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A modified sorting task to investigate consumer perceptions of extra virgin olive oils

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ABSTRACT

A two-stage sorting task was used to probe Californian consumers' opinions of twenty-five extra virgin olive oils based on visual assessments of the bottles. The modification of the simple sorting task aimed to encourage consumers to further discriminate products through sub-groupings of products within the groups they had already made. Sorting data were analyzed using a 3-way extension of classical multidimensional scaling called DISTATIS which explores the level of consumer agreement as well as the structure of the extra virgin olive oil products. Consumer agreements were explained by 46% of the variances found in the ways consumers sorted the bottles. Decreased amount of explained variance from the first stage to the second stage of the sorting task was observed in the olive oil product structures. Consumers were asked to describe the characteristics defining each group formed. Consumer comments were analyzed qualitatively prior to statistical analysis and were later used to understand the sorting results. Despite background differences in the usage of olive oil products, the majority of the consumers perceived the product set similarly. The two-stage sorting task allowed subjects to provide more criteria or multidimensional views of their perception of the products.

1. Introduction

Olive oil accounts for about 8% of all fats and oils consumed in the USA (Vossen, 2009), and that percentage has been increasing steadily for the past 18 years. Current olive oil consumption level is about 246,000–251,000 tons, which correspond to a 185% increased compared to the level in the year 1990 (International Olive Council, 2008a). Yet, the average yearly local production from the year 1990–2008 was about 1240 tons or 0.5% of the consumption level (International Olive Council, 2008b). This huge "production–demand gap" in the USA has been addressed mainly by importing olive oils from various Mediterranean countries. As a consequence, the olive oil import level in America in the year 2008 was about 46.4% of the level of the year 1990 (International Olive Council, 2008c).

Numerous studies have pointed out the health benefits associated with olive oil. The higher proportion of monounsaturated fatty acid in olive oil compared to other oils is believed to help reduce the ratio of LDL/HDL cholesterol and thus lower cardiovascular risk (Martinez-Gonzales & Sanchez-Villegas, 2004). Other bioactive components in olive oil such as polyphenols have been associated with health benefits as well. Three main polyphenols found in olive oil – oleuropin, hydroxytyrosol and tyrosol, are believed to help reduce the risk for degenerative disease by functioning as strong antioxidants (Tuck & Hayball, 2002) and as potent radical scavengers (Saija & Uccella, 2001). Food and Drug Administration (2004) (FDA) announced that a qualified health claim could be used for labeling olive oil products to inform consumers that consuming about a tablespoon of olive oil per day may help reduce their risk for heart disease. This presents an opportunity for olive oil producers to inform consumers about the health benefits consumers can enjoy beyond the sensory properties of the oil itself.

According to the California Olive Oil Council (COOC), there are now over 200 olive oil producers in California. The proliferation of extra virgin olive oil products from California shows a commitment among olive farmers to meet consumer needs for olive oils. Although olive oil has been around for a relatively long time and has been part of the Mediterranean Diet for centuries, California-produced extra virgin olive oil is a relatively new food product category in America. Understanding how Californians perceive California-produced extra virgin olive oils in comparison to imported ones will help American olive oil producers to tailor-make products to meet Californian consumer needs.

Consumers generate personal constructs to evaluate the world around them (Gains, 1989). The repertory grid method (RGM) is an integral part of George Kelly's theory of personal constructs (1955) in which triadic elicitation is used to gather people's perceptions of various phenomena. Numerous studies have utilized RGM to study a variety of foods across different ages and cultures, such as, for example, UK consumer perceptions of starchy food dishes (Monteleone, Raats, & Mela, 1997), Argentinean consumer

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perceptions of genetically modified foods (Mucci & Hough, 2003), Australian consumer perceptions of food products produced by novel technologies (Evans & Cox, 2006), middle-aged consumer perceptions of meat (Russel & Cox, 2004), and older consumer perceptions of meat and fish products (Russel & Cox, 2003).

The original RGM in those studies was expanded to involve not just the qualitative triadic elicitation, but also – using some kind of rating scale –quantifications of product characteristics. The combined qualitative elicitation and quantitative ratings of the product characteristics aimed to produce a product map with the aid of a multivariate analysis, such as generalized Procrustes analysis (GPA). The characteristics elicited helped determine the underlying structures of the product dimensional structures. Although the method produces useful information, it is time consuming for the consumers to complete when there is a greater number of stimuli to be examined. For instance, RGM provided more information compared to free choice profiling when utilized to profile the flavors of cider (Piggott & Watson, 1992). Yet, the two methods produced similar conclusions with RGM taking slightly longer to complete.

Other elicitation methods exist to gather consumer personal constructs. Bech-Larsen and Nielsen (1999) compared five elicitation techniques, namely triadic sorting, free sorting, direct sorting, ranking, and picking from an attribute list, to elicit attributes associated with vegetable oils. They found that the number of concrete attributes generated was higher for triadic sorting and free sorting than for direct elicitation and attribute listing although the former two were not significantly different from the ranking method by Scheffé's multiple comparison test. Yet, the number of abstract attributes generated did not differ significantly across all five elicitation techniques. The attribute list technique generated significantly fewer attributes than triadic sorting and free sorting although not significantly less than the direct elicitation and ranking technique. The triadic sorting followed by the ranking technique took significantly longer than free sorting, direct sorting and picking from an attribute list. Bech-Larsen and Nielsen (1999) suggested the higher complexity of the task natures required additional time for researchers to explain to the subjects and subjects needed more time to elaborate for the more difficult task.

Because of triadic elicitation's longer time requirement, which is limiting for a large set of stimuli, a sorting method was selected in this study instead of the repertory grid method to investigate consumer perceptions of extra virgin olive oils and to elicit consumer language associated with extra virgin olive oil products. The sorting task is a simple way to categorize objects that share similar characteristics into the same group. This task produces similarity data and is less tedious and time consuming than other similarity data producing methods because all products can be presented together at once.

Within the sensory science community, sorting tasks have been used successfully to investigate the perceptual structure of odor quality (Chrea et al., 2005; Lawless, 1989; Lawless & Glatter, 1990; MacRae, Rawcliffe, Howgate, & Geelhoed, 1992; Stevens & O'Connell, 1996) and a variety of complex food products such as vanilla beans (Heymann, 1994), cheeses (Lawless, Sheng, & Knoops, 1995), drinking waters (Falahee & MacRae, 1995), grape jellies (Tang & Heymann, 2002), beers (Chollet & Valentin, 2001; Lelièvre, Chollet, Abdi, & Valentin, 2009), and wine (Ballester, Abdi, Langlois, Peyron, & Valentin, 2009), and yogurts (Saint-Eve, Paài Kora, & Martin, 2004). Sorting has also been used successfully to study non-food products such as automotive fabrics (Giboreau, Navarro, Faye, & Dumortier, 2001), cloth fabrics (Soufflet, Calonniera, & Dacremont, 2004), and plastic pieces (Faye et al., 2004).

Multivariate statistics such as multidimensional scaling (MDS) are normally used to analyze the similarity data derived from sorting. A similarity matrix is generated by computing the number of times each pair of products has been sorted in the same group. The product map shows points in the two dimensional space with each point representing each product to give insights about the similarities and differences among the stimuli. Products that are often sorted together are closer to each other on the map than products that are rarely sorted together. It can be difficult, however, to understand the underlying perceptions of similarities and differences of products from an MDS map. Hence, recent studies have adopted qualitative descriptions for naming the groups formed after subjects have finished the sorting task (Faye et al., 2004, 2006). The verbal descriptions can help identify the underlying dimensions of the similarity map.

