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Analysis of data from a free-listing study of menus by different income-level populations

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ABSTRACT

Free listing can help understand how a domain is perceived across a group of people by examining the average psychological saliency of items, in this case, menus elicited by a population. The objectives of the present work were: (a) compare different indexes used to analyze the saliency of items listed by individuals in a free-listing exercise, (b) test if time distance can be an improvement over rank distance in associating items mentioned by subjects, and (c) apply the above indexes and associations to gain insight in the menus listed by different income-level populations in Argentina. In the present study we surveyed a total of 200 women from low and medium/high-income levels who were asked to list all the menus they knew registering the mention order and time to mention. Smith's saliency index and cognitive salience index (CSI), previously not applied in the food science literature, proved useful in selecting the core menus listed by a population. The hypothesis that time distance would be a more adequate measure of the association of items in a list than order of mention was not sustained in the present study. Cluster analysis was also found useful in analyzing how menus were grouped by different income levels using a free-listing procedure. ANOVA on the CSI values showed a significant menu × income-level interaction, thus indicating that saliency was not the same for listed menus across income levels.

1. Introduction

A cultural domain is a set of items or things that are all of the same type or category. A cultural domain is a mental category like "animals" or "illnesses". They are a set of items that are all alike in some important way (Borgatti, 1999). These can be lists of physical observable elements – fruits or things to eat/drink at breakfast – or more conceptual elements – words associated with dining out, feelings associated with hospital food. Free listing is one of the most popular methods to collect these lists. In the words of Bernard (2002): "Free listing is a deceptively simple but powerful technique". In free listing, you ask respondents to "list all the X you know about" or inquire "what kinds of X are there?" where X might be cookie brands, movie stars or menus. Practically speaking, to define a cultural or cognitive domain is to make a list of its elements. For example, to define the domain of menus is to generate a list of what people in a given culture would consider a menu (Borgatti, 1996). Free listing is commonly used to identify the elements and boundaries of a particular domain (in this case, menus mentioned by a population) and determines the relative salience or importance of words defining the domain. Merging lists from a group of respondents shows which words are typically used by these respondents to describe a given concept (Barg, Keddem, Ginsburg, & Winston, 2009).

Free listing is a technique that has been used regularly in anthropological studies. For example, Henley (1969) asked adult Americans to name as many animals as they could in 10 min. Trotter (1981) asked Mexican Americans to name home remedies they knew and what illnesses each remedy was for. Walker and Hennig (2004) used a free-listing procedure to generate the attributes of three types of moral exemplars (just, brave, and caring). Schrauf and Sanchez (2008) concluded that free listing proved to be an accessible, easily administered tool for probing age and group differences in cultural domains.

In food related research it has received little attention. Monárrez-Espino, Greiner, and Martínez (2004) used the method to find foods adequate for a basket targeted at Tarahumara children in Mexico. Hough and Ferraris (2010) introduced free listing as a method to gain initial insight of a food category, using as an example of its application the listing of fruits by 15–18 year-old respondents. Ares and Deliza (2010) used free listing to elicit package information

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considered by consumers when deciding on the purchase of milk desserts.

Free listing has also received research attention. Brewer, Garrett, and Rinaldi (2002) tested different cueing procedures for enhancing recall in free listing of different semantic domains. Schrauf and Sanchez (2010) addressed the question of whether informant age affects list length, concluding that when idiosyncratic items (mentioned by only one person) were eliminated from the analysis, older and younger adults produced equivalent numbers of items. Thompson and Zhang (2006) investigated free listing as a means to assess the relative similarity and difference of the cognitive salience of elements within a domain across groups of respondents.

Smith & Borgatti (1997) calculated a saliency index to analyze their free-listing data about a study of English color terms. This index considers the number of respondents who mentioned the item, the average position of the item in the free-listing procedure and the length of each respondent's list using the following formula (Barg et al., 2009):

$$S_j = \left(\left(\sum_{i=1}^{F_j} (L_i - R_{ij} + 1)/L_i \right) \Big/ N \right)$$

where S_j = saliency index for menu j, F_j = number of respondents who mentioned the menu j, L_i = length of respondent i's list, R_{ij} = rank given by respondent i to menu j, and N = total number of respondents.

