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The Smell of Success – Exploiting The Leather Aroma

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ABSTRACT

The sense of smell has profound importance for humans. The scent of pine reminds us of Christmas; the smell of turkey brings back memories of Thanksgivings past. There is a scientific reason that happens. Our olfactory and limbic systems collect, transmit and decode aromas into emotions and even into behavior. We can't see or physically feel this facet of consumer satisfaction. But it has a strong influence. Consumers care as much about their new car's smell as its horsepower.

Automakers have indirectly changed the new car smell through the evolution of materials used in automotive interiors. They have also directly changed it through attempts to amplify the leather smell and, in some recent cases, to actually engineer a total interior smell. The direct techniques have had varying degrees of success, measured as consumer ratings of "that new car smell" in annual J.D. Power and Associates Automotive Performance, Execution and Layout (APEAL) studies.

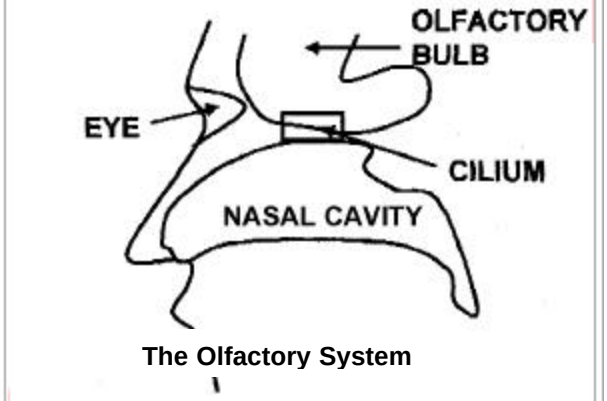
Leather is the only interior material that carries the burden of satisfying a consumer's expectation for a specific smell. Yet, when leather is the only interior aroma that is controlled, the results can be undesirable. Other interior smells can mix poorly with the aroma chosen for the leather, to offset or minimize the intended effect.

Evaluation of annual new car smell ratings and proprietary consumer research have led two suppliers to propose a new approach in exploiting leather's unique olfactory powers.

SMELL: THE FUNDAMENTAL SENSE

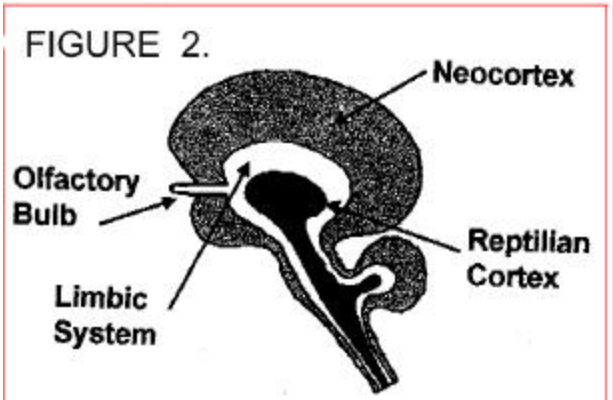
Every 24 hours, with reptilian instinct, each of us inhales nearly 23,000 times. Each time we do, odorant molecules enter our nose with the required weight and adequate vapor pressure to be properly concentrated for detection. Day and night, in a process that cannot be "turned off," the odorants are first warmed and moistened. Then, hair-like cilia in the roof of our nasal cavity detect the molecules and transmit data about their shape or vibration to our olfactory bulb (see FIGURE 1). The olfactory bulb sends this descriptive data to the 6 million receptor-cells in the limbic system of our brain (see FIGURE 2).

FIGURE 1.



The Olfactory System

FIGURE 2.



The Triune Brain

Employing an ability we are born with, this ancient, emotive area of our brain interprets the odorants and

recognizes them out of a crowd of up to 10,000 separate odor memories, and then changes our physiology, our emotions, and our behavior.

The use of smells is intrinsic to our very survival and fundamental to our quality of life. Yet in spite of its importance, the study of this greatest sense is still in its infancy. We can quantify, measure, and mechanically correct our ability to hear and to see, successfully amplifying near-deafness and achieving 20:20 vision. But in smell we have merely opinions. Some of those opinions may be genetic and are either universal -- such as fetid odors that warn us not to eat spoiled food -- or highly individual, such as our preference for a specific perfume or cologne.

