Sensory and Consumer Research in Food Product Design and Development

Howard R. Moskowitz, Jacqueline H. Beckley, and Anna V.A. Resurreccion

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Dedications

I dedicate this book with love to my dear wife, Arlene, who has encouraged me and continues to inspire me daily to develop new ideas, invent new products, and push the limits. Thank you, Arlene, for being there, and for being you.

Howard Moskowitz

To my dear sweet husband, Leslie, for supporting goals and dreams. To Hollis Ashman for helping keep the business fires burning. To Howard for moving forward the field of sensory and consumer research even through adversity.

Jacqueline Beckley

To Rey, the love of my life, thank you. To Howard, my gratitude for your relentless pursuit in bringing sensory science to a new level.

Anna Resurreccion

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Preface

When Blackwell Publishing approached us in 2003 with the invitation to write about new developments in the early stage world of product research, we were quite excited. By the early 21st century it was already becoming apparent that the field of product testing and so-called "sensory analysis" had matured far beyond those pained beginnings decades ago, developing into a partner with marketing and management.

The real question that occurred to us is what would we write to our business colleagues, and to the next generation? What guidance could we provide them, especially in a world of hypercompetition where products come and go in the blink of an eye, where success may be measured in months, and where job security is no longer a hallmark of the field?

As a group we decided to write about new developments in the field, rather than concentrating on the traditional approaches of discrimination, scaling and hedonics. We decided that the students of today and tomorrow—both in a college or university *or* in business, might like to hear a different voice, and a different message; not so much a message of "how to do it" as a set of ideas about what to do in certain business situations.

And so we set down to write, from a combination of business and academia, more with the goal of enthusing the reader about the potential than passing on simple prescriptions of what to do; more with the idea of saying "here's the way your world is working" rather than saying "here is what prescribed wisdom says."

We hope we have been successful. Should we be able to inspire students to move forward in a new direction, merging business and science, new developments and battle-tested methods, we will feel our book to have made a difference.

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Howard Moskowitz
Jacqueline Beckley
Anna Resurreccion

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1 Emerging Corporate Knowledge Needs: How and Where Does Sensory Fit?

Introduction

During the past thirty years companies have recognized the consumer as the key driver for product success. This recognition has, in turn, generated its own drivers—sensory analysis and marketing research, leading first to a culture promoting the expert and evolving into the systematic acquisition of consumer-relevant information. Styles of management changed as well. At one time it was fashionable to laud the "maverick executive" as a superior being, perhaps the management equivalent of the expert. Over time we have seen this type of cowboy machismo decline into disrepute. Replacing this maverick decision making has been an almost slavish adoption of fact-based decisions, and the flight from knowledge-based insight into the "soulless" reportage of facts.

How does corporate decision making affect a discipline such as sensory analysis, which has only begun to come into its own during the past three decades? If one were to return to business as it was conducted in the 1950s and 1960s one might discern a glimmer of fact-based decisions among the one or two dozen practitioners of what we now call sensory analysis. These individuals—scattered in corporations, working quietly in universities, executing food acceptance tests for the U.S. military, and a handful of others scattered about in other countries around the world—were founding the field that now provides this type of fact-based guidance for product development and quality assurance. In the early years many of the practitioners did not even know that they were creating a science that would emerge as critical, exciting, and eminently practical. These pioneers simply did the tests the best they could, attempted to understand how people perceived products, and kept to themselves, hardly aware of how they were to affect the food industry in the years to come.

As the competition among companies to secure market share in consumer goods relentlessly increased, and as the consumer continued to be bombarded with new products, it became increasingly obvious to many that consumer acceptance would be increasingly paramount. Whereas before one might hear such platitudes as "people always have to eat" as an excuse for complacent mediocrity, one would now hear catchphrases such as "consumer tested" or "significantly preferred." Companies were catching on to the fact that the consumer had to actually like the product. The privations of World War II and before were fading in memory. The supply economy was giving way to the demand economy. The consumer, surfeited with the offerings of countless food manufacturers, could pick and choose among new products that often differed only in flavor or in size from those currently available. In the face of such competition by fellow manufacturers, it became necessary for the marketer and product developer to better understand what consumers would actually buy, and in so doing perhaps understand what consumers really wanted.

The end of the 20th century saw the professionalization of product testing. What had started out fifty years before as a small endeavor in corporations to "taste test foods" as one step in the quality process became a vast undertaking (e.g., Hinreiner, 1956; Pangborn, 1964). Company after company installed large market research departments reporting to marketing and sensory analysis departments reporting to R&D. Whether this was the optimal structure was unclear. Often the two departments did similar studies. The express purpose of these often-competing departments was to ascertain what consumers wanted, and to feed back this information in a digested, usable form to those who either had to create the product at R&D or those who had to sell the product. The era of fact-based decision making was in full swing. Decisions would no longer be made on the basis of the response from the president's "significant other" (whether husband, wife, or child), but rather would be made on the basis of well-established fact, such as the positive reaction by consumers who would test the product under conditions that management would trumpet as being "controlled and scientific." Such fact-based decision making would be introduced into all areas dealing with consumers, first as a curiosity, then as a luxury, and finally as a desperate necessity for survival. For the food and beverage industries the emergence of fact-based decision making would bring new methods in its wake.