In MDS analysis, the individual data are pooled to obtain an aggregated similarity matrix. Consequently, the individual data are lost in the final product map. Other statistical analyses exist that can take into account individual perceptual differences and project verbal descriptions onto the product map. An example of such a statistical technique is generalized Procrustes analysis (GPA), which finds a compromise matrix iteratively from a set of factor score matrices (Gower & Dijksterhuis, 2004; Meyners, 2003; Meyners, Kunert, & Qanari, 2000). Subject positions in relation to how they perceive the differences and similarities among the products can also be projected on the product map to find out how much they agree or disagree in their perceptions of a particular product. Verbal descriptions from the subjects can be projected onto the product map as well. GPA can also analyze distance matrices obtained by sorting, but it requires a large number of iterations for this type of binary matrices to be able to provide the compromise solution (Kiers, 1998).

Consequently, a new statistical method called DISTATIS was adopted as a tool to analyze the sorting data collected for this study. DISTATIS combines classical MDS and STATIS, and takes into account individual subject differences (Abdi, Dunlop, & Williams, 2009; Abdi, Valentin, Chollet, & Chrea, 2007). DISTATIS produces maps for products and for subjects. It can also project the verbal descriptions used to describe product groups onto the compromise space by using the barycentric projection procedure (Abdi & Valentin, 2007). The resulting statistical solutions DISTATIS provides can be akin to the ones GPA provides, e.g. compromise product map, understanding of individual subject positions on the product map, and attribute descriptions projected on the product map. All of these with the added advantage of a lesser analysis time with DISTATIS because GPA necessitates numerous iterations for poorly conditioned binary matrices like the ones from sorting. In addition, DISTATIS incorporate an inferential statistical component and can be used to display confidence intervals for the objects (i.e. olive oils) described in the compromise solution.

Even though some studies found comparable results (Faye et al., 2004; Saint-Eve et al., 2004) and good reproducibility (Cartier et al., 2006), it was noted also that there were some perceptual differences between the product maps derived from sorting and classical descriptive analysis, typically with slightly less product discriminations with sorting. It could be hypothesized that the level of subject expertise (Tang & Heymann, 2002), the level of exposure to products (Frewer, Howard, & Shepherd, 1996; Petit, Hollowood, Wulfert, & Hort, 2007), or even the level of subject category knowledge (Chocarro, Cortiñas, & Elorz, 2009) may contribute to the observed effects. Therefore, to encourage finer product perceptual discriminations and ensure the collection of broad overviews of the extra virgin olive oil product perceptions, the sorting task in this study was modified to include two stages to provide subjects with a second opportunity to expand on their efforts for the original task to provide additional criteria they might not have mentioned earlier.

Because 90% of the extra virgin olive oil (EVOO) producers in California operate on a small scale, either around the coastal regions or the Central Valley, the majority of EVOO products are sold through farmer's markets, specialty/independent stores near the area of production, select wineries, or online stores. Hence, the majority of the consumers we recruited for this study were from Northern California. Our study aimed to investigate the EVOO product perceptions among US consumers, based on product visual appearance, using a two-stage sorting task, and to find out if the modification to the simple sorting task improved perceptual product discrimination.

2. Experimental design

2.1. Materials and methods

2.1.1. Subjects

Previous studies using the repertory grid method recommended recruiting at least 20 consumers with diverse backgrounds to be able to obtain the full spectrum of consumers' personal constructs (Scrivens, Gains, Green, & Thomson, 1989; Thomson & McEwan, 1988). This experiment utilized thirty-one Californian consumers (6M, 25F, age range 20–70 years, mean age 45 years). Consumers were recruited through classified advertisements in the local newspaper and general advertisement of the study on bulletin boards on campus, and through personal recruitment at local supermarkets. Interested consumers were screened through by telephone for simple demographics such as gender, age, occupation, and olive oil and other oil consumption/usage frequencies. Table 1 shows a summary of the consumer demographics and olive oil usage backgrounds.

2.1.2. Stimuli

Twenty-five commercial extra virgin olive oils were utilized in the modified sorting task. Nine of the oils were imported products with eight of them (products #1–8) bought at local supermarkets in Davis, CA (i.e. Nugget, Safeway, and Davis Co-Op) and 1 of them (product #9) donated by an olive oil producer from Spain. Sixteen of the oils (products #10–25) were commercial oils donated by olive oil producers in California and were made from olives grown in California, except one product that also included olives grown in other countries. Only a few of the donated olive oils can be found in the supermarkets where consumers typically go for grocery shopping. Table 2 shows the characteristics of the olive oils tested without the actual brand or company name identified. The oils were presented in their individual unopened bottle packaging with the brand, label and other information visible on either the front and/or back labels, or engraved on the bottles, and available to the consumers for reading inspection. All olive oil bottles had labels pasted as part of the packaging except product #17, which had its information engraved on the bottle itself.

2.1.3. Procedure

Individual consumers were invited to a consumer research facility at the Robert Mondavi Institute (RMI) for Wine and Food Science at UC Davis for an individual experimental session. The 25 extra virgin olive oil bottles were presented horizontally from left to right on a long rectangular table under white light. The order of presentation was randomized for each consumer. The sorting task was performed based on product visual appearance, and not based on the product aroma and flavor. However, there were small amounts of tactile interaction with the products as the consumers held/touched the bottles to inspect them visually and/or to read the labels.

After the consumer arrived at the facility, rapport was established, and then, the experimenter explained the sorting procedure to the consumer. The following instructions were given for the first stage of the sorting task:

> "*please sort all these extra virgin olive oil bottles into groups according to your impressions of the similarities and differences you perceive among the extra virgin olive oil products. I am going to ask you to describe the characteristics that define each group that you form after you finish sorting the bottles. The grouping or classification of the extra virgin olive oil products can be multidimensional meaning you do not have to group them in terms of just one attribute or one dimension. There are 25 products in front of you; you may form as few as two groups and as many as 24 groups. You are welcome to examine all these olive oil products as long as you wish to help you decide which group the olive oil product belongs to*".

After the participant had finished sorting, the experimenter proceeded by asking him/her to describe the similarities perceived for each group formed. The experimenter recorded the groupings made and the verbal answers on the prepared paper ballot.

After the consumer finished with this verbal description task, the experimenter proceeded with the second stage of the sorting task by giving further instructions as follows:

> "*I am now giving you a second chance to subgroup the olive oil products within the existing group if you perceive some further differences within a group; you can make further subgroups with those samples. However, you cannot create new groups by mixing samples from different groups already made. I am going to ask you again to describe the characteristics you perceive for each new group you form*".

After consumers finished with the second stage of the sorting task, they were asked what criteria of similarities they perceived for each new group formed. Again, the experimenter recorded the grouping and verbal answers on the prepared paper ballot.

Upon completion of the modified sorting task, each consumer was asked to complete a short exit survey. Each experimental session lasted 35–40 min. Upon completion of the session, consumers received a gift certificate to a local store in appreciation for their participation.

2.2. Data analysis

Statistical analysis was performed using programs written with the MATLAB software. DISTATIS was utilized to analyze the first stage of the sorting exercise. A more detailed description of the general principles and operation of this statistical analysis technique can be found in Abdi et al. (2007, 2009). The second stage of the sorting task produced data that was somewhat hierarchical in nature with a simple tree-like structure due to the one-time, optional opportunity given to consumers to form sub-group(s) from each initial group created. Therefore, the algorithm provided in the above-mentioned reference was modified slightly to take into account the hierarchical nature of the data from the second stage of the sorting task to ensure representations of products that would be further away from earlier/original group(s) formed during the first stage of the sorting task since those products formed the second layer or group from the original group.