Bradway, Dahlberg, and Barg (2010) applied this saliency index to determine a small core of salient patient-derived terms to help understand female urinary incontinence. Sutrop (2001) presented a different index which he called cognitive salience index (CSI). This index takes into account two cognitively important parameters: the frequency of mention of the term, its average position and the number of subjects in the study and is calculated as follows:

$$CSI_j = F_j/(N \times Ap_j)$$

where F_j = number of respondents who mentioned the menu j, N = total number of respondents, and Ap_j = average position of a menu j. This index is useful to compare results from different investigations, as it does not depend on the length of the individual lists. Fagbemissi and Price (2008) used the CSI index in analyzing results from a free-listing study on pest-knowledge among HIV/AIDS child orphans, non-orphan children and adults in rural Benin. Both Smith's saliency index and the CSI take into account the number of times an item is mentioned and the average position it occupies in a list. To date there are no references to research that have used the saliency index and/or CSI to analyze data from studies of free listing applied to food.

Quoting Bernard (2002): "The distance between items in a free list can give glimpses of the underlying cognitive structure of the domain". That is, the difference in rank between two items would provide a natural measure of the distance between them in the mind of each respondent. The rank has been used to calculate a saliency index for each item (Barg et al., 2009) or to group items using multidimensional scaling or cluster analysis (Hough & Ferraris, 2010). When a subject is listing menus, he/she may mention ravioli and immediately name cannelloni as an associated pasta; thus the rank distance between ravioli and cannelloni would be = 1. After mentioning cannelloni, he/she may not think of another pasta and could remain silent for some time till the next menu is brought to mind, for example a rice stew. The rank distance between cannelloni and stew would also be = 1. However, if the time taken to mention each menu were recorded, then the time distance between ravioli and cannelloni would be small, and between cannelloni and rice stew it would be relatively large. The time distance would be more representative of the true distance between menus in the mind of the subject than the rank distance.

In gathering knowledge about food menus consumed by a population different methods have been used. Lambe et al. (2008) compared a 14-day diary with a 3-day diary followed by a food frequency questionnaire; both alternatives are time consuming in relation to free listing. Dapi, Nouedoui, Janlert, and Haglin (2005) conducted focus groups to obtain information about the most consumed food to be included in a food frequency questionnaire which was then employed to investigate Cambodian adolescent's food habits. Food frequency questionnaires provide quantitative data with the prime objective of assessing the nutritional status of a population; however, they lack the spontaneity obtained from free listing through which insight as to salient menus consumed by a population can be gained.

Marshall (2000) discussed class differences in British meal patterns, indicating that diet differences were more pronounced in the past but that over the long term, rising standards of living gave more choice to the working class and, socio-economic differences in diet tended to narrow. This has not been the case in developing countries where socio-economic differences are still pronounced. In Argentina, like in other countries, common meal patterns across the overall population have ceased to exist to give way to income related patterns across the population. Aguirre (2005) reported that there was a tendency for low income population to consume foods high in carbohydrates such as bread, noodles and potatoes; while medium to high income populations tend to choose high value foods such as ready prepared menus, industrialized dairy products and sophisticated fruits. In Argentina the traditional rural or urban workman's menu was beef grilled over wood embers, yet today this menu is somewhat of a luxury. The same has happened in Brazil with "feijojada", a meat stew originated among the poorer classes but ritually eaten by all socio-economic groups. Oths, Carolo, and Dos Santos (2003) reported that the poor could not afford to eat it. Sosa and Hough (2006) measured acceptability of menus among children and adults from low- and medium-income households in Argentina. On average subjects from low income households had higher acceptability scores than subjects from medium income households. From this brief discussion income level is an issue to be considered when investigating menus consumed by a country's population.

In Argentina and other countries knowledge of menu saliency as elicited by respondents from different income-level populations would provide interesting information for both the food industry and government agencies. It would help the food industry focus its development on improving products that are the most salient in consumers' minds. Government agencies could use this information in designing food-aid programs.

The objectives of the present work were: (a) compare different indexes used to analyze the saliency of items listed by individuals in a free-listing exercise, (b) test if time distance can be an improvement over rank distance in associating items mentioned by subjects, and (c) apply the above indexes and associations to gain insight in the menus listed by different income-level populations in Argentina.