The Era of the Expert, and the Emergence of Sensory Analysis Out of That Era

The real business-relevant beginnings of sensory analysis occurred in the 1950s and 1960s and can be traced to the quantum leap in business thinking provided by consultants at Arthur D. Little, Inc. (ADL), in Cambridge, Massachusetts. ADL was a well-known consulting company, with one division specializing in agribusiness. In the 1940s, a group of enterprising consultants at ADL developed the Flavor Profile, a then-revolutionary idea to quantify the flavor characteristic of foods (Cairncross & Sjostrom, 1950; Little, 1958). The Flavor Profile was precedent-shattering on at least two fronts:

1. Systems thinking: No one was thinking about flavor in this organized, quantifiable fashion. It was certainly unusual to even think of a formalized representation of flavor. Researchers had thought about flavors for years, but the formalization of a descriptive method was certainly new.
2. Anyone could become an expert—albeit after training: The expert reigned supreme, in brewing, in perfumery, etc., but to have the experts created out of ordinary consumers by a formalized training program was new thinking.

Sensory analysis as an empirical discipline emerged out of the application of expert judgments in formalized evaluation. Before the Flavor Profile (Caul, 1957), the expert judgment would certainly be called upon, and relied upon as the last word. The notion of consumer acceptance, or consumer input, was not particularly important, although the successful product would be touted as filling a consumer need. The Flavor Profile formalized the role of the expert in the situation of disciplined evaluation. The expert was given a new task—evaluate the product under scientific conditions. The consultants at Arthur D. Little, Inc., won numerous contracts based upon their proclamation that the Flavor Profile could assure so-called *flavor leadership* for a product.

At about the same time as ADL was selling its Flavor Profile, the U.S. government was winning World War II. The popular aphorism attributed to Napoleon Bonaparte that "*an army travels on its stomach*" guided the development of new methods. The Quartermaster Corps recognized the importance of food to soldier health and morale. The slowly emerging scientific interest in measuring responses to food, appearing here and there in industry, took strong root in the military. Measuring soldiers' food preferences became important because the commanders could often see firsthand the effects of food rejection. Unlike the executives sitting at the heads of food companies, the commanders walked among their troops. Failure to feed the troops meant a weakened army and the real prospect of a lost battle or even war. Food acceptance became a vital issue, and its measurement a key military task (Meiselman & Schutz, 2003).

The confluence of sensory analysis in the food industry and the military recognition of the importance of consumer-acceptable food produced in its wake the sensory analysis industry. The industry did not emerge overnight. It emerged slowly, haltingly, like all such new creatures do, with false starts hampered by wrong decisions, but in its own way it matured. Expert panel approaches begun by consultants at Arthur D. Little, Inc., matured to more quantitative, statistics-friendly methods such as the QDA (Stone et al., 1974). Military interest in food acceptance led to advances in sensory testing and the 9-point hedonic scale (Peryam & Pilgrim, 1957) to actually measure level of acceptance. The U.S. government funded research into food acceptance (Meiselman, 1978) and eventually got into the funding of taste and smell psychophysics, especially at the U.S. Army Natick Laboratories, where Harry Jacobs built up a cadre of young scientists interested in the sensory evaluation of foods (Meiselman & Schutz, 2003). Other organizations such as the Swedish Institute for Food Preservation Research in Gothenburg (now Swedish Institute for Food Research) pioneered research methods and applications as well as recording the literature from the burgeoning field (Drake & Johannson, 1969).

Industrial efforts adopted methods for product testing, and the field grew, prospered, and of course heralded its maturity through journals and conferences. The first major international symposium involving sensory analysis took almost fifty years to come about from the start of the field in the 1940s. This Pangborn Symposium held in Jarvenpaa, Finland, just outside of Helsinki, attracted over two hundred participants. The organizing committee headed by Dr. Hely Tuorila had expected this conference to represent a one-off event, but the palpable excitement shared by the participants soon changed the committee's mind. Eleven years later, the same conference, in its fifth convening, held in Boston, attracted over seven hundred participants. Popularity increased so that from being held every third year the conference is now held every second year. Allied conferences, such as Sensometrics, also developed, to the point where the Sensometrics Conference is held on the years that the Pangborn Symposium is not. The field was well on its way. Scientific decision making in the food industry had given rise to a new discipline.

The success of the Pangborn Symposia, and their continuing increase in attendance in the face of decreases at other conferences, deserves a short digression that can also shed light on the growing field of sensory analysis and the pent-up needs of the members. When the era of the expert was in its heyday there were no conferences to speak of, and the professionals in sensory analysis were few, scattered, and scarcely aware of each other, all laboring away in, as John Kapsalis had often said, "*splendid isolation*." The Pangborn Symposium brought these individuals together in a concentrated, four-day format, somewhat

longer than the more conventional professional organization such as IFT (Institute of Food Technologists). At least six things occur at such extended meetings:

