insight into individuals' food schemas could help nutrition practitioners tailor messages to maximize health impact (Axelson & Brinberg, 1992; Campbell et. al., 1994; Shepherd & Sims, 1990). Nutrition practice would also be informed by future studies of how individuals' food schemas relate to food choice behaviors and how education can shape or change schemas (Nishida, 1999; Worsley, 2002). Additional studies of population level differences and similarities in the use of food categories would provide valuable insight into culturally shared food schemas. This information would be useful for public health nutritionists in the design and implementation of "healthy eating" programs.

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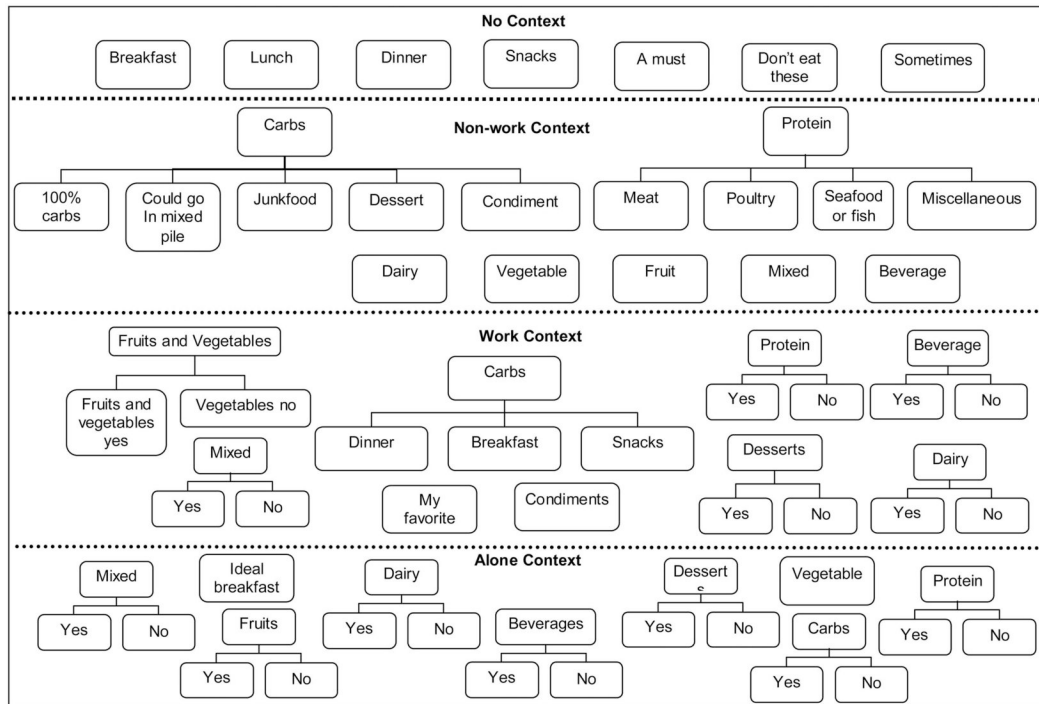
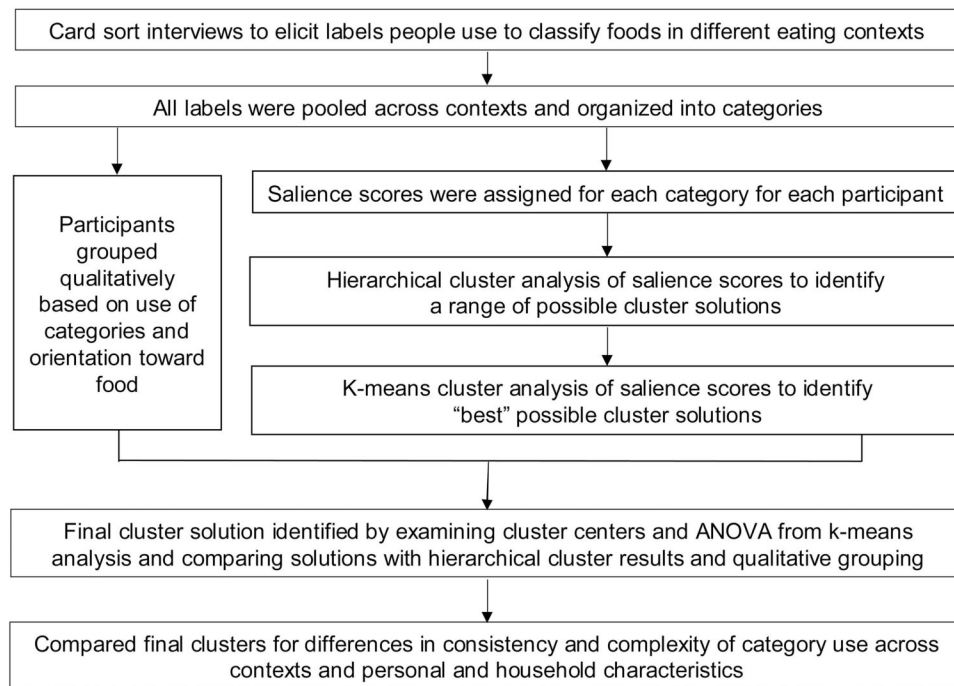**Figure 1.**
Data Collection and Analysis Flow Chart