Of all our genes, one percent is devoted to the detection of odors -- more than for all other senses combined. Still, our exploitation of smell has not advanced much since our ancestors used scents during religious and social events to promote awe, fear, and arousal. Now, however, in the changing field of automotive interiors, the smell of leather upholstery may be a key to competitive advantage and to inspiring higher overall consumer satisfaction with the entire vehicle. Taken with the probability that there is a genetic opinion that leather will have a "leather-like" smell, the importance of this subject to the automotive industry is clear.

ODORANTS PERSUADE US WHAT TO DO

Science classifies the effects of odorant/memory recognitions into three broad categories: how they affect our body chemistry, our emotions, and our behavior.

Changes from a normative state in our body's electricity, chemistry, and physiology are measurable. A lie detector test, for example, detects and charts simultaneous stress-induced changes in more than one variable. In similar ways, scientists study changes caused by odorants. In summarizing eleven of those experiments Jellinek (1994) describes changes in:

- Brain patterns
- Evoked potential in the nostril being stimulated
- Steady-state brain waves (a marker for concentration)
- Systolic blood pressure
- Microvibration (a fine tremor in warm-blooded animals)
- Heart rate
- Electro-dermal activity (EDA – an indicator of arousal)
- Skin potential
- Pupil dilation / constriction
- Startle-probe reflex.

Regarding moods and emotions, two major studies have proven that odorants can affect degrees of stress and anxiety, perceptions of good health and well being, and various other mood changes.

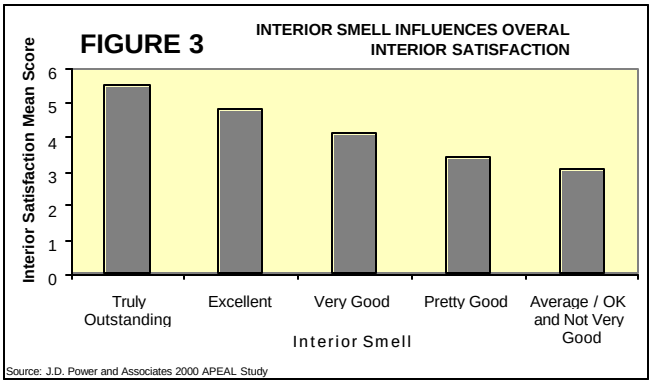
These effects are important because of their impact on human behavior, proven in both clinical and real life situations. As summarized by Jellinek (1994), ten major clinical studies show odorant-induced changes in:

- Sustained attention
- Reaction times
- Creative task solving
- Learning and recall
- Evaluation of ambiguous stimuli
- Sleep disruption (with introduction of an "undetectable" amount of a synthetic component of body odor)
- Concentration (or hostility) in driving performance.

In real life settings, Jellinek (1994) reports five studies that document:

- Greater in-store lingering time (but not sales)
- A 45% increase in gambling (where odorants complimented a casino's theme)
- Increased sales (from a pine odorant in a furniture store's heritage line department)
- Reduced in-hospital patient insomnia plus patient calming (through exposure to heliotropin, a key ingredient in baby powder scents).

But how does this relate to Automotive Interiors? The Year-2000 APEAL study reports a strong relationship between how well consumers rate their vehicle's interior smell with how they rate the vehicle's interior overall (see FIGURE 3).



Yet, while important, the new car smell and the leather smell have gone through uncontrolled changes over time. To fully appreciate how they have changed, and how they present a new opportunity, we need to look at each historically. Since leather came first, let's start by examining the "highly prized scent of the leather upholstery" (Wessel 2000).

LEATHER'S HISTORY EXPLAINS TODAY'S EXPECTATION FOR "THAT LEATHER SMELL"

Over 7,000 years ago, when our ancestors learned how to preserve hides instead of just drying them, all leathers were some shade of brown. They had a rich, organic, regional smell that was accidental and unique to the tanning methods discovered by individual tribes. To this day most consumers consider brown leather more "natural" and instinctively hold leather to their nose before examining it critically in any other way. Now, however, modern leathers can be any color and automotive leathers no longer have an organic smell. The smell now results from modern chemistry -- with the exception of the few automotive leathers into which the manufacturer has added a separately manufactured "leather-like" perfume.