1. Masses of people with very similar interests interact in a confined location. The participants meet with individuals who are, by and large, sympathetic to them. Rather than participating in specialized symposia where the sensory specialists come together, albeit as a minority, in the Pangborn Symposium they come together with many of the same purposes. This mass of people is an intellectual hothouse.
2. Easy meetings occur so that like-minded people can reach out to each other. The interpersonal nature of the meeting cannot be overemphasized. Many people have known each other for years, so the close and long meeting allows these people to renew acquaintanceship.
3. Density plus time plus fatigue reduce interpersonal barriers. The surrounding density of people at the meeting and the continued stimulation over time from seeing people with common interests leads to fatigue, real reduction of barriers, and increased professional intimacy.
4. Long meetings make for more memories. The four-day period suffices to imprint many positive memories of interactions on the participants. The scientist lives in the future, propped up by memories and propelled by hopes.
5. Information intake and exchange allows people to take each other's measure. The plethora of posters, of talks, of meals shared together allows people to come and go at their convenience, spend time looking at other peoples' work in an unhurried situation, and in general get comfortable with each other. They size up each other, challenge, share, form opinions of character, of promise, and of expectations for each other's future. In a sense people learn about each other in a way no journal article could ever hope to imitate.
6. The laying on of hands, from the older to the young, occurs more readily in this environment. The young researcher can get to meet the older, more accomplished researcher on a variety of occasions, some professional, some social. This opportunity to meet each other produces in its wake a cadre of inspired young professionals who can receive the necessary reinforcement from their older role models in this artificially created, short-lived "hothouse of kindred souls." One should never underestimate the value of interpersonal contacts in science, and the effect on the morale, motivation, and joy of a younger scientist who is recognized and encouraged by an older role model. The Pangborn Symposium was set up, perhaps inadvertently but nonetheless successfully, to produce that motivation and "laying on of hands" over its extended, four-day time.

The Manifold Contribution of Psychophysics

Psychophysics is the study of the relation between physical stimuli and subjective experience (Stevens, 1975). The oldest subdiscipline of experimental psychology, psychophysics makes a perfectly natural, almost uncannily appropriate companion to sensory analysis. The study of how we perceive appearances, aroma, tastes, and textures of food might easily be a lifelong topic of psychophysical research. Indeed, many of today's leading sensory analysts have been grounded either in formal education in psychophysics or at least have enjoyed a long-term interest in the details of psychophysics. Psychophysics did not start out as the conjoined twin of sensory analysis, although to many novices in the field the intertwining of the two areas seems uncannily tight and quite meaningful.

Psychophysicists are natural complements to sensory analysts, but with a slight change in focus. Sensory analysts study the product, using the person as a bioassay device. Knowledge of how we perceive stimuli does not help sensory analysts do their job better in terms of the specifics but does give the analyst a broader perspective in which to operate. Psychophysics uses stimuli as probes to understand how the sensory system processes external information. Historically, and for a great many years, psychophysics confined itself to the study of "model systems," such as sugar and water or simple chemical odorants. In their desire to be pure, these psychophysicists valued systematic control over real-world behavioral meaning. Psychophysics of taste and smell followed psychophysics of hearing and vision, wherein the stimulus variability could be controlled by the researcher and then channeled into systematic stimulus variation.

Psychophysics would expand its scope, however, in the early 1970s as a group of young researchers moved out from academia to the applied world. During the 1960s psychophysics underwent a renaissance, first begun by S.S. Stevens at Harvard University but taken up by others worldwide in a variety of fields. These young researchers found that they could use Stevens's method of magnitude estimation to measure the perceived intensity of stimuli. Stevens had provided the tool. These young researchers, such as Linda Bartoshuk, William Cain, Donald McBurney, Herbert Meiselman, Howard Moskowitz, and others would use the magnitude estimation method for direct estimation of sensory magnitudes, applying it to model systems first, then to more behaviorally meaningful stimuli such as foods, beverages, the environment, and so forth (e.g., McBurney, 1965). Bartoshuk, Meiselman, and Moskowitz would all begin their careers with some involvement at the U.S. Army Natick Laboratories, in Massachusetts, working with Harry Jacobs. Natick would stimulate all three to look at the application of psychophysics to food problems, a stimulation that would have lifelong consequences for these researchers and for their contributions to the field.

The Emergence of Statistical Thinking in Sensory Analysis

Quantitative thinking has been a leitmotif of sensory analysis, whether in the early days a half-century ago or today, whether in academia or in industry, whether in the United States or abroad. Indeed, with the founding of the Sensometrics Society (www.sensometrics.org) and the burgeoning number of quantitatively oriented papers in sensory analysis presented at the different symposia, one might almost conclude that sensory analysis could not exist as it does except based upon statistical methods. The question is, why this reliance on quantitative methods? Why are numbers so important?

To answer this question we have to consider the hedonics or likes/dislikes, the intellectual history of sensory analysis, and the nurturing influences of both science and business. Sensory analysis deals with the response of people. People are, by definition, variable. They lack the pleasing uniformity that delights a scientist. Subjective data are messy. When it gets down to likes and dislikes, the pervasive variation across people become almost unbearable to some, those who want to flee back to a world of ordered simplicity.

If we imagine what it was like a half-century ago or longer, we notice first that many of the sensory professionals were chemists or other individuals in corporations who did not fathom that they were inventing a new field. Chemists are not accustomed to variability. They are accustomed to regularity in nature, with variability constituting an unwanted secondary influence to be dispensed with, either by controlling it or ignoring it. When dealing

with the issues involving food and the subjective reaction to these foods, the natural inclination of a chemist is to ask simple questions, such as magnitude of intensity and magnitude of acceptance. Not having any other intellectual history, such as sociology, the early practitioners relied on simple quantitative methods by which to make conclusions. It should come as no surprise, therefore, that the statistics used by these chemists/sensory practitioners would be simple inferential statistics. It was not the nature of the problem but indeed the nature of the worldview. The intellectual history and quantitative predilections of such practitioners would be those of a chemist thrust into a world far beyond that which had formed his or her intellectual character years before.

