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Sensory

BY ARMAND V. CARDELLO

## Sensory Quality



Everywhere you turn today, people are concerned about quality. This concern stems from the realization that, often, quality has taken a back seat to profits and that many companies have failed to pay heed to those groups who are most familiar with the quality of their products—the workers who produce them and the consumers who use them. In response to this, companies are scrambling to institute “quality” circles within their total “quality” management program and “customer” feedback systems as part of their new “customer” focus program. Yet, there are still those companies that, due to ignorance, corporate inertia, or some mistrust of turning the reins of quality over to workers and customers, continue to do business as usual. I find this same situation occurring within the field of sensory evaluation when it comes to the concept of sensory quality.

## An Old Concept

The concept of sensory quality has been with us for a long time. Archeological chemists from the University of Pennsylvania recently discovered chemical evidence of beer in a 5,000-year-old jar in the Zagros Mountains (Michel, R. H., McGovern, P. E., and Badler, V. R. Chemical evidence for ancient beer. *Nature* 360:24, 1992). The evidence, calcium oxalate, which settles out from barley beer, was found in grooves on the inside of the jars. The researchers suggested that the grooves may have been deliberately put there to remove this bitter compound, presumably to improve the beer's sensory quality. If mountain inhabitants in 3000 B.C. were already working on the problem of sensory quality, it might be expected that the concept would be well understood by today. Yet, I am continually astonished to see evidence in the food science literature that the concept of sensory quality and its measurement are still poorly understood by many practitioners, both inside and outside the field of sensory evaluation.

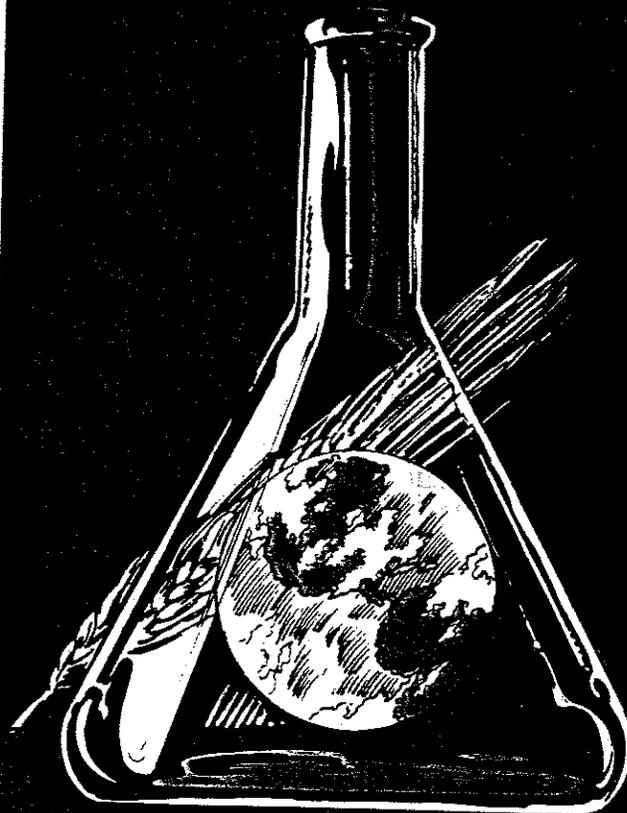
Both Merriam Webster and the food industry agree that the word “quality” refers to “degree of excellence.” Thus, a simple definition of quality is “the degree of excellence in the sensory attributes of a product.” The problem with this definition is that it involves subjective evaluations by an unspecified perceiver. As a result, a chronic problem in sensory quality assessment has been who should do the perceiving and how.