2. Methodology

2.1. Respondents and task

Bernard (2002) mentioned several free-listing studies where the number of respondents ranged from 20, 21, 40, 54, 105 and 378. Barg et al. (2009) interviewed 193 adolescent pre-drivers and early drivers; while Lucan, Barg, and Long (2010) sampled 40 subjects for a study on promoters and barriers to fruit, vegetable, and fast-food consumption. Borgatti (1996) recommended a "small set of respondents (say 30)". In the present study we surveyed a total of 200 women aged between 25 and 55 years of age. Women

Table 1
Distribution of respondents according to city and income level, minimum and maximum list lengths, and average number of menus.

Total number	City	Income level	Minimum	Maximum	Average
200	Nueve de Julio	50 medium/high	7	32	20.6
	(n = 100)	50 low	9	31	17.2
	La Plata	50 medium/high	13	31	20.5
	(n = 100)	50 low	7	32	17.7

were chosen because in Argentine society they are generally the food providers and certainly know what menus the family consumes. Table 1 shows how the 200 respondents were distributed. Nueve de Julio is a city with 40,000 inhabitants located 250 km to the west of Buenos Aires in a rural area. In Nueve de Julio the ethnic origin (majority white Caucasian), the products in supermarkets and exposure to nationwide media is similar as to the rest of the Argentine. La Plata is a major city with 600,000 inhabitants, 60 km from Buenos Aires and its population can be considered typical of Greater Buenos Aires. The choice of these two cities was to have a sample from a rural city and a major metropolis.

Low income respondents were recruited from people who were under food-aid programs targeted to low-income populations. In Nueve de Julio medium/high respondents were recruited among women who sent their children to private schools, a clear symbol of this income level. In La Plata medium/high respondents were recruited among women walking down a central street by experienced recruiters, if their family possessed a 2004 or newer model car, they were invited to participate. This study was conducted between September and December 2009. In Argentina few families have more than one car, and a 5-year old model is an approximate indicator of medium class income.

All interviews were conducted in central locations. Respondents were interviewed individually. The interviewer had a laptop computer with an Excel® spreadsheet and the interview proceeded as follows:

(a) Age, city and income level were registered.
(b) Respondents received the following instruction: "Your task is very simple. All you have to do is mention all the menus you know, whether you have eaten them or not. That is, all the menus you have eaten, seen or heard about. You have a total of 10 min to complete the task, so there is no rush and there is plenty of time for you to remember the different menus. Don't feel embarrassed if there is a pause or silence while you remember, this is normal."
(c) Respondents were then asked to start listing their menus verbally and the interviewer typed each menu into the spreadsheet. This spreadsheet had a macro which registered the time elapsed between the first typed letter of one menu and the first typed letter of the following menu. When a subject mentioned a menu, the interviewer started typing. During this typing period, the subject was already thinking about the following menu, thus the choice of the time between starting to type one menu and starting to type the next. For example, if a subject mentioned "spaghetti" let us call the time when the interviewer typed the "s" ts. If the following menu mentioned by the subject was "pizza", let us call the time when the interviewer typed "p" as tp. The time difference between "spaghetti" and "pizza" was registered as tp−ts. In most cases several seconds elapsed between the end of typing one menu and the subject mentioning the next menu, thus overlapping was considered negligible. Interviewers had good typing speed.
(d) When the 10 min had finished most respondents had nothing more to say, however they were asked if they had any other menu to mention. Few did.
(e) Respondents were thanked and received a gift equivalent to approximately US$10 for their participation.

2.2. Data analysis

2.2.1. Raw data classification

Data classification was performed by two investigators who applied the following criteria:

(a) The same menu given different names was unified to a single name. For example a beef steak in Argentina can be called: "churrasco", "chuleta", "bife" or "costeleta".
(b) Some menus consist of a main item (e g. steak) and a side dish (e g. french fries or salad). Most respondents just mentioned the main item as the menu ("steak"); when a side dish was mentioned ("steak with french fries") only the main item was retained. If side dishes had been considered, then for example, "steak with french fries" and "steak with salad" would have been counted as different menus and the incidence of the main item of the menu, that is "steak", would have diminished. The focus of this research was on the main menu items and not on the side dishes.
(c) Side dishes were considered a menu when mentioned on their own. For example "salad".
(d) Menus with different preparations were unified. For example "ravioli with tomato sauce" and "ravioli with cheese sauce" were unified to "ravioli".
(e) When a main menu was mentioned two or more times with different side dishes, only one mention was considered; however, the positions of the mentions were respected. For example if a respondent mentioned 1 – stew, 2 – barbecue with salad, 3 – barbecue with french fries and 4 – pizza; this respondent's list remained as: 1 – stew, 2 – barbecue and 4 – pizza.