Qualitative analysis was also performed with the numerous words and phrases consumers mentioned to describe each group formed. Similar words/phrases were categorized under the main categorical themes so that keywords could be projected onto the product map to help interpret the underlying product dimension structures. The barycentric procedure was utilized to project the

Table 1
Consumer demographics from the telephone screening and exit survey.

		Number of consumers	(%)
Gender	Female	25	80.6
	Male	6	19.4
Age group	18–25	6	19.4
	26–30	2	6.5
	31–40	4	12.9
	41–50	6	19.4
	51–60	6	19.4
	61–65	5	16.1
	>66	2	6.5
Olive oil consumption frequency	Heavy	19	61.3
	Light	3	9.7
	Moderate	4	12.9
	Nonuser	5	16.1
Origin of olive oil	Imported	21	67.7
	Local	2	6.5
	Both local and imported	8	25.8
Ethnicity	Caucasian	23	74.2
	Hispanic/latino	2	6.5
	Asian	3	9.7
	Mixed	1	3.2
	African American	1	3.2
	Jewish American	1	3.2
Occupation category	Government/state	10	32.3
	Not-for-profit organization	3	9.7
	Private sector	2	6.5
	Self employed	2	6.0
	Homemaker	3	10.0
	Retired	4	12.9
	Unemployed	1	3.2
Present occupation	Artist	2	6.5
	Director	2	6.5
	Educator	2	6.5
	Higher education	1	3.2
	Homemaker	2	6.5
	Research	3	9.7
	Retired	4	12.9
	Social work	1	3.2
	Student	7	22.6
	Teacher	3	9.7
	Unemployed	2	6.5
	Writer	2	6.5
Highest education completed	High school	1	3.2
	Some college	2	6.5
	Bachelor	12	38.7
	Some graduate	6	19.4
	Master	6	19.4
	Ph.D.	2	6.5
	Professional degree	2	6.5
Total household income level	$19, 999 and below	9	29.0
	$20,000 – $49,999	4	12.9
	$75,000 – $99,999	8	25.8
	$100,000 – $149,999	7	22.6
	$150,000 and above	1	3.2
	Prefer not to answer	2	6.5
Marital status	Single	13	41.9
	Married no children	2	6.5
	Married with children	14	45.2
	Divorced/separated	2	6.5
Number of children under 18 years old living in the household	0	24	77.4
	1	3	9.7
	2	2	6.5
	3	1	3.2
	4	1	3.2
Number of years living in CA	1–10	7	22.6
	11–20	4	12.9
	21–30	6	19.4
	31–40	4	12.9
	41–50	5	16.1
	51–60	3	9.7
	61–65	2	6.5
Home ownership status	Mortgage	5	16.1
	Own	12	38.7
	Renting	14	45.2
Home living status	Alone	7	22.6
	With spouse only	10	32.3
	Spouse and children	8	25.8
	With extended family	1	3.2
	With roommates	5	16.1

consumer language onto the product map (Abdi, 2007; Abdi & Valentin, 2007). Specifically, the factor coordinates of a given word or phrase were created by identifying for each consumer the olive oil coordinates corresponding to this word or phrase, and then computing the average of these coordinates over the consumers.

A further refinement to the multivariate statistical technique was the provision of confidence intervals, which can be akin to standard hypothesis testing. Because the sampling distributions of the population were not known, a non-parametric cross-validation technique such as bootstrap was used (Chernick, 2008; Efron, 1979). Bootstraping involved derivation of sampling distributions from the distributions of a large set of samples drawn with replacement from the observed data set. The bootstrap distribution obtained from these samples is then used to estimate the sampling distribution of the population. When confidence ellipsoids of two products do not overlap, these two samples can be considered as statistically different at the $p < .05$ level; when the ellipsoids of two products overlap, these two products cannot be considered as statistically different at the $p < .05$ level. The method to draw confidence ellipses can be found in the appendix of Abdi et al. (2009).

3. Results

The DISTATIS-produced map allowed the identification of subgroups of consumers and of outliers. Two consumers were eliminated because their perceptions of the extra virgin olive oil set were somewhat different than those of the majority of the consumers. Fig. 1 shows the consumer map for 29 consumers and how they perceived the 25 extra virgin olive oils. It can be seen that all consumers formed one large cluster without any significant consumer segmentation. The total percentage of the variance explained by the first two dimensions changed marginally from about 43% to 46% after elimination of the two outliers, thereby validating our approach. The low percentage of variance explained re-

Table 2
Origin, type of olive variety and bottle color of the extra virgin olive oils used in the study.

Products ID	Origin and varietal	Bottle color	Image	Harvest year	'Quality' notes	Cap closure	Culinary suggestion
1	Imports	Clear	Gold olympic wreath	N.A.	First cold pressed, 100% natural	Green metal screw twist with spout	Dressings, marinades, bread dipping
2	Imports	Clear	A man carrying a basket filled with olives and picking olives from the tree	N.A.	Rich taste	Green metal screw twist	Salads, bread dipping
3	Imports	Clear	Olive trees in plantation with a castle picture	N.A.	N.A.	Golden metal screw twist with spout	N.A.
4	Italy	Clear	Olive fruits and leaves, oil pouring on a sliced bread	N.A.	N.A.	Golden metal screw twist with spout	N.A.
5	Spain	Clear	A milling house picture	N.A.	Cold pressed	Wood cork	N.A.
6	Greece	Dark	Two mythological Greek man running, golden olympic wreath	N.A.	Olives obtained solely by mechanical means, packed in modern factory	Dark green cap wrapper	N.A.
7	Greece	Dark	M. Alexander's head coin surrounded by golden olympic wreath	N.A.	First cold press, Kosher, acidity 0–0.8, produced directly from handpicked olives, processed mechanically only	Dark green cap wrapper	N.A.
8	Italy	Clear	Drawings of newly planted trees, a new unmature olive fruit, a mature olive fruit, and an olive plantation	N.A.	Hand-picked, estate grown, 100% Italian olives, first cold press, 0.2–0.4% acidity	Very light gold metal screw twist with pour control spout	A pesto recipe attached
9	Spain	Clear	Half tomato slice, grilled chicken, sliced carrots, bread, French fries, and green leafy salads; olives attached onto branches	N.A.	Home grown; obtained directly from olives and solely by mechanical means	Olive green metal screw twist	As illustrated by the image
10	CA blend	Dark	Lime green alphabet 'O'	N.A.	Cold pressed, olives handpicked on small family farms	Transparent white plastic cap wrapper, black cap twist wood cork	Drizzle
11	CA blend	Dark	Picnic foods (cheese, bread, wine glass and bottles) layout on a picnic blanket on a hill	November 07	COOC Quality seal	Dark maroon cap wrapper, wood cork	N.A.
12	CA blend	Dark	Stained glass artwork with olives attached on branches with leaves	N.A.	Yolo County Fair 2007 gold award, COOC Quality Seal, Los Angeles olive oil competition 2007	Silver cap wrapper, ribbon around bottle neck	N.A.
13	CA blend	Clear	Light lime green olives on branches with leaves	2008	Award winning, harvested by hand and immediately first cold pressed within 24 h, un-filtered with low acidity level	Black cap wrapper	Dressing or condiment
14	CA Manzanilla	Clear	Olive trees in plantation	Fall Harvest	Cold pressed, unrefined, produced naturally, contains no imported olive oil, chemicals, artificial coloring or preservatives	Red cap wrapper, plastic screw twist	For application in which the full flavor of the olive oil is desired
15	CA Mission	Clear	Photo of real olives on thin branches	Early harvest	COOC Quality seal	Black cap wrapper, wood cork	N.A.
16	CA blend	Dark	Two globes of world map	2008	Hand-picked, crushed within 24 h of harvest, cold pressed, un-filtered, and COOC Quality seal	Black cap wrapper, wood cork	Grilled fish or vegetables, drizzle over garlic bread
17	CA Frantoio	Clear	A golden horse surrounded by golden olympic wreath	N.A.	N.A.	Black cap wrapper, wood cork	N.A.
18	CA blend	Dark	Very light olive green olive leaves on branches on left and right side	2007	COOC Quality seal	Black cap wrapper, plastic cork	N.A.
19	CA blend	Dark	Handpainted picture of olives on branches with hills on background	N.A.	COOC Quality seal	Black cap wrapper, wood cork	Drizzling over grilled vegetables and cheeses for antipasto, blending with garlic and basil to make pesto
20	CA arbequina	Dark	Part of brand name letter alphabet used olive and leave image	N.A.	Obtained solely by mechanical means, un-filtered, hand picked, 100% California estate grown, cold pressed immediately, COOC Quality seal	Golden metal twist cap screw with spout inside	Dipping, dressings, poached fish, pasta, grilled vegetables alike

