Example food: What are its sensory properties and why is that important?

Herbert Stone

Sensory evaluation is a science that measures, analyzes, and interprets the reactions of people to products as perceived by the senses. It is a means of determining whether product differences are perceived, the basis for the differences, and whether one product is liked more than another. The value of the science lies in its use of limited numbers of consumers to reach decisions that can be extrapolated to larger populations with confidence. This means that the subjects are representative of the consumer population for whom the product is intended and have the necessary sensory skills. In practical terms, it enables one to evaluate products in a relatively short time and at low cost. In the discussion that follows, key sensory resources are described: however, a detailed discussion about the science can be found in the reference list at the end of this article.
Analytical methods include discrimination/difference and descriptive analysis. Results from a difference test tell us whether product differences are perceived. Results from a descriptive test identify the specific kinds of differences, e.g., a fruit aroma for a series of samples and their intensities. An example of results from the latter is shown in Fig. 1, a sensory map showing results from a test of competitive wines.

Analytical tests rely on limited numbers of qualified subjects but all require replication. This is no different than a chemical analysis of a product which is done more than once to have confidence in the reported result. For discrimination, between 20 and 30 subjects are recommended. With replication this yields sufficient judgments to have confidence in the conclusions. More discussion about this recommendation, see Stone2.

For descriptive analysis, the optimal number of subjects is 12 and not < 10. Empirically, it has been observed that using more than 12 does not result in more information, only greater and not < 10. Empirically, it has been observed that using more than 12 subjects and 4 replicates (N = 48).

Fig. 1  A sensory map of aroma and appearance attributes obtained from a descriptive analysis of an competitive chardonnay wines. The intensity values are measured from the center to that point where a line crosses and are the computed means obtained from a panel of 12 subjects and 4 replicates (N = 48).

Test plans and analyses
The importance of using appropriate design and analysis cannot be underestimated. Plans must reflect behavioral and physiological elements in the design which means that balanced designs are preferred and designs that rely on randomized serving orders should be avoided. Otherwise, risk is high that one sample will be served in one position several times, whereas another product is never served in that position. First sample effects cannot be eliminated so one must be sure that each product appears equally often in each position. Although this is relatively easy to achieve in a test of four or fewer products, it is more difficult in a test of ten products. A solution is to balance the design across all subjects. With replication, the serving order challenges are minimized but not eliminated. A variety of test designs have been published while others are connected with software packages; however, all need to be reviewed before use.

In situations where products are scored, a common feature of descriptive analysis and liking, the most useful analysis is the analysis of variance. As with any statistical procedure, it is important that the data collection process fit the model on which the test plan is based. Much has been written about statistical methods and the interested reader is directed to Stone2.

Facilities and support services
Traditionally, sensory tests were fielded in a purpose built facility with a controlled environment and partitions to minimize visual contact between subjects and servers. Responses were captured on paper ballots and then transcribed for analysis. Today’s facility has touch screens and the ability to provide real time analyses regardless of where the data were obtained. In addition this has enabled the actual data collection to no longer be restricted to a sensory facility. Use of a tablet and the web has made it possible to test products anywhere, based on the purpose for the information. This means that managers can obtain information and transmit instructions to others regardless of their location.

APPLICATION, AN EXAMPLE
As previously noted, a sensory map is very useful in identifying the effects of formulation changes on sensory attributes from a developer’s perspective. Maps also have value for marketing and brand managers when results are connected with preferences and other consumer measures.

Figure 2 shows results from a plot of sensory attributes and consumer preferences. The circled groupings show the connection between specific sensory attributes and preferences enabling marketing to identify which word groupings are best used in communicating to which consumers. Additional discussion about this and other applications are described in the aforementioned references.

CONCLUSION
Sensory evaluation is all about people using their senses vs. simply eating a meal without appreciating the experience. Learning to use one’s senses has many rewards especially as it relates to a greater appreciation for the food and beverages we consume. Companies invest substantial sums of money in developing and marketing products without fully appreciating the consumer’s ability to identify what makes one product a success and another just getting by. Sensory information should be an integral part of any product effort, whether at the formulation stage or at the
marketing stage if one expects to be more successful in satisfying consumer expectations.

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REFERENCES
1. Cohen, J. Statistical Power Analysis for the Behavioral Sciences. 2nd edn. (Taylor & Frances Group: NY, 1988).
2. Stone, H. in Rapid Sensory Profiling Techniques and Related Methods (eds Delarue J., Lawlor J. B., & Rogeaux M.) pp 27–50 (Woodhead Publishing, Cambridge, 2015).
3. Stone, H., Bleibaum, R. M., & Thomas, H. Sensory Evaluation Practices. 4th edn (Academic Press: San Diego, 2012).

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