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Illuminating Product × Demographic Interactions

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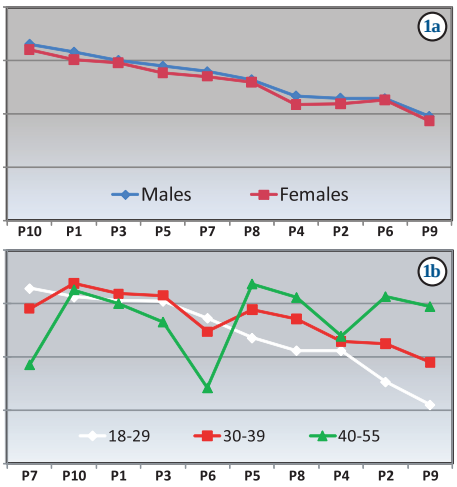
Background: It is virtually a fundamental law of nature that people have idiosyncratic likes and dislikes. They may cluster into groups or segments of similar-minded individuals, but it is often difficult to determine what causes segments to exist. In a typical consumer product test, respondents are usually screened and profiled according to a full battery of demographic, psychographic and product usage attributes. Then an analysis of variance is used to study responses to products by identified groups to determine if there is a group × product interaction. In the case of a demographic group such as gender, the interaction reveals whether the products were rated differently by males and females. The mere identification of an interaction does not reveal why the interaction occurs or how to design products that are optimal for each subgroup. In this report we discuss how to take the next step towards understanding and using interactions by fitting a model that reveals the location of individual ideal points for demographic groups in a map that identifies the attributes important to liking.

Scenario: Due to a pressing need to understand an apparent transformation of the underlying product and consumer landscape, your management has approved a large category appraisal. The project involves 10 milk chocolate bar products (P1,…, P10) and a group of 250 consumers, recruited according to a carefully designed demographic, psychographic and consumption based screener. Your main objective is to investigate potential demographic differences in terms of liking patterns in your population of interest.

Upon receipt of the data, you conduct a repeated measures analysis of variance on liking to investigate whether some consumer factor segments your population. You do not find a significant Product × Gender interaction ($p=0.99$), but you do find a Product × Age interaction ($p<0.0001$). This effect appears to be driven by the response pattern of the 40-55 age group. The results are shown in Figure 1. Although this information is interesting, it does not give you any insight as to what is driving the differences between these age-related groups.

Figure 1. Liking ratings by gender and age.



Using Ideal Point Models to Study Demographic Effects: Techniques that involve consumer ideal points are based on the intuitive assumption that liking ratings are generated by consumers based on the distance between a momentary product percept and a momentary ideal[1,2] in a drivers of liking space. The smaller the distance, the greater the liking rating, and vice-versa. Individual ideal point models can also be used to study and quantify consumer-related effects. This is possible because they retain the individual consumer information in the map that they create. An attractive aspect of this approach is that it permits such exploration within a common framework, without using other types of models with different metrics and assumptions.

Once we create an ideal point map, the first thing we can do to investigate a particular demographic, such as gender, is to identify each ideal point according to their membership in that demographic group. Trends are sometimes obvious, yet it is more helpful to consider ellipses representing 95% confidence regions around the average location of each particular demographic group. *IFPrograms*™ can create such ellipses and, for each pair of ellipses, provides a χ^2 statistic indicating whether they are significantly different from each other. These ellipses allow the systematic identification of the demographic effects leading to differing trends in liking.

Mapping the Category Appraisal: You analyze your data using Landscape Segmentation Analysis® (LSA) and obtain the map shown in Figure 2. The main direction of the map is driven by sweet, milky and bitter properties, while a texture attribute, crumbly, characterizes the east-west direction. This agrees with your knowledge of the products, as samples P3, P6 and P7 (square symbol) are milk products with a profile closer to that of white chocolate and samples P2, P5, P8 and P9 (triangle symbol) have a greater amount of cocoa thus providing them with characteristics of darker chocolate products. P1, P4 and P10 (circular symbols) are intermediate products.

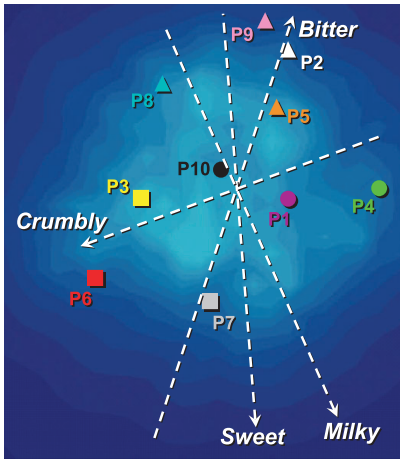


Figure 2. LSA map with the main drivers of liking.

You next investigate gender and age differences, separately. Figure 3 shows the map color coded for gender, on which you do not notice segmentation. You create the 95% confidence ellipses for each group and confirm that their average locations are not significantly different ($p=0.86$), which corroborates the findings from the analysis of variance.

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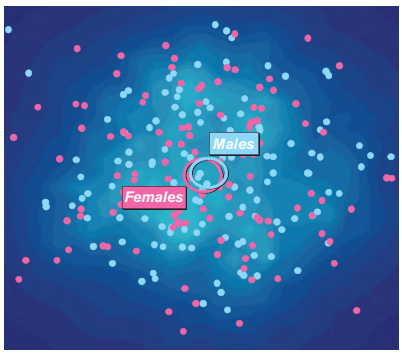


Figure 3.
Ideal points color coded by gender and corresponding 95% confidence ellipses around the mean locations.