(*continued on next page*)

Table 2 (*continued*)

Products ID	Origin and varietal	Bottle color	Image	Harvest year	'Quality' notes	Cap closure	Culinary suggestion
21	CA arbequina	Dark	Photo of reddish olives on tree branches, drawing of an (olive) tree	October 07	Harvested by hand, un-filtered	Golden metal twist cap screw with spout inside	N.A.
22	CA Tagiasca	Dark	Caligraphic brand name writing	N.A.	Estate grown, hand picked, stone milled within hours, low acidity levels	Plastic cork	Finishing oil over fish, seafood, vegetables, delicate dishes, in pestos, or for dipping
23	CA arbequina	Dark	Drawings of two olive trees on a hill	October 07	Un-filtered, hand harvested	Black cap wrapper, wood cork	Vegetables, pasta, drizzle over fish
24	CA arbequina	Dark	Handwritten brand name on front bottle	N.A.	Award winning, handpicked and crushed immediately after harvest	Black cap wrapper	N.A.
25	CA blend	Dark	Green horse	November and December 2008	Milled within 24 h of harvest	Brownish olive green cap wrapper, wood cork	N.A.
26	Italy	Dark	Photograph of the actual person producing the oil	N.A.	First cold pressed	Dark green metal screw cap	–
27	CA blend	Dark	C letter with olives attached onto branches with hills on background picture	N.A.	Los Angeles County Fair Gold Medal Award	Black cap wrapper	Salad dressing, drizzled over cheese, tossed with pasta and herbs

Products ID #1–25 were used in the consumer study using modified sorting. Products ID #1–8, #10–19, #21–23, and #26–27 were used in the preliminary study using repertory grid.

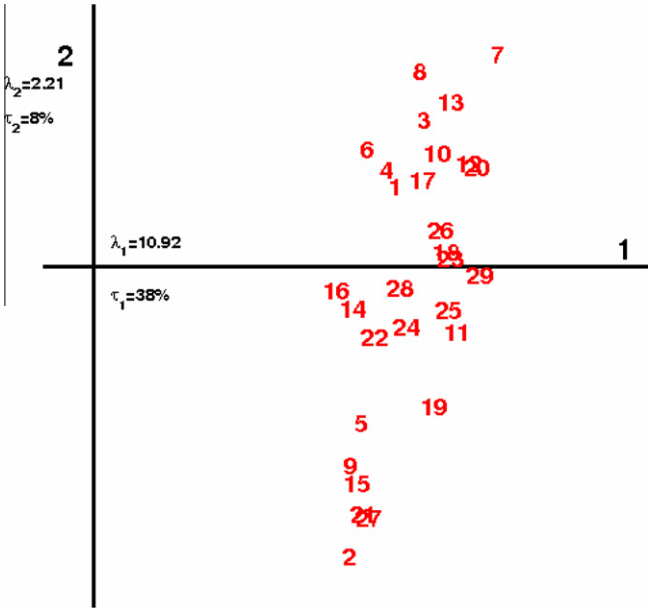

Fig. 1. The level of agreements among 29 consumers for 25 extra virgin olive oils.

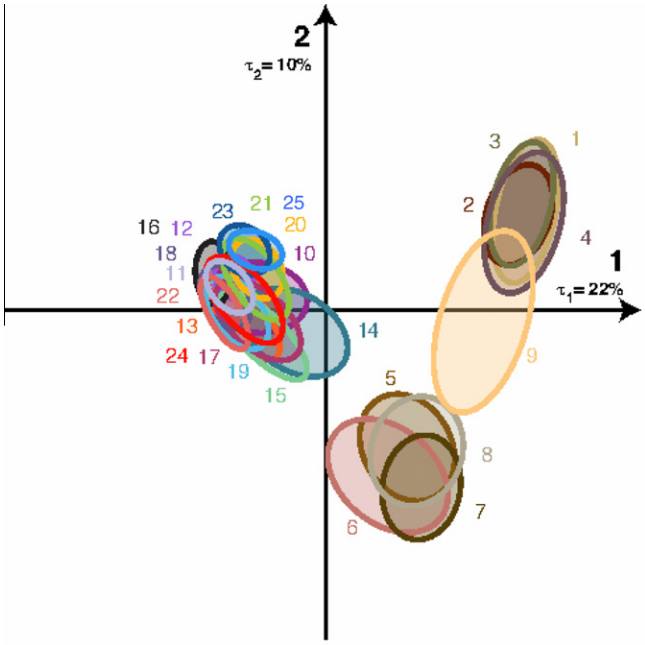

Fig. 2. Positioning of 25 extra virgin olive oil products and the associated confidence intervals from the first stage of sorting task.

flected the great variability normally found among consumers in most consumer studies.

Fig. 2 shows the product perceptions from the first stage of the sorting task with confidence intervals drawn around the products. It can be seen that products 1, 2, 3 and 4 were not significantly different from each other as reflected by the overlap of their ellipsoids. The same can be said of products 5, 6, 7, and 8. Product 9 overlapped with all products 1, 2, 3, 4, and 8. The many ellipsoids overlapping for products 10–25 confirmed that these products were not perceived as significantly different. The total percentage of the variance explained by the first two dimensions was 32%, likely because of the unexplained variability from the 16 oil products that formed one big cluster.

Fig. 3 shows the product perceptions from the second stage of the sorting task with the confidence intervals drawn around the products. Products 1, 2, 3 and 4 were still not significantly different from each other as in the first stage of the sorting task. However, product 9 was now significantly different from products 1, 2, 3, and 4. Products 5, 6, 7, and 8, which originally had the confidence intervals overlapping each other now had lesser overlaps. Products 6 and 7 now overlapped with only product 5. And product 8 now overlapped only with products 5 and 9. There was a decrease in total percentage of variance explained from 32% to 21% signifying consumer efforts in further differentiating the original groups they had formed in the first stage of sorting. After the second stage of the sorting task, some of the confidence intervals surrounding the products 10–25 became smaller, but there were still a great degree of overlaps indicating similar perceptions among these products still.