2.2.2. Summary statistics and saliency indexes

Once menus had been classified the following summary statistics and indexes were calculated:

- Total number of menus mentioned by all respondents.
- Minimum, maximum and average number of menus listed by each group.
- Number of times each menu was mentioned.
- Average position that each menu occupied in the list from each group using the following formula:

$$Ap_j = \left(\sum_{i=1}^{N} R_{ij}\right)/F_j \quad (1)$$

where Ap_j = average position for menu j, R_{ij} = rank given by respondent i to menu j, F_j = number of respondents who mentioned menu j.

- Average time to mention for each menu using the following formula:

$$Atm_j = \left(\sum_{i=1}^{N} T_{ij}\right)/F_j \quad (2)$$

where Atm_j = average time to mention for menu j, T_{ij} = time to mention given by respondent i to menu j, F_j = number of respondents who mentioned menu j

- Smith's saliency index:

$$S_j = \left(\left(\sum_{i=1}^{F_j} (L_i - R_{ij} + 1)/L_i\right) \Big/ N\right) \quad (3)$$

Cognitive salience index (CSI):

$$CSI_j = F_j/(N \times Ap_j) \quad (4)$$

When considering the time taken to mention each menu we found that the average time over the 50 medium/high income respondents from the city of La Plata was substantially lower than other groups. These respondents were recruited while walking down the pavement in a central street and were promised that they would not be delayed more than 15 min. Many respondents under these conditions want to finish the task as soon as possible, and interviewers were also conditioned to this fact. Thus it is not surprising that interviews proceeded quicker than for other groups and thus general response times were shorter. Respondents from other groups were pre-recruited and asked to go to a familiar central location, with a flexible time limit to their interview. Thus their general response times tended to be longer than for the medium/high income La Plata group. Another factor that can influence the speed of response is the dynamics generated between the interviewer and the respondent. Age, gender and general behavior can lead to shorter or longer interviews. To correct data for these effects each respondent's time list was mean centered.

2.3. Cluster analysis

To perform cluster analysis the first step is to construct a distance matrix. Hough and Ferraris (2010) found city-block distance to be more appropriate for this type of data. Procedures for calculating the distance matrix accept a certain number of missing values (Payne, 2007). It is obvious that a distance between a menu listed by only one respondent and other menus cannot be measured. Distances of menus mentioned by very few respondents either cannot be calculated, or there is a high uncertainty in the calculated distances. So when calculating a distance matrix menus listed by more than a certain percentage of respondents has to be considered. In the present study distance matrices were calculated for core menus chosen as discussed in the results section.

Once the distance matrix was formed it was used to perform cluster analysis. Hierarchical cluster analysis was performed using the average distance option (Jacobsen & Gunderson, 1986, chap. 10). Genstat-12th Edition statistical package was used for calculations (VSN International, Hemel Hempstead, UK).

3. Results

3.1. Summary statistics

3.1.1. General averages

After the initial compilation of the raw data, a total of 121 unique menus were mentioned. Table 1 shows the minimum and maximum list lengths, and average number of menus corresponding to each one of the groups. There was no significant difference between the average number of menus in both cities. There was a tendency for low income respondents to mention fewer menus than medium/high income respondents ($P < 6\%$), however magnitude of the differences was not large: approximately 17 and 20 on average for low and medium/high-income levels, respectively. Considering the total number of consumers, the average number of menus mentioned was 19.

3.1.2. Choosing the adequate index

The five indexes proposed in the data analysis section were calculated over the 200 respondents. Table 2 shows the values obtained for the 24 core menus calculated over the 200 respondents, values were ranked according to CSI. The choice of the 24 core menus is explained in Section 3.1.3. The first observation is that the CSI and the saliency index presented the same rank for the menus; the other three indexes (average position, number of mention and average time) did not present the same rank.

In a first impression a menu that was mentioned by many respondents may suggest an important cultural salience. However, if it was mentioned at the end of respondent's lists its saliency would not be that important. An example is tart, which was the 8th most mentioned menu but its average position was 15th (Table 2). The opposite would be a menu that had a few number of mentions with a low average position value; an example was the case of the pot roast which was placed 6th in the rank of average position, but 17th in number of mentions.