Prior to the emergence of the field of sensory evaluation in the 1930s, sensory quality was judged as it had been in the 18th and 19th centuries when tea, coffee, wine, and beer “experts” reigned as the arbiters of sensory quality for these products. Of course, even then, there were those mere mortals who voiced suspicion about the use of such “master palates.” A popular guide to wine tasting quotes T. G. Shaw lamenting in 1863 that “in wine tasting and wine talk there is an enormous amount of humbug.” Even Colonel Haraszthy himself noted in 1889, “The difference in a trial of wine by the consumer

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*Dr. ARMAND V. CARDELLO is chief of consumer research within the Behavioral Sciences Division at the U.S. Army Natick Research Development and Engineering Center in Natick, MA.*

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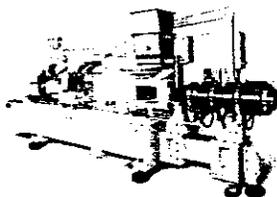
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and the expert is that the former seeks for something agreeable, something to praise; whilst the latter seeks for a fault, a blemish, something to condemn." Yet, in spite of what we now know is an impoverished and highly idiosyncratic approach for assessing sensory quality, old habits die hard. So even today, the remnants of this approach still make newspaper headlines, as the Clinton administration moves to terminate the ancient and honorable U.S. Board of Tea Experts.

The first paradigmatic shift in the approach to sensory quality occurred in the 1940s, as the field of sensory evaluation began to evolve. It was then that responsibility for sensory quality shifted away from individual experts and toward panels of trained assessors using standardized approaches to grade the sensory quality of products. Unfortunately, this shift preceded the first real emphasis on consumer testing of products by 25 years. As a result, the practice of employing trained panels to judge sensory quality had sufficient time to entrench itself. Complicating the issue at this time was the rapid expansion of sensory evaluation into quality control applications, leading product managers to boast about measuring changes and decrements in the sensory quality of their products by using on-line sensory panels in their production facilities. Of course, these panels were not measuring sensory quality as "degree of excellence," but rather as "deviations from a standard." The only relevance of these judgments to degree of excellence derives from assumptions about the inherent excellence of the standard. One must wonder how many times a production error has produced a deviation that actually improves the product's sensory quality, but that the deviation is quickly identified and "corrected" by quality control.

### Consumer-Oriented Approach

The most important paradigmatic shift in the approach to sensory quality occurred during the past 15 years, as researchers came to realize that the concept of sensory quality is intimately tied to consumer perceptions of the degree of excellence in a product. This "new" approach to the measurement of sensory quality has been detailed in several major works on the topic in which it has been described how the concept of excellence or degree of excellence had evolved to be more in accord with consumer acceptance judgments and to reflect consistent conformance to consumer expectations (see A. Williams and R. Atkins, Eds. *Sensory Quality in Foods and Beverages*, Ellis-Howard, 1983). Perhaps the best and most concise definition of sensory quality that I have read recently is "the acceptance of the sensory characteristics of a product by consumers who are the regular users of the product category or those who comprise the target market" (Galvez, F. C. F., and Resurreccion, A. V. A. Reliability of the focus group technique in determining the quality characteristics of mungbean noodles. *J. Sens. Stud.* 7:315, 1992).

So why is it then, that we still see evidence in the literature of researchers measuring what they call "sensory quality," but using trained/expert panels or even instruments? I personally believe that the reasons are the same as those noted at the outset for why certain companies have failed to adopt customer-focus or total quality management approaches: lack of knowledge, intellectual inertia, and/or fear or mistrust of consumer data. Overcoming the first two problems is the responsibility of educators, industry managers, and journal editors. However, the fear and mistrust of consumer data is something that has always fascinated me. Perhaps it is because in my own field of psychology, almost all that we know about sensory mechanisms, perception, and learning was derived from studies using naive college students or laboratory rats. Food science, on the other hand, was founded upon instrumental measurements, physical observations and, as we have seen, expert evaluations. But, in addition, I believe that there are a number of unchallenged stereotypes of consumers and

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## High-Nutrition Breakfast Cereals



A new consumer-driven movement regarding health maintenance by diet management and modification is emerging. The United States and many international markets already have products for lactose intolerance, obesity control, diabetes, and osteoporosis. Next in line are products that may prevent age-related oxidation damages known to be responsible for many common and chronic diseases such as

arthritis, atherosclerosis, some cancers, and immune disorders. Because consumer demand for these products is expected to grow strong, government and industry have little choice but to help meet associated demands in the areas of basic and applied research, diet-related etiology of diseases, role of vitamin and non-vitamin antioxidants in disease control, nutritional impact of major ingredients, nutraceutical food formulations, and governmental regulation of health and nutrition.