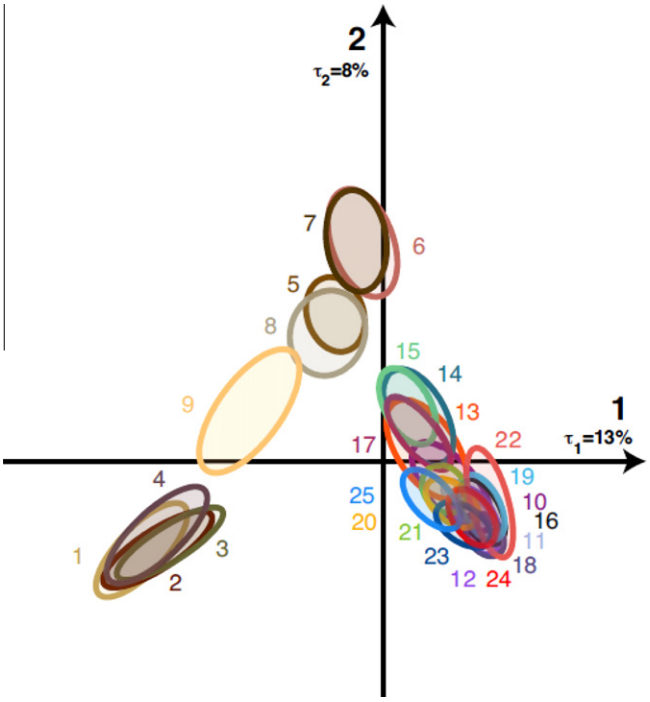

Fig. 3. Positioning of 25 extra virgin olive oils and the associated confidence intervals from the second stage of sorting task.

Table 3 shows the many words or phrases consumers used to describe their perceptions of the olive oils. A number of terms described similar concepts and were combined into the same keyword category. Because of the numerous words consumers used to describe color, words with opposing and/or totally different meanings were combined together under color to help reduce the complexity of projecting the keyword categories onto the product map. The same reduction was done with words describing shape, size, and viscosity.

The projected consumer perceptions on Figs. 4 and 5 were somewhat crowded and hard to see especially for the Californian EVOO products despite of the qualitative analysis done on consumer verbal descriptions to reduce their extra virgin olive oil product perceptions into key categorical themes. Readers are advised to refer to Figs. 2 and 3 to understand Figs. 4 and 5, respectively.

Fig. 4 shows the projection of consumer perceptions onto the product map from the first stage of the sorting task. The keyword categories projected onto the product map helped to explain the underlying product dimension structures. Products 1, 2, 3, and 4 were perceived by consumers as the '*standard*' and '*basic*' extra virgin olive oil products and '*mass-produced*'. Consumers were '*familiar*' with these oil products as they normally saw them in the '*grocery store*'. Consumers perceived these extra virgin olive oil products that were contained mostly in '*clear bottles*' to be '*cheaper*' and to possess mainly '*mild flavor*', and thus, as better suited for '*cooking*'. Consumers were '*unfamiliar*' with '*imported*' products 5, 6, 7, and 8. The '*color*' and '*shape*' of '*imported*' product 9 especially differentiated it from '*imported*' products 1–8. The rest of the 16 extra virgin olive oil products were perceived as being either produced in '*California*' or '*local*' products that were produced in '*farms*' signifying smaller production capacity and thus, were perceived as providing '*stronger flavor*' than especially the '*basic*' extra virgin olive oil products found in the '*grocery store*'. Some of these products gave more '*information*' about the '*varietals*', kinds of '*processing*', and the sensory flavor descriptions among others than the '*imported*' and '*standard*' extra virgin olive oil products. Some of these products were described with '*wine references*' when displaying information pertaining to the year the olives had been harvested, production location that was traditionally associated with wine production in California, or when the oil bottle shape looked like a wine bottle albeit of smaller size. These products were perceived as '*more expensive*' and as being found in '*specialty store*' such as farmers' markets, specialty cheese shops, gourmet shops, or wineries. As these Californian extra virgin olive oil products were perceived as being '*fancier*', consumers perceived this product category as being appropriate for '*gifts*' and special culinary dishes such as bread dipping, salads or dressings, besides the normal '*cooking*' uses.

Fig. 5 shows the projection of consumer perceptions onto the product map from the second stage of the sorting task. Besides the criteria consumers used to describe their perceptions of the 25 extra virgin olive oil products already mentioned in Fig. 4, the additional sorting resulted in better discrimination among '*imported*' products and less discrimination among '*California*' oils. '*Imported*' products 5 and 8, for instance, were perceived as the '*higher* quality' products in comparison to products 1, 2, 3, 4 and 9. Products 6 and 7 were separated from products 5 and 8 due to their perceived '*viscosity*'. Some of the '*California*' products were also perceived as being '*local*' products (i.e. products 10, 20, 21 and 25) as they were produced in nearby regions (e.g. Yolo county, Northern California, Davis, etc.). A few of these Californian products were differentiated by '*shape*' whether they were beautifully designed or just a typical square or round bottle. '*Shape*' tied in closely with the product concept '*usability*', which related to how easy it was to hold/grip the bottle, how easy it was to pour the oil, or how easily the bottle could fit in the pantry.

The concept applies to both '*imported*' and '*Californian'* products as this terminology's position was between these two product categories. Oil bottle packages that were shorter, smaller or typical squarish/roundish were perceived as more convenient due to their ability to fit easily in the pantry and their typical functionality as a cooking oil. Consumers utilized the bottle packaging appearance to discriminate further the '*Californian*' products. Those in the lower right hand quadrant were in '*dark bottle*' while those in the upper right hand quadrant were in '*clear bottle*' (i.e. products 13, 14, 15 and 17).

Due to the opposing views contained within the keywords '*color*' and '*shape*', the projected keywords ended up positioned in the middle of the map, in between the California and imported oil products. This was to be expected because consumers were describing the different colors and shapes perceived for the different oil product categories. Referring to Table 3 helps to understand further the consumer perceptions of the 25 EVOOs.

4. Discussion

This research shows that a two-stage sorting task can be used to elicit attributes based on consumer language to investigate product perceptions based on visual assessment. This method yielded understanding of how the sampled consumers viewed imported and California-produced EVOOs. These consumers were more knowledgeable about the imported EVOO products than the California-produced EVOO products since more significant discriminations were observed among the imported EVOOs after the second stage of sorting, but not among the California-produced EVOOs. The elicited consumer language aided the understanding of the product dimensions discovered using DISTATIS. Social representation theory was utilized to understand consumers' product discrimination performance results.

Table 3
Qualitative analysis of consumer words and phrases.