In calculating average position (see Eq. (1)) an alternative would have been to divide by the total number of respondents, instead of dividing by the number of respondents who actually mentioned the menu. As the total number of respondents was larger than the number of respondents that elicited a menu, this calculation would have given an artificially low average position.

With average time to mention, the discrepancies with number of mentions were similar as those described for average position. For example soup was placed 7th in the ranking by average time to mention but 16th according to number of mentions.

From the above discussions while the analysis of the number of mentions, average position and average time to mention can provide an idea of the cultural salience of a menu, discrepancies may occur when comparing the results obtained by each of them. For this reason it is necessary to integrate these indices with the purpose of obtaining more trustworthy results of the cultural salience of a menu. Smith's saliency index and CSI provide this integrated approach as they consider number of mentions and position in the lists. These indexes are plotted for the first 26 menus in Fig. 1. Both indexes provided the same ranking of relevance. Both indexes consider position and number of mentions. For this

Table 2
Five indexes calculated for the 24 core menus over the total number of respondents. Menus are ordered according to the cognitive saliency index.

Menu	Cognitive saliency index (Eq. (2))	Smith's saliency index (Eq. (1))	Number of mentions	Average position (Eq. (3))	Standardized average time to mention
Milanesa[a]	0.202	0.803	193	4.782	−110.196
Spaghetti	0.110	0.626	176	8.006	−58.218
Stew	0.093	0.550	149	7.980	−95.073
Chicken	0.089	0.548	161	9.093	−51.367
Barbecue	0.071	0.475	162	11.401	−12.076
Beef steak	0.056	0.379	130	11.600	−13.915
Pizza	0.054	0.371	141	13.163	3.336
Tart	0.051	0.362	135	13.156	6.107
Ravioli	0.051	0.354	126	12.349	−14.597
Salads	0.051	0.354	123	12.106	−10.937
Rice	0.050	0.345	121	12.215	−7.169
Empanadas	0.047	0.325	141	14.879	30.059
Shepherd's pie	0.047	0.293	96	10.313	−30.943
Gnocchi	0.041	0.280	104	12.635	−9.948
Hamburguer	0.039	0.269	106	13.679	7.892
Soup	0.036	0.256	93	12.817	−14.918
Pot roast	0.035	0.239	75	10.573	−35.011
Cannelloni	0.031	0.224	84	13.357	−1.126
Fish	0.029	0.214	86	15.000	49.721
Puchero[b]	0.027	0.185	68	12.632	2.346
Roast meat	0.027	0.183	75	14.147	0.761
Meat balls	0.022	0.159	64	14.641	47.716
Tortilla	0.021	0.159	67	15.955	54.540
Corn meal	0.019	0.132	58	15.034	24.441

[a] Fried breaded veal or chicken.
[b] Boiled meat and vegetables.