Fifty years later it would no longer be cadres of chemists who were the main practitioners of sensory analysis. It would instead be people with newer, more informed, more sophisticated worldviews, coming from statistics, from experimental psychology and the like. The predilections of these professionals for measurement and modeling would be more profound because they were nurtured on worldviews that could handle variability, rather than perceiving it as an intractable nuisance. Not content to find differences between samples, these new practitioners had been schooled to search for relations between variables and to represent these relations either in terms of equations or in terms of maps (e.g., Heymann, 1994). They were looking for laws or at least generalities, not coping with the often more profound and equally disquieting issue of, how do I measure this private sensory experience?

What does all this have to do with sensory analysis? Quite simply, quantitative thinking has emerged as a major facet of sensory analysis, and not just the ability to do analyses of variance. Most meetings with sensory analysts have some portion of the meeting devoted to quantitative methods. Indeed, quantification using "modern methods" has become so very popular that researchers in sensory analysis have formed a group, the aforementioned Sensometrics Society, to promote the approach. Sensometrics is growing and thriving, embracing more and more adherents and acolytes each year.

A sense of the growing power of quantitative approaches in the field can be readily seen from the nature of conference presentations. Whereas four decades ago interest focused on new methods for removing variability in analysis of variance, today interest focuses on method for representing data and gleaning insights. Four decades ago the researcher involved in quantitative methods was happy to show that some effect occurred, as revealed by significant treatment effects in analysis of variance. The focus for new methods lay in the ability to provide added types of analysis, cautiously remaining, however, within the framework of inferential statistics, descriptive statistics, and kindred approaches. The notion of insights in the data as empowered by statistics would have to wait three decades for the birth of available, easy, cheap, and powerful computing. The PC revolution also revolutionized statistics, as the more adventurous and inquiring statisticians began to explore other methods with this available computing power, such as mapping.

Increased *quantitation*, especially beyond the more conventional tests of differences among products generated at least three outcomes:

1. Infused intellectual vitality: The sensory analyst, armed with these new techniques, felt empowered to advance beyond a simple service role and do more scientific work. Whereas before the sensory analyst was many times relegated to "tray pusher" despite the protestations of being a professional, all too often that is exactly what happened. The ability to collect data, then create maps and equations, reveal novel relations among

product stimuli, and apply this information to many types of stimuli producing a sense of pride in one's capability.

2. Increased ambition in the corporate world: The ability to understand aspects of products through high-level statistics led to the realization that this information was valuable to the business. Knowing the strengths and weaknesses of the in-market competitors gave the sensory analyst some degree of power to influence business decisions. This power led to increased ambition, or at least to a desire for greater roles in corporate decision making.
3. New currency for interchange with fellow scientists at meetings: Whereas in the 1960s and 1970s, the birthing years of sensory analysis, there was little really to talk about except one's hope for the future, now in the early 2000s, with high-level statistical analyses there is always something to talk about at meetings. Having a thriving, robust corpus of statistical methods allows the researcher to analyze data many different ways and to present the data and the analysis at conferences. Different types of analyses are always more interesting to scientists than, say, the consumer acceptance of yet another flavor of dessert pudding. This statement is not meant to denigrate the old data but rather to emphasize that as the sensory scientist became familiar with statistical techniques, that familiarity led to new ways of analyzing data that would become the basis for presenting papers and posters at meetings. Simple research, of the disciplined, well-executed type promoted by Rose Marie Pangborn, doyenne of sensory analysis in the 1960s through 1980s, and that of her associates could never have produced this "currency" for scientific meetings. It would take a new generation of skilled, quantitatively-oriented professionals to leap the barriers that circumscribed and limited sensory analysis for so many years.

Rose Marie Pangborn: From Focus on Experts to Focus on Consumers

The early history of sensory analysis is a history of studies with small numbers of subjects and a focus on their ability to detect differences and describe perceptions (Amerine, Pangborn, & Roessler, 1965). To some degree this focus came from the intellectual heritage shared by the chemists and product developers who found themselves in sensory analysis jobs, even before the field was recognized. They turned to the literature and found the work of perfumers, flavorists, winemakers, brew masters, and the emerging science promoted by consultants at Arthur D. Little, Inc. It did not take the researchers long to conform to the standard that sensory analysts were developing. The field was to focus on the description of sensory characteristics (descriptive analysis) and perhaps on the discrimination of small differences. The descriptive efforts were part of the Linnaean tradition, which was prevalent first in biology, then in psychology, and then in sensory research. Linnaeus confronted the unknown world by describing it. Description was a natural task. It seemed reasonable that one could learn about the product properties by first elucidating them. Experimental psychologists just a half-century before had done the same by describing the characteristics of sensory experience in the psychological school of "structuralism." Edward Bradford Titchener had laid the groundwork at Cornell by the methods of introspection. Sensory analysts took these methods and ran with them (Boring, 1929).