Collective term	Consumer words or phrases used to describe extra virgin olive oil perceptions
Blend	Blend, mixture, different types/kinds of olives, from different crops, blends of different oils, blends of various location, blends from all over the place, olives from multiple location, comes from different places, references to different countries, made with olives not from California, do not know where from, did not say where olives come from, no label where it is grown
California	California olive oil, Californian oil, California produced, California grown, from California foothills, from around California, very Californian, from Northern California, from Napa Valley, from Napa area, from Sonoma Valley, from Sonoma, from Modesto, from Central Valley, from Coastal Valley
Local	Locally grown, very close to home, very close by, local produce, locally produced, look pretty local, from Yolo county
Imported	Imports, imported, foreign oil, from abroad, another country's olive oil, not from California, Italian oil, Italian brand, Spanish oil, from Spain, Greece, Greek oil, Greek product
Cooking	Have in kitchen, put in kitchen, not for tasting/gift, not save for special occasion, general cooking purpose, for cooking spaghetti, cooking pasta, for cook use, cooking oil like canola oil, good for cooking, buffering for high heat cooking, can use for more than one thing, put in a pan, grease a pan
Non-cooking use	Souvenir, gift, gift basket, nice present, display on kitchen countertops, salad dressing base, good for salad, serve raw, not cooking, for dipping oil, bread dipping, for bread, use for specific purpose, for special occasion, splurge
Mass produced	From corporation, larger company, big institutional olive oil, big institution brand, processed in big factory, mass produced, not small independent company
Smaller production	From particular farm, produced in small farm, small farm/rancher/grower, from smaller olive oil company, more handmade, handmade crop, from vineyard, from particular estate or region, estate grown, smaller production, small batch, larger quantity produced by grower
Grocery store	Seen in store, find at grocery store, see at Safeway, from Safeway, from supermarket, find in supermarket, supermarket brand, supermarket type, generic brand, store brand, commercial grade, mainstream brand
Specialty store	Farmer's market, not supermarket, Whole Foods, cheese shop
Cheaper	Inexpensive, least expensive, less costly, less expensive, more inexpensive, cheap, cheaper, cheapest, usually cheaper, cheaper brand, on sale, mid range, better value, accessible = able to afford
Expensive	More expensive, most expensive, expensive, look expensive, pricey, overpriced, will spend more
Basic	Standard, regular, look simple, plain, good everyday thing, use everyday, basic stock, basic, economy olive oil, run-off, run-off the mill, low brow, functional product, tradional, ordinary, does not stand out, not elegant
Fancy	More fancy, fancier, fancy, fancy bottle, high end, upper end, beautiful, beautiful bottle, beautiful shape design, bottle looks pretty, pretty, pretty looking, special, premium product, craft olive oil, nice bottle, arty end, artistic design, elegant bottle, more dress-up, distinctive looking, aesthetically interesting, attractive looking bottle
Mild flavor	No distinguishing flavor, no taste characteristics, tasting plain, no specific flavor, no dominant flavor, not much flavor, not as flavorful, not the best tasting, mild tasting, oily taste
Stronger flavor	More flavor, stronger taste, really tasty, more olivy, green oil flavor, different taste, taste different, vegetable green quality, fruity, use for taste, thick, creamy type tasting
Varietal	Specific variety, comes from particular olive, one variety of olive, Arbequina, different varietals, varietal, Spanish variety, Mission from Spain
Processing	Handpicked, handdated, specific time, date when pressed and picked, know exactly when harvested and pressed, when they were pressed, harvested after 24 h, pressed after 24 h, unrefined, un-filtered olive oil, filtered assumed, first cold press, cold press, cold extraction, handmade presses, processed in same way, machinery
Wine reference	Year tag like wine, reminiscence of wine bottle, wine bottle wannabe, tall bottle like wine, smaller California wine, the wine regions, the wine country, like wine, high end wine, a bottle of liquor, for people who experience wine
Information	Award, won award competition, description of different flavor and aroma, description how it should taste, description how to use olive oil, educated information, too much information, more description, straightforward information, recipes attached, COOC, directions about storing in dark place, acidity level, kosher
Shape	Simple bottle, beautiful bottle shape design, nice shape bottle, different bottle design, bottle look different, bottle more tastefully design, appealing bottle, distinctive shape, bottle presentation, aesthetic shape, squarish shape, square shape, squad, round bottle, unique shape, classic bottle shape, shape, bottle, stubbier bottle, bottle appeals, Italian shape
Clear bottle	Clear glass bottle, light color bottle, can see through bottle, can see what color it is
Dark bottle	Dark bottle glass, colored bottle, could not tell color, hard to see inside the bottle
Color	Clear olive green, lime green, greenish, green, darker green, clear light green, darker green, clear green with a smidge of yellow, dark, not so clear green, dark clear chartruse, opaque green looking color, clear yellow oil, yellow, really yellow, goldish yellow, more yellow, clear yellow green oil, greenish yellow, darker not so clear green yellow, color of oil, light mustardy color, not too light color, clarity, crisp color, beautiful color
Familiar	Familiar with, where I am going to school, because it is a UCD, use at home, seen it, tasted before, had before, usually see, recognized the brand, well known brand, bought before, went to the ranch
Unfamiliar	Not familiar with, never seen
Usability	Fit in pantry, sit easy on pantry, easy to fit pantry shelf, more utilitarian, fit in hand, better handgrip, easy to grip and pick up, easy to pick up and use, easy to hold, easy to pour
High quality	High quality, higher quality, good quality, supposed to be good, best quality, nicer variety, all around quality
Size	Short, shorter, smaller, tall, comparable size
Viscosity	Thicker, low viscosity, medium viscosity, most thickest

4.1. Social representation theory

Some consumers expressed their extra virgin olive oil perceptions for California-produced EVOOs using '*wine*' as an example or as a reference point. Social representation (SR) theory (Moscovici, 2000) assumes that for new perceptions to form with regards to the unfamiliar, unnamed or non-categorized objects, a linkage to existing knowledge structures needs to be made to make the objects more familiar and to understand them. Two processes are involved in the formation of social representation: anchoring and objectification. Anchoring allows people to name and classify objects to link the unfamiliar to a familiar reference point. Objectification transforms the abstractions into something concrete and communicable in the form of images, icons, or metaphors, which represent the new phenomena (Moscovici, 1981; Wagner et al., 1999). SR theory had been applied to study food biotechnology (Wagner & Kronberger, 2001), genetic engineering of foods (Bauer & Gaskell, 1999), word associations of food (Lahlou, 1996, 2001) and new functional drinks (Huotilainen, Seppälä, Pirttilä-Backman, & Tuorila, 2006).

In this study consumers transferred some of the attributes normally found in wine products (i.e. production year, bottle shape, bottle color, bottle design, etc.) to the EVOOs produced in California to objectify California-produced EVOO into more concrete levels and make them more familiar. This shows that, although olive oils have been around for a long time too in America, California-produced extra virgin olive oil was a relatively new product category for the US consumers in this study. These consumers were

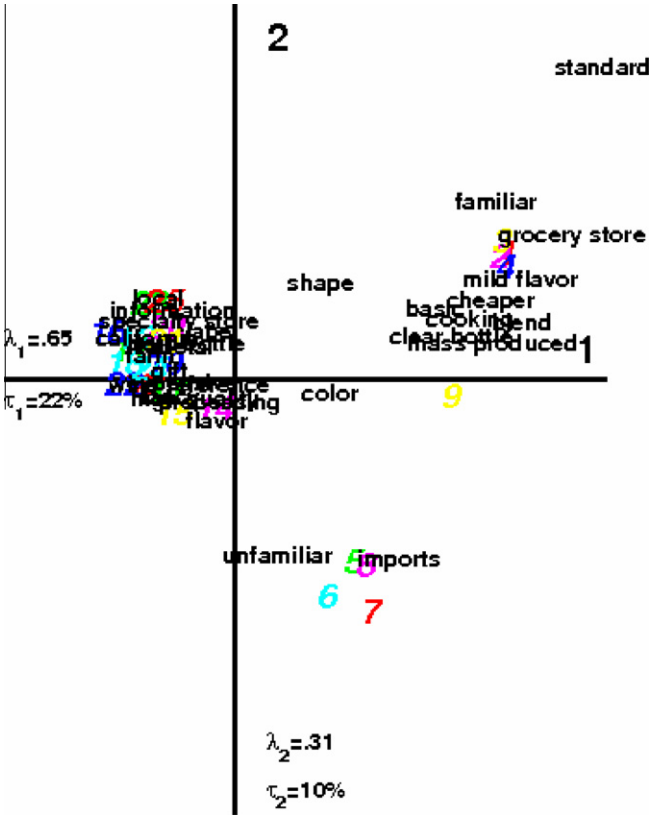

Fig. 4. Consumer keyword categories representing their perceptions for the 25 extra virgin olive oil products from the first stage of sorting task.