*Dr. TRIVENI P. SHUKLA heads his own consulting firm, Food Research & Innovation Enterprises, Inc., P.O. Box 67, New Berlin, WI 53151.*

The discipline of human nutrition may in itself change in perspective and scope. Because the breakfast cereal industry has been a leader in designing foods for better nutrition in the past, its early involvement in redefining this trend is necessary for two very critical reasons: sustainable growth and profit for the manufacturers and consumer confidence in the science-based value of new products. Given the impact of snack foods on the diet and dietary behavior of consumers, the involvement of the snack food industry is equally critical.

### Intrinsic Value of Breakfast Cereals

Breakfast cereals are intrinsically high-nutrition foods. They represent the ultimate in convenience with added attributes—absence of cholesterol; rather low levels of fat; and high levels of dietary fiber, complex carbohydrates, minerals, and vitamins. Even more significant is the ease with which disease control, health maintenance, and high nutrition may be designed into shelf-stable ready-to-eat cereals and snack foods by adding dehydrated fruits, vegetables, and other edible plant materials. The market for traditional products can be developed further to close the gap between recommended 6-11 daily

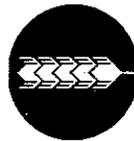
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consumer data, such as 1) consumers are less sensitive than trained panelists or instruments, 2) the methodology employed in consumer research is less precise or reliable, and 3) consumer data are relative and, therefore, not actionable.

Concerning the first of these stereotypes, it should be kept in mind that the past reluctance to use consumers for difficult discrimination tasks means that we have little empirical data on the matter. However, in a unique study, John Powers tested the discriminative abilities of consumers in a seemingly difficult tea-tasting task. ISO procedures specify that tea samples be prepared by adding the tea to the milk, not vice-versa, because trained tea tasters can detect such a subtle difference. However, Powers demonstrated that inexperienced consumers have the same ability to detect this minor manipulation in sample preparation (Power, J. J. Mathematics of a lady tasting tea revisited. *J. Sens. Stud.* 3:151, 1988). It is also worthwhile to remind the reader of two facts. First, all of us, trained or otherwise, can detect the presence of certain odorous chemicals at concentrations far below those detectable by gas chromatographs or other available instruments. Second, the validity of all instrumental measures depends on correlations with human data. On the issue of methodology, a recent report from the University of Birmingham in England (McRae, A. W., and Geelhoed. Preference can be more powerful than detection of oddity as a test of discriminability. *Percep. Psychophys.* 51:179, 1992) bears noting. Investigators demonstrated that the triangle test, one of the standard test methodologies to detect sensory differences among samples with trained judges, is a less sensitive test of discriminability than is the traditional consumer method of preference testing. Moreover, ASTM-sponsored interlaboratory studies of three different methods of consumer hedonic testing have demonstrated reliability values exceeding 99% for these methods

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BY AARON L. BRODY

## At Home or on the Run—Breakfast or Brunch?



*Rise and shine, awake, good morning*—formerly just greetings before the day's first meal, these terms are now names for products intended to be easily prepared and consumed as breakfast, as a component of a breakfast, or as a substitute for breakfast. The once-traditional breakfast of eggs, bacon, ham, toast, hot or cold cereal, juice, and coffee has been declared unhealthy, unwise, and too much. However, these foods have not been relegated to our gastronomic landfills. Instead, interesting alternatives that are lower in calories, faster to prepare and consume, and more abundant in choice have been offered. Breakfast is the most rapidly growing food category by time-of-day segment, and, therefore, the prime target of America's armies of product and market managers in food and food-service organizations.