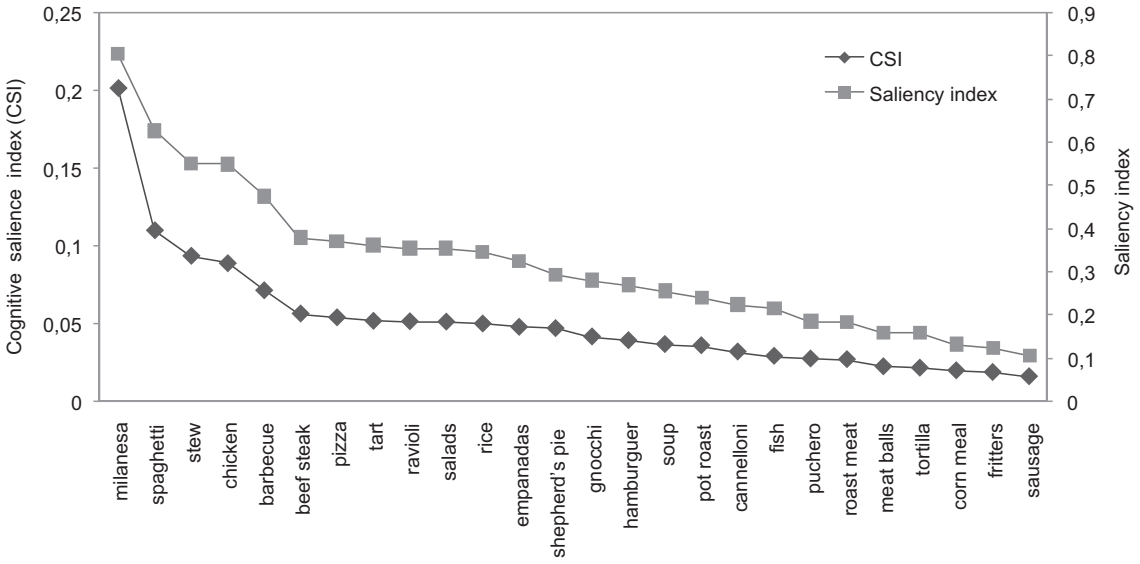

Fig. 1. Smith's saliency index and cognitive salience index (CSI) of the first 26 menus.

study any of the two could have been chosen, we chose CSI as its calculation is simpler.

3.1.3. Choosing the core menus

In a free-listing study it is of interest to define the core elements of the list. In the present study: which of the 121 unique menus can be considered to be the most salient? Different criteria in defining the core elements have been used in previous studies. Hough and Ferraris (2010) defined the most salient fruits as those mentioned by more than 25% of the respondents, basing their choice on obtaining an adequate stress value in their multidimensional scaling analysis. Ares and Deliza (2010) considered items mentioned by more that 10% of respondents. Barg et al. (2009) based their choice on the saliency index. These authors sorted the saliency indexes from high to low and then plotted them as scree plots using the salience scores as values on the y axis. The scree plots were inspected to select a natural breaking point. Elements with salience scores above that breaking point were retained as the list of salient terms.

To define the core menus in the present study, the CSI values were calculated for each one of the four groups: 2 cities × 2 income levels. For each group the CSIs were ranked from highest to lowest. Then for each group the first 19 menus were chosen. This value of 19 was adopted as it was the average number of menus mentioned by the 200 respondents (Table 1). Of these four lists of 19 menus each, there were a total of 24 different menus and these were considered as the core menus for the studied population and they are listed in Table 2.

Table 3
Cognitive salience index values (Eq. (2)) of the 24 core menus corresponding to each city and income level.

Menu	9 de Julio		La Plata	
	Low income	Medium/high income	Low income	Medium/high income
Milanesa	0.258	0.198	0.179	0.186
Spaghetti	0.163	0.101	0.104	0.094
Stew	0.113	0.057	0.234	0.056
Chicken	0.072	0.11	0.065	0.118
Barbecue	0.07	0.081	0.055	0.079
Beef steak	0.066	0.076	0.027	0.06
Pizza	0.047	0.043	0.06	0.064
Tart	0.039	0.047	0.046	0.077
Ravioli	0.064	0.066	0.036	0.041
Salads	0.05	0.04	0.033	0.08
Rice	0.054	0.047	0.051	0.05
Empanadas	0.046	0.041	0.044	0.061
Shepherd's pie	0.043	0.047	0.056	0.043
Gnocchi	0.049	0.048	0.043	0.027
Hamburguer	0.052	0.04	0.029	0.038
Soup	0.024	0.022	0.083	0.036
Pot roast	0.062	0.015	0.065	0.011
Cannelloni	0.034	0.033	0.025	0.035
Fish	0.016	0.03	0.025	0.045
Puchero	0.041	0.025	0.038	0.009
Roast meat	0.022	0.034	0.008	0.042
Meat balls	0.028	0.017	0.033	0.013
Tortilla	0.02	0.02	0.016	0.03
Corn meal	0.023	0.008	0.038	0.013

3.2. Effects of income levels and cities on saliency of core menus

Table 3 shows the CSI values of the 24 core menus for each surveyed group. In order to determine the influence of city and income level on the CSI values an analysis of variance (ANOVA) was calculated, considering menu, city, income level and their two-way interactions as variation factors. Neither the city main effect nor the menu × city interaction was significant.

The menu × income interaction was significant ($P < 5\%$). The means resulting from this interaction are plotted in Fig. 2; where the 5% least significant difference is also shown. Fig. 2 shows pot roast, and stew were significantly more salient for low income respondents than medium/high income respondents, spaghetti was also more salient for this group but with a significance level of 10%. Pot roast, stew and spaghetti are relatively cheap. Only chicken was significantly more salient for medium/high income respondents. As for the other menus it was observed that barbecue, beef steak, fish, salads and tart showed a tendency to be more salient to the medium/high income level; these menus are relatively more expensive. On the other hand meat balls, milanesas, puchero (see Table 2 for descriptions of milanesa and puchero) and soup showed a tendency to be more salient for the low-income level; these menus are relatively cheap. A menu to highlight is milanesa, on average mentioned first by both income levels; obviously a very popular dish in Argentina for all income levels.