Decades later, and with the influence of business objectives as motivation, sensory researchers evolved away from pure descriptive analysis to understanding consumer behavior. Descriptive analysis was fine but not particularly cogent in a highly competitive business

world. One could, of course, link descriptive analysis to ongoing product quality, as many researchers did and did effectively. However, the bigger picture demanded from the sensory analyst that he or she concentrate on the consumer. It was acceptable to "keep one's foot in the profiling world" as stated by more than one researcher, as long as the sensory researcher dealt with consumers. The focus on consumers would grow in the 1980s but emerge very strongly in the 1990s to constitute the prime direction. One reason was the call of business—those employed by corporations had to stay relevant or lose their jobs and their raison d'etre. Another, and a more subtle reason, was the premature death of Rose Marie Pangborn, a founder in the field and a purist. Pangborn trained many of the students at the University of California, Davis, and in some ways single-handedly crested the academic field. Pangborn was part scientist, part teacher, 100% rigorous, but with an inspiration to introduce her students to the scientific method. She encouraged purism on the part of her students, many of who went into descriptive analysis. While she lived, many of her students maintained an unspoken level of scientific purity through descriptive analysis, even though Pangborn was more sympathetic to psychophysics than to descriptive analysis. From descriptive accounts of her classes, Pangborn was clearly a mother figure, but one who spared no criticism if her student departed from the path of rigid, pure, and puritanical science. After her death, however, the rigid purity that she so strongly espoused and the elevation of methodological correctness and orthodoxy became less evident. The unique force of her professional personality waned, as it must wane after one's death. Those fortunate students who had gained her respect through tightly controlled descriptive analyses were somewhat freer to pursue consumer research, and many did so. Thus, through that fortuitous combination of focus by business on facts and sales, and the passing of Pangborn's influence, the sensory analyst would be liberated to focus more on consumers.

Destroying Old Myths in the Crucible of the Marketplace

Having been influenced by science, sensory analysis would also be influenced by marketing. This nascent discipline was caught in another emerging current, the whirlpool of business, filled as it is with currents, countercurrents, cabals, capriciousness, and yet at the same moment unbelievable opportunities. Business requires different ways of thinking than science does, and the direction sensory analysis grew in the fertile ground of business was quite different. Sensory scientists often began their career with dreams of understanding the way products work, at least at the subjective level. Business issues soon disabused industry-based sensory scientists of many such idealistic visions. The business world demands obedience, demands delivery, demands success. Sensory scientists could practice their field and craft, but under the strict auspices of a research director, held accountable for splashy product introductions, unerring product quality, and profitable market success.

It should come as no surprise, therefore, that in the crucible of the marketplace the sensory scientist should change course. What had been in the 1950s and 1960s a slow dance between scientists studying sensory perception and business-oriented researchers studying products changed to a set of silos that would inevitably discourage cross-fertilization. The Arthur D. Little, Inc. Flavor Profile, so carefully constructed by Cairncross, Sjostrom, Caul, and others during the 1940s and 1950s had matured into big business, supporting infrastructures in ADL and in laboratories of their corporate clients. The introduction of their descendent methods, such as the QDA method (Stone et. al., 1974) in the 1970s and the

Spectrum method in the 1980s (Munoz & Civille, 1992), found fertile, protected ground. However, it would be some years before scientists would publicly scrutinize the methods (Zook & Pearce, 1988). In the meanwhile, sensory analysts quickly flocked to profiling methods, leaving psychophysicists and their research methods far behind. The story would not end there, however, as we will see later. However, it is worth noting that the 1970s and the 1980s witnessed the paths of sensory analysis and psychophysics diverging. What had originally been a conjoined, developing, and occasionally intimate relation in the 1960s, with psychophysics invited to food science meetings, turned somewhat colder a decade or two later on. A great deal of the polarization came from the need of sensory analysts to do routine, ongoing profiling work. The success of sensory analysis in industry came at the price of increased demands on the sensory analyst to do maintenance work. That success turned sensory analysis away from its psychophysical roots, as the practitioners in the field enjoyed their acceptance, but they paid the price in corporate demands on their time.

The Inevitable Slide into Turf Wars

Turf wars for control of primary research among consumers characterized much of the relation between the growing field of sensory analysis and the incumbent field of marketing research. Both disciplines had responsibility to understand the consumer but came at their tasks from radically different directions. As discussed earlier, sensory analysis came from the tradition of physical and chemical science, and indeed many of the early practitioners of sensory analysis during its terra incognita stage were bench scientists involved in product development. They knew the products well and the subjective perceptions less well. We can contrast this group of explorers with their somewhat counterparts sitting in marketing, the so-called marketing or consumer researchers. These individuals were rarely if ever trained in science, tended to be professionals who studied social science (and now business), and were in general not particularly comfortable in high-level mathematics. They did understand inferential statistics, and generally they could trace their intellectual heritage to sociology, or at least acted as if they had come equipped with a sociological background. They were interested in market performance of the product and had no sympathy for the product itself except as the topic of research. They focused on how the consumer bought the product or accepted the product, but for the most part the products could be substituted for each other, willy-nilly, without making any particular impact to the way these market researchers analyzed their data.