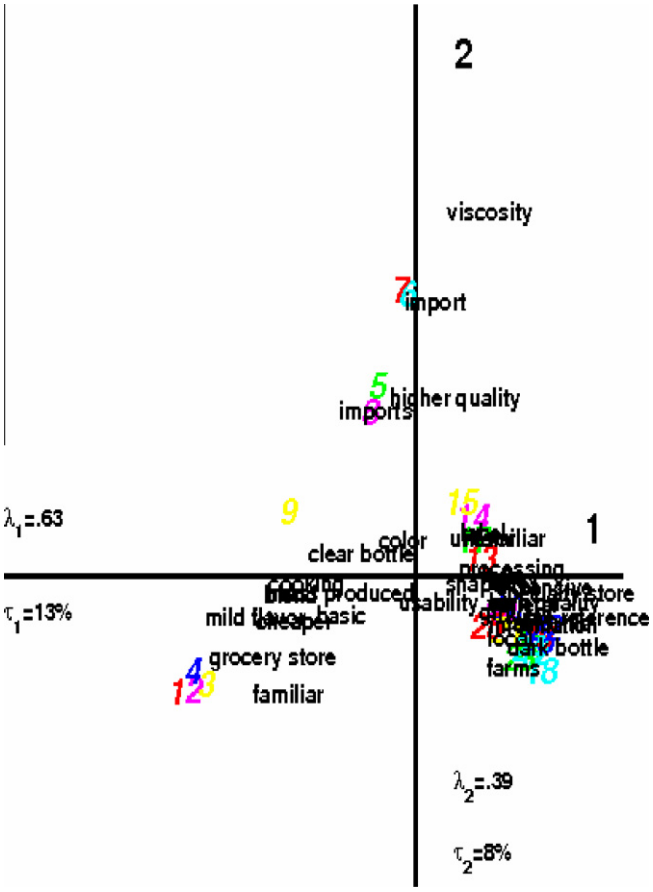

Fig. 5. Consumer keyword categories representing their perceptions for the 25 extra virgin olive oil products from the second stage of sorting task.

probably not familiar enough with these California olive oil products such that the second stage of the sorting task was not helpful in differentiating the California products significantly because consumers did not have many criteria to separate them with. Table 1 shows that about two-thirds of the consumers in the study currently consumed imported extra virgin olive oils. This could explain why they were not that familiar with the California-produced oils.

It is worth nothing that some of the most frequently cited brands owned (e.g. Trader Joe's and Napa Valley Naturals) were blends of different kinds of extra virgin olive oils, some imported and some from California olives. Consumers were not asked during the telephone screening whether or not their oils originated from California. Hence, we made a conservative guess that the consumers consumed mostly imported olive oil.

4.2. Modified sorting task

Products were not discriminated significantly as shown by the large confidence intervals noted in Figs. 2 and 3, and this may have been due to the nature of the sorting task analysis which used 0/1 values only (Abdi & Valentin, 2007).

Although not statistically significant, there is a tendency for subjects to take longer to complete a triadic elicitation task than a free sorting elicitation task (Bech-Larsen & Nielsen, 1999). In this study, the modified sorting task took approximately 30–40 min per consumer on average, which was much shorter than the time needed to accomplish the same goal using the repertory grid method. RGM took an average of 3 h over 2 days per person to complete during a preliminary study with the same products (results are shown in Fig. 6). It can be seen that similar conclusions regarding product structures were reached.

The amount of variability across products in the first stage of the sorting task was just below that of other consumer studies that used RGM and GPA. A consumer study with 20 consumers in the UK had the first two dimensions accounting for only 41.4% on the use appropriateness of 16 cheeses (Jack, Piggott, & Paterson, 1994). Another consumer study with 20 subjects evaluating the consumption of 22 alcoholic beverages found that 46.4% of the variance was explained by the first two dimensions (Scrivens et al., 1989). A consumer study analyzing the perception of 29 consumers for 12 starchy foods had the first two dimensions accounting for 58% of the variance (Monteleone et al., 1997). A consumer study investigating 26 consumer perceptions for 31 chocolate confectionary products had its first two dimensions accounting for 59.4% of the variability in the data (McEwan & Thomson, 1989). A few examples of past studies utilizing sorting and MDS were as follows. A sorting study with 24 subjects and 10 commercial grape jellies explained 66% of the variability found in an MDS sorting model for the first two dimensions. A free sorting study with 150 French subjects for 26 plastic pieces resulted in 57% of the global inertia expressing the perceptive dissimilarities among the samples within the first two dimensions (Faye et al., 2004). Twenty-four untrained panelists familiar with sensory evaluation provided about 55% of the total variance found in the MDS configurations for understanding 14 different commercial breakfast cereals (Cartier et al., 2006). It is worth noting that the slightly higher percentage of explained variance in the examples above could be due to the lower numbers of products involved, such as in Tang and Heymann (2002), and Faye et al. (2004). It is worth nothing that some studies employed almost equal numbers of consumers to products or a

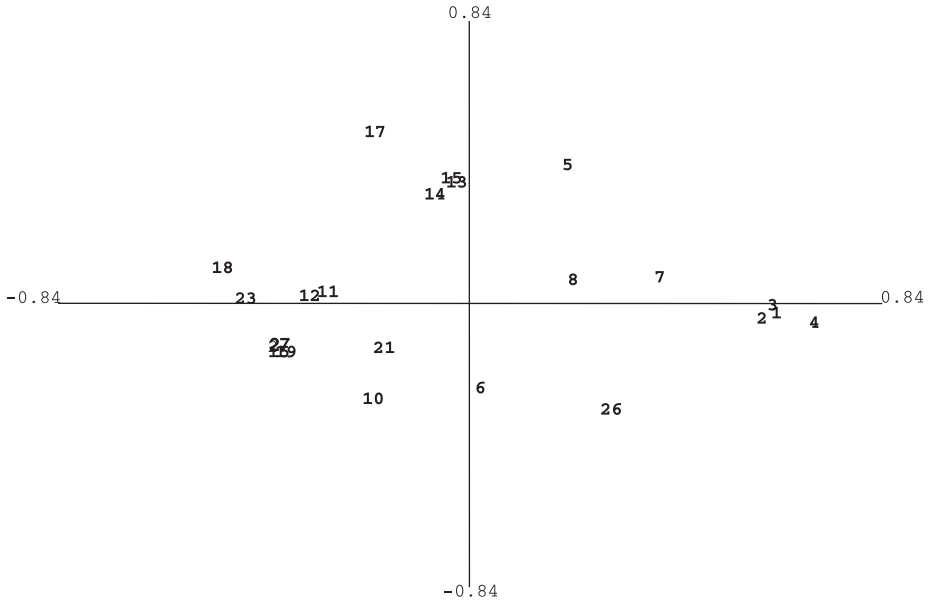

Fig. 6. Preliminary consumer perceptions of extra virgin olive oils using repertory grid method and generalized procrustes analysis.

slightly greater number of products than consumers; e.g. 20 subjects versus 16 cheeses (Jack et al., 1994), 24 subjects versus 14 breakfast cereals (Cartier et al., 2006), 20 subjects versus 22 alcoholic beverages (Scrivens et al., 1989), and 21 subjects versus 31 chocolates (McEwan & Thomson, 1989) while few other studies employed about 40% more number of subjects than products, e.g. 20 consumers versus 12 starchy foods (Monteleone et al., 1997) and 24 subjects versus 10 grape jellies (Tang & Heymann, 2002). Even when the number of consumers was almost 8 times the number of products (e.g. 150 consumers versus 26 plastic pieces) (Faye et al., 2006), the percentage of explained variance was relatively similar to the studies employing similar numbers of consumers and products. This demonstrates that variability among consumers is common and normal in consumer studies. Furthermore, those studies with about the same number of products as in this study were about product categories that were fairly well established in the consumer marketplace while this study utilized both a well established product category (i.e. imported EVOOs) as well as a relatively new product category (i.e. California-produced EVOOs).