*Dr. AARON L. BRODY is managing director of Rubbright-Brody, Inc., with offices in Eagan, MN, and Devon, PA.*

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(Pearce, J. C., Korth, B., and Warren, C. B. Evaluation of three sealing methods for hedonics. *J. Sens. Stud.* 1:27, 1986).

Lastly, concerning the issue of relativity in consumer judgments, the fact that consumer judgments are relative is exactly why we use consumers to judge sensory quality. Sensory quality is a relative concept. It changes over time and circumstance. Fifty years ago, fatty meats were perceived to be of better quality than were lean meats; 25 years ago, frozen TV dinners were the height of quality. I am reminded of the recent plight of investigators developing a new process to replace steam sterilization in canning with a hot water process. Although the process produced fresher tasting product with less water in the can, the investigators pondered over how to get consumers to accept the product, because consumers had come to expect a certain level of "quality deterioration" in their canned products. The quality deterioration of which the investigators spoke had now become the essence of quality to the consumer.

So what is the message? The message is that sensory quality, when defined in the sense of degree of excellence, is a consumer-oriented concept. One must, therefore, involve consumers at every step in the research and development process; from concept formation through development, production, even in quality control operations for assessing the importance of observed sensory deviations. The food companies that survive into the next century will be those that focus on quality. Understanding sensory quality and the consumer's role in defining it should be Job #1 for all of us.

In breakfasts of the past, Mom arose before dawn to prepare the traditional fare—eggs from molded pulp cartons, bacon from a vacuum-skin package, coffee from a can, and juice reconstituted from a spiral-wound composite paperboard can. Today, however, the offering has been radically altered. Kitchens, freezers, and refrigerators are stocked with a breath-taking array of prepackaged items.

### Breakfast Drinks

Juice now comes packed in several forms. It comes single strength in gable-top, plastic-coated paperboard cartons, which feature screw closures for easy opening and reclosing. The contents most often are not-from-concentrates for enhanced flavor, which are packaged using aseptic techniques that deliver extended refrigerated shelf life. A new freshly squeezed juice is not heat pasteurized and is aseptically packaged in paperboard plastic/aluminum foil gable-top cartons to permit about four weeks of chilled shelf life. Of course, the old-fashioned 3:1 concentrate is still available from the freezer section.

There are also several new forms of breakfast drinks. Juice and juice drink concentrates that have been packaged by conventional aseptic packaging technologies are displayed on the ambient temperature shelf. Single-strength juices and juice drinks come aseptically packaged in block or brick-shaped cartons in single-serve sizes or hot-filled in polyester bottles and jars, even for baby juices. Juices also come in thermoformed plastic cups that have been either hot-filled or aseptically packaged, depending on the manufacturer. Single-serve juice and juice drink cans are now two-piece aluminum with easy-open ends. And, of course, dry powders for rehydration with water are still available, packaged in glass, plastic, and spiral-wound paperboard composite cans. A list of all options for fruit beverages would be endless.

Milk, another traditional breakfast beverage, is still offered in traditional gable-top plastic-coated paperboard cartons and in extrusion blow-molded, high-density polyethylene bottles (which are now the prime source of raw material for most of the highly publicized bottles made from post-consumer recycled plastic, so drink more milk). Diligent searches can still unearth shelf-stable, aseptically packaged milk in brick-shaped cartons. (This is another sign of American conservatism relative to food and beverage packaging—Europeans consume much of their fluid milk from these packages.)

Coffee, the hot beverage that is essential for beginning the day for many consumers, comes in such a wide array of packaging forms that entire journals could be devoted to this fascinating topic. The traditional steel can is still available in one-, two-, and three-pound sizes, complete with an injection-molded polyethylene overcap reclosure. For roasted and ground coffee, flexible vacuum-brick packages fabricated from laminated polyester and aluminum foil have become standard. Roasted and ground coffee is now offered in single-serve vacuum brick packages, in porous paper bags to be used for in-cup preparation, and in pot-sized porous paper pouches in gas flush-packed, convolute-wound, square-shaped cans made of reverse-printed paperboard/aluminum foil laminations with injection-molded plastic reclosures. Both whole bean

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