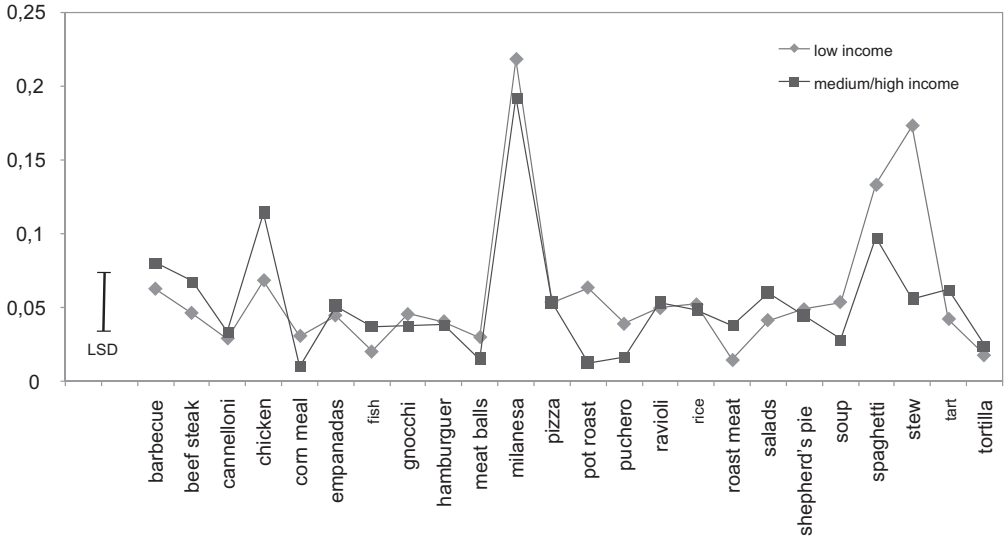

Fig. 2. Cognitive salience index (CSI) values for the 24 core menus for different income-level respondents. LSD: 5% least significant difference.

3.3. Cluster analysis

As the ANOVA analysis showed that there was a significant menu × income interaction, cluster analysis was performed separately on low and medium/high-income levels. In the introduction it was hypothesized that time distance would be more representative of the true distance between menus in the mind of the subject than the rank distance. Cluster analysis was performed using both time and rank distances. Results for rank distance are plotted in Figs. 3 and 4. The results for time distance (not shown) were entirely similar. Thus the hypothesis that time distance would be a more adequate measure was not sustained for this particular study.

Some menus were grouped similarly by both income levels: *ravioli–cannelloni–gnocchi* as pastas and *pizza–empanadas* as quick or finger foods. Low income respondents grouped *milanesa–spaghetti–stew* together and they can be considered frequent, everyday menus. This category for medium/high-income level was *milanesas–beef steak–chicken–barbecue*. *Spaghetti* was included within the pasta group for medium/high-income level, while for the low income it was included in the everyday group. Low-income level had a group of menus prepared with chunky meat: *pot roast–roast meat–barbecue* and *meat balls–puchero–hamburguer*; this group was not present as such for medium/high-income level. This last income level formed groups of economic menus: *pot roast–shepherd's pie, stew–corn meal–soup* and *meat balls–hamburguer*. Other menus, were not clustered, such as *rice, tortilla, salads* and *tart* with medium/high-income level or *chicken* with low-income level; or formed groups with no special meaning such as *roast meat–puchero–fish* for medium/high-income level and for low income *shepherd's pie–corn meal, rice–fish* and *salads–soup*. The number of menus that were not clustered or formed unexplained clusters was not more than 1/3 of the total core menus. The clustering was based on a single criteria: closeness in the free-listing task; and this criteria was sufficient to cluster 2/3 of the core menus in logical groups. Menus that did not belong to any cluster, such as *rice* for the medium/high-income level or *chicken* for the low-income level, were not associated with other menus in the minds of respondents. Menus clustered in groups with no special meaning, had clustering reasons beyond the scope of the free-listing task. Such a simple task left the clustering