Figure 2.
Food Card-sort Labels in Four Contexts for One Participant

Table 1

Food categories organized by basis for classification with corresponding food card-sort label examples and food card-sort label scoring for each card-sort context for the labels depicted in Figure 1.

FOOD CATEGORIES AND FOOD CARD-SORT LABEL EXAMPLES	Card-Sort Label Scoring Example				
Personal-Experience-Based	*None*	*Home*	*Work*	*Alone*	**Total**
Routine — "I'd eat most often," "hardly ever," "once a week," "staples"	3	0	3	3	**9**
Well-being — "healthy," "bad for you," "mood foods," "allowed on my diet"	0	0	0	0	**0**
Preference — "favorite," "I like it," "I don't like it," "I hate," "treat"	0	0	1	0	**1**
Context-Based					
Meal/Time — "breakfast," "dinner," "snack," "stuff in the evening," "summer"	4	0	2	2	**8**
Meal component — "main dish," "side dish," "condiment," "goes together"	0	0	3	2	**5**
Convenience — "quick and easy," "logistically difficult," "not available"	0	0	0	0	**0**
Person — "foods for my child," "company food," "my boss' food"	0	0	0	0	**0**
Location — "eat at home," "at work," "restaurant food," "road food"	0	0	0	0	**0**
Food source — "homemade," "stop by store and get," "get out of the machine"	0	0	0	0	**0**
Food-Based					
Food Group — "grains," "vegetables," "dairy," "meats," "candy"	0	4	4	4	**12**
Physical Characteristics — "sweet food," "cooked," "processed," "cold," "finger food"	0	0	0	0	**0**
Nutrient Composition — "starches/carbohydrates," "proteins," "fats," "calorie"	0	3	2	2	**7**

Table 2

Mean salience scores for a seven cluster solution using K-means cluster analysis. *

Food Category	Cluster 1 (n=9)	Cluster 2 (n=4)	Cluster 3 (n=3)	Cluster 4 (n=2)	Cluster 5 (n=9)	Cluster 6 (n=7)	Cluster 7 (n=8)	Sig.**
Meal/time	12.8	10.5	13.0	14.5	11.8	13.0	11.0	0.31
Routine	13.4	10.8	10.7	6.5	8.2	1.6	10.1	0.00
Meal component	1.4	7.5	1.3	4.5	6.7	11.3	7.4	0.00
Preference	2.9	5.8	7.0	4.5	4.3	3.7	1.4	0.03
Well-being	1.0	7.3	1.7	1.5	4.0	.4	1.6	0.00
People	.7	.3	6.0	.0	1.7	.3	.4	0.00
Location	1.1	4.3	5.0	1.5	2.9	2.9	.9	0.03
Source	.7	.3	3.7	8.5	1.2	2.9	.6	0.00
Convenience	.7	.5	3.7	.0	7.4	1.0	1.0	0.00
Food group	.1	2.0	.0	.0	1.4	4.1	7.1	0.00
Physical characteristics	.1	.5	.0	1.0	2.2	1.7	.5	0.08
Nutrient composition	.0	1.5	.0	.0	.1	.4	1.4	0.27

*
Cells include mean salience scores for each food category of participants included in the cluster.

**
Significance for comparison of mean salience scores using one-way-analysis of variance across seven clusters.