The lower percentage of variance explained by the first two dimensions of the product map for the second sorting was due to more variability among the consumers as they formed more product clusters within formed product groups that might have already been different among each other to begin with. The modified method encouraged further criteria elicitation, but not in terms of product consensus.

4.3. Consumer language and perceptions

As shown in Table 3, different words or phrases were used by consumers to describe their perceptions for the extra virgin olive oil products. This study focused solely on products based on visual assessment. There were relatively few sensory related vocabularies under '*mild flavor*' and '*stronger flavor*' because consumers did not taste the products. It can be seen that more ambiguous terms such as '*more flavor*', '*stronger flavor*', '*really tasty*', '*different taste*', etc. were used to describe possible '*stronger flavors*' associated with some olive oils, and '*tasting plain*', '*no specific flavor*', '*no dominant flavor*', '*not much flavor*', etc. were used to describe possible '*milder flavors*' associated with some other olive oils. Those terms were rather non-specific. It can be seen from Table 3 that the only specific sensory terms elicited were '*fruity*', '*olivey*', '*vegetable green*', and '*green oil*'. This sorting study pointed out the limited ability of consumers to use sensory vocabularies to describe olive oil products.

Nevertheless, it can be seen that the consumer language aided the interpretations of the perceptual dimensions discovered in DISTATIS product maps, and afforded an understanding of consumer perceptions for extra virgin olive oils as a product category. Consumers seem to have two dichotomous flavor perceptions with regards to olive oil products used for '*cooking*' versus olive oil products used for '*non-cooking applications*'. Olive oils with '*milder flavor*' were associated more with '*cooking*' whereas olive oils with '*stronger flavor*' were associated more with '*non-cooking*' purpose. '*Basic*' olive oils were associated with '*standard*', '*regular*', '*economy*', '*functional*', etc. products that could be found in '*supermarket*' or '*grocery store*'. Not all olive oils in the '*grocery store*' were considered '*basic*' or '*regular*' products; some could be considered as possessing '*high quality*' or the '*nicer variety*' too. Variety of '*non-cooking*' uses discovered in this research were '*souvenir*', '*gift*', '*salad dressing base*', '*serving raw*', '*dipping oil*', '*bread dipping*', '*special occasion*', '*splurge*', etc. '*Fancier*' oils with '*beautiful design*', '*pretty looking bottle*', '*arty olive oil*', '*craft olive oil*', '*elegant bottle*', etc. seemed to associated more its utility as a '*gift*' or '*souvenir*' as opposed to '*every day use*' or '*basic stock*', for instance.

Consumers also had different perceptions with regards to product characteristics for products produced in '*smaller production*' versus '*bigger production*'. From the elicited consumer vocabularies, for instance, '*mass-produced*', '*big institutional company*', '*corporation*', '*larger company*', '*big factory*', etc. were associated with '*bigger production*', and '*farm*', '*small ranch*', '*vineyard*', '*estate grown*', '*small batch*', etc. were associated with '*smaller production*'. Products were also further differentiated based on where they would be sold, the quality, and the associated price.

An interesting concept relates to '*usability*' of olive oil products. Usability is commonly studied in the technology area as reflected by the multitude of publications and textbooks dedicated to this topic (Lawrence & Tavakol, 2007; Spencer, 1985). Usability related to food products has rarely been studied. This sorting study provided insights that usability could have been a key factor overlooked among food product designers. In this study, particular

bottle packaging appearance and shapes were two key factors defining usability: how easy or difficult it was to hold/handle/pour the oil as well as its place appropriateness within a household whether on a kitchen countertop or inside a pantry, for instance. Another interesting finding was that '*familiarity*' could be one particular key issue defining consumer choices and selections for olive oils that were purchased habitually. Consumer languages are laymen terminologies for every day communication. For effective communication, the targeted recipients need to receive and understand the message appropriately. Consumers sometimes had difficulties in apprehending scientific or technical language used in product mass-advertisement (Lautman & Percy, 1978). Consumers did not understand the product attributes promoted in the advertisement or the product benefits did not seem to appeal to consumer needs due to incompatibility of the language. Using consumption vocabulary has been reported to aid stable preferences (West, Brown, & Hoch, 1996). Consumption language helps consumers to establish more consistent and more defined preferences as the vocabulary aids consumers to understand the determinants of their own likes and dislikes.

To summarize, the research results pointed out that the Northern California consumers in this study had fewer criteria to differentiate the California-produced EVOOs despite of the quantity of information found on the product labels and their diverse appearance. The results demonstrate that modified sorting task can be used as a tool in consumer studies to understand product perceptions that are already established in the market, but not yet well understood. Should one wish to improve product characteristics but need directions and understanding of how consumers perceive one's product compared to others, he or she could utilize this two-stage sorting method to ensure elicitation of all possible criteria known to consumers with the added advantage of shorter study times. A quantitative study should be conducted to confirm the importance of elicited attributes in consumer consumption behaviors.

Due to the systematic dichotomy between the products categories of imported oil and Californian oils, the results could probably be improved further by studying only the California-produced extra virgin olive oils to lessen the contrast effect that has been known to operate in some product evaluations. The feasibility of including different consumer populations such as ones with different olive oil consumption patterns may be limiting. As the International Olive Council statistics have shown, the level of olive oil production in America is barely 1% of its consumption level and the gap is mediated by importing olive oils from overseas. Therefore, it was logical for this study to find that consumers consumed mostly imported olive oils.

From a methodological perspective, it would be of interest to refine the sorting task in order to ensure product discriminations at a similar level as other established categorization methods yet still maintaining the original advantage of the relatively short time and ease of completion on the consumer part. One could hypothesize that the instructions given to the subjects prior to the sorting task affected the outcome. It would be of interest to see if informing consumers right at the beginning of the task that they would have to perform the sorting task twice would have motivated them to be more analytical in discriminating among products from the very beginning. It would also be of interest to find out whether sorting elicitation gathered from a focus group setting would be different from pooled individuals as in this study. Having a group of subjects convene to discuss their sorting perceptions takes less time on the researcher side and should it provide similar levels of information from the study utilizing pooled individual results such as this one, then, one could opt for a group study. Such an approach would possibly negate whatever segmentation might exist in consumer perceptions, however.

5. Conclusions

The modified sorting task showed more success in staging finer product discriminations for established and familiar products such as imported EVOOs than for unfamiliar products such as the California-produced EVOOs. A second sorting stage provided opportunities for consumers who were not putting as much effort initially during the first sorting stage to share further their perceptions of the products under study. Within the imported EVOOs, the perceptions for most familiar, basic/standard products that consumers normally found in the grocery store persisted despite modification of the sorting task. However, there was a perception that some imported products were actually higher in quality than others upon further probing.

As explained by the Social Representation theory, California-produced EVOO is still a relatively new product category, so perceptions were relatively limited to the existing knowledge structures. Therefore, only slight product separations were seen with California-produced oils, and these were not statistically significant due to the nature of the task, which used 0/1 values for statistical analysis. One should be careful not to confuse statistical significance with practical significance.

Further methodological work should aim to understand the effects of different instructions on outcomes, whether grouped sorting results would be similar to pooled individual results for a given demographic, and how many subjects are needed per group and how many groups are needed for obtaining similar results as with pooled individual results.

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