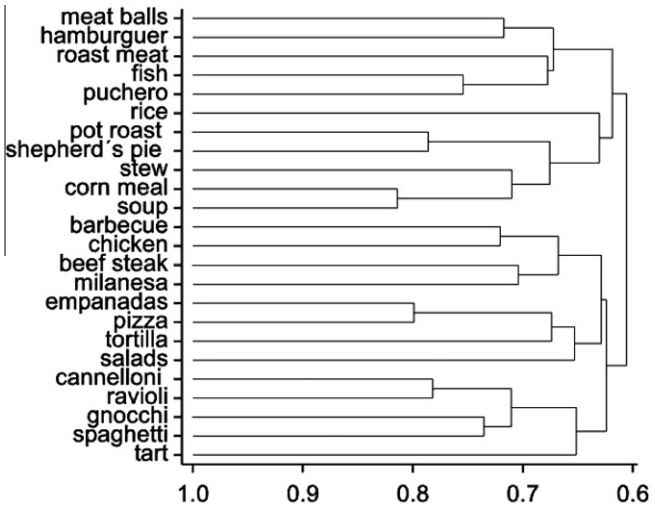

Fig. 3. Cluster analysis of menus based on mention order by medium/high-income respondents.

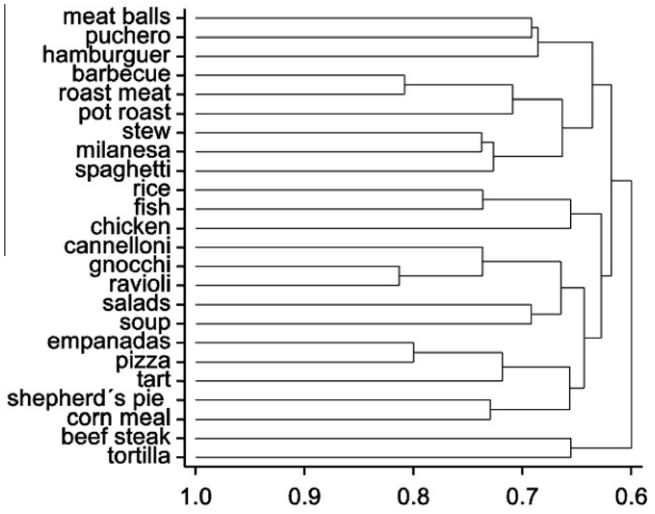

Fig. 4. Cluster analysis of menus based on mention order by low-income respondents.

of some menus unexplained.Hough and Ferraris (2010) in their free-listing study on fruits found that most fruits were grouped logically, while some were not. These authors also found differences between clusters according to income level.

4. Conclusions

Smith's saliency index and CSI, previously not applied in the food science literature, proved useful in selecting the core menus listed by a population. These two indexes were more appropriate to determine the cultural salience of core menus than the other three calculated indexes (number of mentions, average position and average time to mention). We do not recommend using the number of mentions as an indicator of cultural salience of a menu. The main disadvantage of this index is that it does not consider the ranking of mention of a term. A menu may be mentioned by many respondents but in the last positions of the lists. On the other hand Smith's saliency index and CSI takes into account the number of mentions and the average position and for this reason are better indicators of the cultural salience of a term.

ANOVA on the CSI values showed a significant menu × income-level interaction, thus indicating that saliency was not the same for listed menus across income levels. Although a significant number of respondents were interviewed in two distinct Argentine cities, the sample was not a random sample and thus extending conclusions on the saliency of menus elicited to the Argentine population as a whole should be taken with care.

It was hypothesized that time to mention would be a better measure of association between menus in a list than simple order of mention, however for this particular study, both when analyzing average values for each menu and when performing cluster analysis, this hypothesis was not upheld. Time to mention is more complicated to register in the field, so the simpler and classical order to mention methodology would be adequate. However other work would be necessary to corroborate this recommendation.

Cluster analysis was also found useful in analyzing how menus were grouped by different income levels using a free-listing procedure. Generally clusters confirmed the hypothesis that the difference in rank between two menus would provide a natural measure of the distance between them in the mind of each respondent.

As pointed out by Hough and Ferraris (2010) free listing could be used for other sensory or consumer studies. Two possibilities would be developing descriptors from a trained panel, or feelings associated to different foods.

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