From the perspective of top management, sensory analysis and market research deal with many of the same issues. Indeed, in 1974, then Professor Erik von Sydow, head of the Swedish Institute for Food Preservation Research (SIK) in Gothenburg, said that the eventual roles of the sensory analyst and the market researcher would merge to become one product-focused role. It would take over thirty years for von Sydow's insight to take hold, but in the meantime the similarity of function and the desire to provide valuable corporate feedback about products had an unexpected outcome. That outcome was an ongoing turf war lasting more than two decades, which in its wake created barriers and silos that only today are being torn down.

Ironically, the turf wars came about because both groups wanted to do a good job in product research and now in what is colloquially called "consumer insights." The sensory analyst, poorly prepared at first to battle in the corporation, retreated to scientific methods, to esoteric charts from newly developing methods, and to presentation of himself as the

low-cost supplier. The sensory analyst fighting these turf wars was poorly equipped to make his case as a strategic partner in marketing, primarily because the personality of the sensory analyst in those early days of the turf wars (1980s) was focused on science and validation of himself, not on success in a corporation. In contrast, the marketing researcher did not carry around the burning desire to found a science and to be judged acceptable and worthy by professionals in other sciences. There were no self-avowed physical or biological scientists working in marketing, as there were in the biology and psychophysics of taste and smell. Hence the marketing researcher was unconstrained by many agendas. Some marketing researchers had academic aspirations and would teach on the side as adjuncts in the university, but for the most part the marketing researcher focused on doing a good job. Smart enough to acquire a discretionary budget to hire outside suppliers, the market researcher became a purchasing agent for talent and information, and was able to use some of the better brains in the industry to work on projects and provide necessary insights. Sensory analysts, however, unaccustomed to a budget to "outsource" their efforts, did not ask for nor did they receive this outsourcing budget. Rather, they grew organically in size, overhead, and responsibility in the organization. They were content to fight the turf wars by showing that they could do everything internally, or at least claimed to be able to do so at a lower cost. It was now a classic fight between the outsourcing model and the internal capabilities model. In business this is the ever-present tension between "buy" versus "build." Does one buy a capability in the way the market researcher buys, or does one build a capability as the sensory analyst builds? When these two approaches vie for the same corporate task—insights about the product—turf wars break out.

Where Are We Heading Today—and Why Are We Heading There?

Where is sensory analysis going? If we look at the number of practitioners in the industry or the number of papers published by academics we might feel justifiably proud that here is a field, which is burgeoning. The life force is almost palpable at meetings, with young researchers actively seeking to show their work to their older counterparts. All the signs of life are about us. Yet, there is some trouble brewing. Many of the young researchers are heavily involved in measuring, rather than in thinking. The plethora of new technical methods, the ease and availability of computation, and the willingness of companies and funding institutions to sponsor research all combine to nurture a thriving business in "stimulus assessment" (viz., applied product testing). On the other side of the coin is the recognition that the younger researchers don't have a chance to think. Their very success depends upon using some of the latest research techniques to grind through data. The young researchers are caught in a race with methods. Each group wants to be the first to use new computer analysis techniques. Each young researcher wants to be the first to win approval by showing prowess at these new techniques, and often sacrifices the slow, methodical, often not apparently productive thinking for the frenetic pace of analysis.

We might look at the field of sensory analysis in the way that the poets write about their world—a world of nature becoming increasingly sophisticated, losing its way, losing contact with its origins. We can see some problems emerging in our world. These problems, often disguised as opportunities, are rapidity of data collection, the plethora of tools, the abundance of conferences. These influences pull us in two directions. One direction is more professionalization, better science, far more rapid advance in knowledge. The other

direction is narrow specialization and the creation of sensory professionals instead of true scientists. Perhaps that polarization and dichotomy are inevitable, and comes to all fields, such as sensory analysis, that have the fortune to survive their own childhoods.

Mind-Sets and How the Sensory Professional Might Cope with Data

How do different sensory researchers cope with data since they have been confronted with data and data analytic methods for a half-century or longer? An interesting organizing principle for people was propounded in the Crave It!® Study but might have application here. Beckley and Moskowitz (2002) suggested from a set of large-scale conjoint analysis studies that consumers fall into three mind-sets when it comes to how they respond to concepts about foods and beverages (see chapter 6 on conjoint analysis for a discussion of the method).

One group, called *Elaborates*, responds strongly to descriptions of the sensory characteristics of food, and responds strongly when these are romanced. A second group, called the *Imaginers*, likes the characteristics of food, but also wants other things such as ambiance, emotion, and brand. Imaginers respond to non-sensory cues as well, although they are strongly affected by the sensory ones. The third group, *Classics*, likes foods in the traditional way.

According to Beckley, perhaps the same typing occurs for sensory researchers. Watching more than six hundred researchers at the Dijon Pangborn Symposium (2001) and over seven hundred researchers at the Boston Pangborn Symposium (2003) led Beckley to note that the same typology emerged for research papers and posters. Some researchers went profoundly into the data and could be called *Data Elaborates*. Others incorporated a variety of non-data sources not strictly in the study but using current trends, and could be called *Data Imaginers*. Still others remained on the straight and narrow path and could be called *Data Classics* because they maintained the conventional analytic techniques, with constraints, applying those techniques simply to a new dataset.