You then consider the age demographic. Here you see more segmentation (Figure 4a), with the youngest consumers (white ideal points) located more towards the south (sweeter, milkier products) and the oldest consumers (green ideal points) located more towards the north (darker, more bitter products). The 30-39 year old respondents (red ideal points) fall in-between. You create the 95% confidence ellipses for each group (Figure 4b) and find that the three age groups have average locations that are significantly different ($p < 0.05$ for all pairwise comparisons).

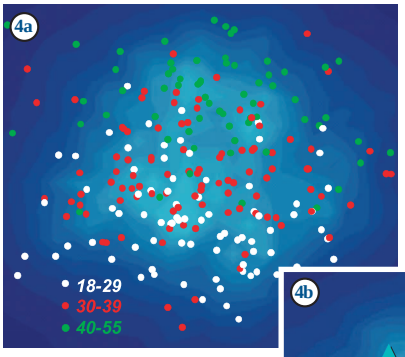
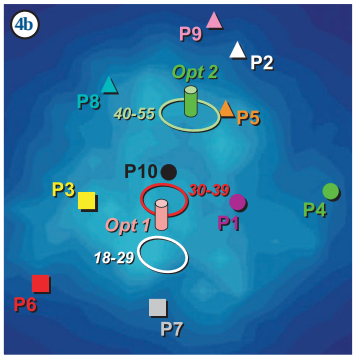
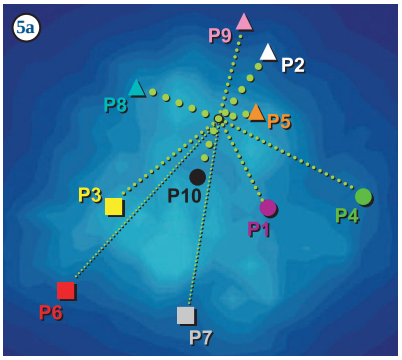


Figure 4.
Ideal points color coded by age (**4a**) and corresponding 95% confidence ellipses around the mean location (**4b**).



You also see a clear connection between the average group locations and the corresponding average liking ratings. For instance, the oldest age group (Figures 5a and 5b), which is located closer to the P2, P5, P8 and P10 products has higher average liking ratings for these products. They also exhibit their lowest average scores for the products from which they are furthest away (P6 and P7). The opposite trend is visible for the youngest age group.



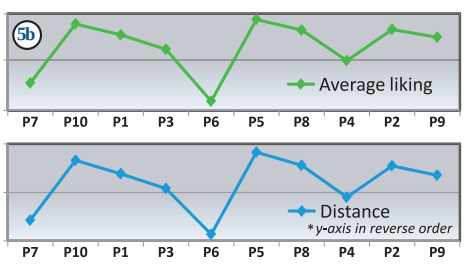


Figure 5.
40-55 year old age group: Distances of average location for ideal points to individual products (*thicker dotted lines = shorter distances*) (**5a**) and relationship between average liking and distances* (**5b**).
**y-axis in reverse order because distance is inverse to liking.*

After meeting with your marketing counterparts, you decide that the best business strategy is for your company to focus on two different types of product (see Figure 4b): the first one is a sweeter product placed between the two younger age groups (Opt 1), while the other is placed to the north and appeals to the oldest age group (Opt 2). The optimal profiles are given in Figure 6a.

Finally, you predict how the perceptual market share of the three age groups will split within each of the two optima. These results are shown in Figure 6b. They are the basis for a corresponding advertising campaign focused on two different imageries, consistent with the age demographic findings from the research.

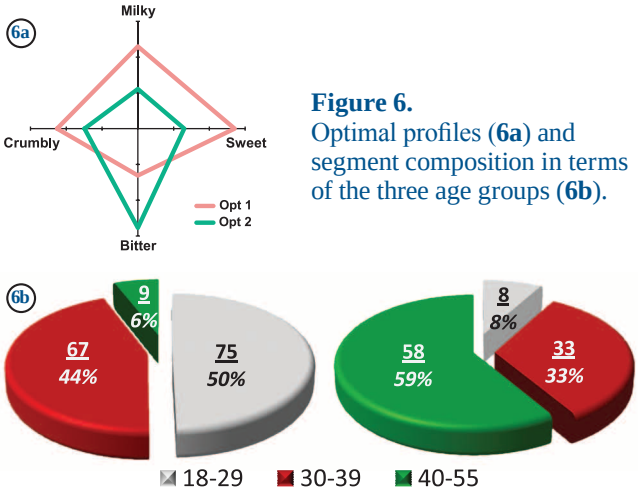


Figure 6.
Optimal profiles (**6a**) and segment composition in terms of the three age groups (**6b**).

Conclusion: When we uncover a product × demographic interaction with the analysis of variance, we have a potentially important finding. Before making use of this finding, however, it is necessary to dig a little deeper. In this report, we describe how a technique involving individual consumer ideal points can identify potential demographic effects but also allows the researcher to extract richer information, such as the optimal product profiles for each segment and the relative perceptual market shares of the subgroups for each of the optimal products. By locating and using individual ideals, we have shown how to illuminate and explain demographic interactions. This will prove useful to product and market researchers as they tailor products to particular needs.

References *(available at www.ifpress.com)*

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2. Ennis, D.M. and Rousseau, B. (2004). Motivations for product consumption: Application of a probabilistic model to adolescent smoking. *Journal of Sensory Studies*, **19**(2), 107-117.