Where Are We Today? Mind-Sets about One's Role in the Sensory Analysis World

Another way to approach the history of sensory analysis and the relevance of its mission in business and science focuses on one's *mind-set*. Mind-set refers to the predisposition of the individual, to the way the individual responds to external stimuli, and to the nature of actions that the individual engages in. We saw different mind-sets previously, regarding one's treatment of data. How about mind-sets for one's own job in the sensory world?

One might consider all sensory analysts to be similar, and perhaps divide them by their scientific background and ways that they solve research issues. Another approach comes from the way that sensory analysts think about their jobs and responsibilities to their employers and to their field. This way of dividing the professionals emerges from a study of the mind-set of employees, reported by Ashman and Beckley (2002) as the "professionalism study." The professionalism study was conducted twice. The goal of the study was to better understand what it meant to be a sensory professional. Ashman and Beckley discovered, probably not surprisingly, that the sensory analyst does not constitute one simple persona. We might have expected this. Sensory professionals appeared to fall into one of three

different segments (see Table 1.1), based upon their pattern of responses to a variety of concepts that portrayed them:

Segment 1—the Academic: This segment, comprising 26%, are not necessarily academics as in university professors. Rather, this segment exists and flourishes as well in industrial settings. For the most part, sensory analysts in segment 1 want to keep up with the literature, want to keep abreast of the newest and best methods. They often come from academia, which is not surprising. They show little real interest in the applications of the method to practical business problems.

Segment 2—the Helpful Staff: This segment, comprising 44%, better reflects what people have thought the sensory analyst to be. The Helpful Staff segment takes little risk. Segment 2 seems to want clean and neat studies. One might liken the Helpful Staff segment to the middle manager. The Helpful Staff can be found in many companies. They are the backbone of the field.

Segment 3—the Business Builder: This segment is characterized by an understanding of how sensory analysis can help build a business. From a total of 137 respondents, the Business Builders comprised 30%. The existence of this Business Builder segment was not expected, because for the most part sensory analysts who participated in the study to understand mind-sets did not come from a marketing or business background. Rather, they came from scientific backgrounds. The Business Builder is an integrator who always keeps an eye on the business implications.

Whether a person falls into a single segment and stays there all his or her career, or whether the person changes from one segment to another as a function of changes in job and responsibility, remains an interesting topic for further research. Certainly, however, the segmentation of the sensory professional by mind-set gives one food for thought, especially as it mirrors the nature of the different types of behaviors in the field. One might expect a dynamic tension in the field as the *Business Builders* go about pulling the company into the future, the *Helpful Staff* dutifully and loyally contributing, all the while as the *Academics* stand back, take matters a little more slowly, spend more time, and "worry more" about the appropriateness of the tools used.

As noted previously, the sensory analyst continually deals with data in one form or another. The sensory analyst, generally challenged to provide newer, better, more actionable answers to problems, all too often feels overwhelmed by the never-ending, two-pronged assault of business problems and new techniques. Such assaults promote growth by the sheer demands they make. The classification of sensory analysts according to the way that they approach a problem, the data they collect, and the work-product they generate provides a novel, provocative, and possibly fruitful area to study this emerging profession, one that hints of deep cross-currents. The dynamic tension between mind-sets, the ever-changing demands of business, and the maturation of sensory scientists from idealistic novices to battle-hardened professionals promise to make sensory analysis a field worth watching and a potentially good home base in which to spend part or even all of a career.

Table 1.1 Utility values for 24 concept elements describing the sensory professional.

Tentative Title	Total Total	Seg 1 Academic 26%	Seg 2 Helpful Staff 44%	Seg 3 Business Builder 30%
Number of Respondents	**137**	**36**	**60**	**41**
Elements driving the Academic segment				
Recognized as an expert in his/her field	5	15	−3	7
Maintains thorough knowledge of technical literature	0	12	−12	8
Maintains close liaison with other practitioners in the field	3	11	−2	3
A team player	4	9	8	−5
Actively promotes new and innovative approaches through the organization	5	9	5	1
Elements driving the Helpful Staff segment				
Adept at applying knowledge and follow-through on the tasks required to complete the job	4	−1	9	2
Shows others how to integrate product, consumer, and market knowledge in the project	5	8	7	1
Elements driving the Business Builder segment				
Applies creativity and critical thinking to move the business forward	−1	−8	−4	9
Provides an opinion and guidance in critical situations	3	−1	3	9
Remains committed, with a drive to succeed	1	−7	1	8
Irrelevant elements or elements that detract from sensory professionalism				
Actively provides point of view in professional discussions	5	7	3	7
Often accepts a leadership role	−3	−15	−1	6
Remains authentic to his/her personal values while considering the values of others or the values of the organizational culture (politics)	−1	−5	−3	5
Provides vision and resourcefulness	2	3	0	5
Provides a role model for individuals new to the field	2	1	2	4
Takes action when discovering that something was done wrong or inappropriately by a functional group	0	−8	4	1
Makes difficult decisions under pressure	−2	−11	1	1
Passionate about listening to the needs and ideas of others	0	0	1	−1
Oriented towards new possibilities and open to change and new learning	0	4	−1	−3
Uses coaching and negotiation to motivate coordinated action to achieve goals	−5	−6	−6	−3
Continues to seek out new internal & external ways to do business	0	−3	5	−5
Personally tries out new and innovative approaches	−2	5	−1	−8
Publishes articles in various journals and books	−19	8	−41	−10
Shows humility in presenting his/her ideas while accepting constructive criticism and contrary opinions without being defensive	−7	−3	2	−24

Note: The study was run using the method of conjoint analysis. The utility is the conditional probability that a respondent will agree that the statement describes a sensory professional.

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2 Making Use of Existing Knowledge and Increasing Its Business Value—the Forgotten Productivity Tool

How you gather, manage, and use information
will determine whether you win or lose.
Bill Gates, *Business @ The Speed of Thought*

The data you own as a company—tracking, insights, sensory, trends, marketing, product development, market research, supply chain, manufacturing, quality, operations, sales, and retail successes and failures—represent the single biggest productivity tool for food development. Most companies today—large or small—have access to more data, lists, and information than they effectively make use of on a regular basis. Turning this information into knowledge that will lead to actionable results is the challenge. The key step in turning information into knowledge is to understand the context in which the data were originally calculated, reframe the data for the current situation, and then creatively manage the data quickly, effectively, and affordably for greater clarity of perspective. And, of course, do all of these things quickly and at lowest possible cost since time and money factor into all successes in today's supermarket, grocery store, or foodservice establishment.

This chapter discusses why barriers occur, suggests one approach for making existing and new data more actionable, and then demonstrates how to use existing information for focused problem solving and decision making.

Learning from the Past

The clever retexturing and reanalyzing of what is known within a company is the ultimate source of so-called "white spaces," that area of undefined yet tantalizing present possibilities. We have often heard teachers say, "Students often dislike history because they do not see it as relevant to their lives or necessary to know" (www.HistoryMatters.gmu.edu). The classic Greek philosopher Heraclitus is said to have declared, "Lovers of wisdom must open their minds to very many things" (Von Oech, 2001). Why do these thoughts pertain to food development today? After one hundred years of sustained food development, we have entered an era of more than enough supply of just about every food item. Whereas there are issues with food distribution in some of the least well-developed countries, by and large there are more than enough choices of any type of food group available in the grocery or superstores across the United States and other developed countries. This overabundance of choice, in which a thousand items in a food store have now multiplied to more than forty thousand (Trout, 2000), provides the food industry with a much more complex scenario in which to develop new products for markets that have become demand driven.

Survey results suggest that the areas of innovation and product development can rank first and second on the list of factors that CEOs consider as sources of competitive advantage (PriceWaterhouseCoopers, 2002; Sopheon, 2002). The question is not "innovation" but rather "innovation—how?"

NPDP, the new product development process (Lynn, 2000) teaches us the concept of systematic product development wherein understanding previous successes and failures is

important. But few food companies have practiced or even installed a robust process of conducting "postmortems." There are no examples of industry commitment to celebrating the best of the year, as with theater, music, and movies (the Tonys, Grammys, and Oscars, respectively), so that those who want to understand what the industry thinks is the best can study the selections, and by so doing continue to evolve. Whereas there are small groups of people within food companies whose job it is to deal with the company's business strategy, there are few individuals whose function focuses on product development strategy and only one group that we are aware of today that does strategic sensory research. This is an area for consumer research/consumer insights, though many in the different research disciplines bemoan their lack of a "seat" at the planning/strategy table.

Reasons abound to explain why thorough understanding of a product business situation has not been respected as an ongoing discipline in food companies. At least eight reasons come to mind:

1. Human nature: Difficulty embracing that which one has not created. An example that comes to mind is the project manager at a grain-based company who tried to interest a group of associates in her findings and could not get them to pay attention, since they had not been part of the exercise.
2. The old standby of lack of time: Time compression is a very common factor in business today. There is always a rush to get a project started and meet a timetable that someone else has set. As a result, doing things thoroughly from the beginning is thought to be a "luxury." Example: A breakfast snack went from concept to manufacture within a short period of time—avoiding any product design or evaluation. It failed in the test market and then was "tweaked" for two more years before the project was killed, allowing the product to die the abysmal death that was built in at the start because of poor planning.
3. Failing to recognize what the company already has learned: Few organizations appreciate how much knowledge they actually have and tend to feel that the history they have is too dated or does not apply to a specific initiative. So there is a lack of recognition of the value of past learning. One well-known company studied the same idea over the course of four years, four times, but with different consulting firms being asked to come up with the "true" answers. After four different PowerPoint presentations, the answer was still the same but with slightly different words and segments.
4. Recognizing what is important: Big shifts in thinking or behavior are fairly easy to spot. When these changes come about from subtler interrelated forces they are more difficult to observe. These changes, called "weak signals," are easy to dismiss as trivial or nonquantitative. The popular story about the development of Post-it® Notes is a classic example of a weak signal that took time to watch and understand and then capitalize upon.
5. Go do: Americans have been a go do, go get it done society. Except for a few academics, the study of the past seems to interfere with this quintessential American human nature of pioneer spirit and the inward nagging desire to get out and do something. As a result, a knowledge-collecting phase of a process appears slow, overly deliberate, and fairly archaic. The nature of most product development people is "to go make a recipe or a formulation"—do something, anything, to reduce the anxiety of a goal unfilled. One consequence is that the disciplined organization, analysis, and thus assessment of data and learning from the past just does not look like or feel like work. Examples are numerous of product development teams who talk about the joys (and pain) of bringing