Like other chemical processes, the origins of tanning are all natural. At first, hides were converted to leather using various tannins from vegetation found in the differing regions where our ancestors lived. Those vegetable tannins (called vegtans, and still used in many products today) were extracted from woods, leaves, nuts, twigs, and barks that also contained starches and gums that provided additional leather attributes. Key sources of tannins were (and are) Oakwood, Chestnut, Mimosa, Mangrove, and Quebracho, a dense, hard-wood tree found primarily in Argentina. These natural tannins all impart a brown color and a rich, natural smell to the hide, the darkness and intensity of which varies because plants vary. Later, with the advent of "global" commerce, brightly colored dyewoods from the trees of the Caribbean allowed leathers to be made in a variety of bright colors. Naturally, these dyewoods added to the variety of leather smells between and within regions.

It is already easy to imagine a global potpourri of leather smells – yet the process is not complete. After tanning, the leather has insufficient lubrication to keep it from drying and cracking from repeated flexing and folding during use. So our ancestors learned to rub in a variety of natural lubricants like animal fats and fish oils to keep the leather supple and flexible. The type of lubrication available depended on region and culture. The type and amount used depended on the functional demands to be placed on the leather. This means that regional, cultural, and functional influences affected the smell of leather (and the darkness of its color).

The best place to appreciate this point today is in a leather goods store. Each reader is encouraged to conduct this easy experiment. Simply enter the store, stop, and inhale. Smell the rich leather smell we all enjoy without much thought about it. Then, try to locate the same store-smell in any of the leather goods within the store. The reader will fail because the store-smell is really a bouquet of all the goods which the store contains and which were made with various methods in various places like Chile, Italy, Mexico, Pakistan, and many others.

TODAY'S AUTOMOTIVE LEATHER – THE EXPERIENCE FALLS FLAT

While a leather goods store offers a rich olfactory experience, today's automotive showroom does not. There are two obvious reasons: material specifications cause greater process conformity, and only one or two suppliers actually produce the leather contained in any line of vehicles. However, the main reason is that most of the sources of the rich leather smells -- natural tannins, dyes (and in some cases, oils) -- are all gone. The natural, odor-producing tannins have been replaced by synthetic chemicals made possible by the chemical and industrial revolutions of the early 20th century.

Modern chemistry began with the development of synthetic molecules. This led to the making of synthetic tannins (syntans) in the 1900's. Like many inventions, the first exchange syntan was developed out of necessity around 1911 by the WW I isolation of Germany, an important source of tannins at that time. These modern syntans offer more consistent results because they are more predictable and controllable. The Industry also developed synthetic dyes and today there are over 1,500 commercial dyestuffs available to the leather making industry.

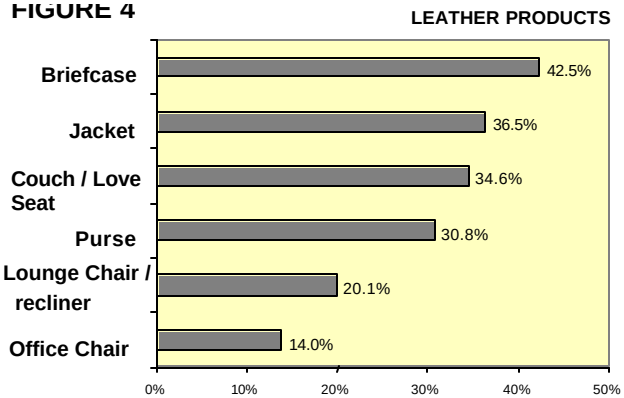
During the same era modern commerce allowed for more widespread use of what are now the most popular fatliquors (lubricants): castor oil, cod liver oil, neatsfoot oil (made from animal hooves), and whale sperm oil (now illegal in the United States and therefore not used). These new syntans and dyes, along with commonized fatliquors, allow the modern leather industry to produce softer, more supple, and more durable leather -- but with a more neutral and consistent smell within and between regions.

This neutral leather smell caused the General Motors Cadillac Division (and some foreign makers) to actually require that a manufactured "leather" aroma be added to the leather being produced for their vehicles. Cadillac's instinct deserves praise. Because all leathers had a rich, natural smell for most of our history, today's automotive consumers are probably genetically hard-wired to expect a leather aroma of some sort. Their expectation is reinforced by the many non-automotive leather products they also own, most of which are apt to contain a natural smell, or to have a "leather perfume" that was added during the leather making process (see FIGURE 4).

AUTOMOTIVE INTERIORS – A SIMILAR STORY

Automotive interiors have a similar history. Originally, they smelled more "natural" -- like wood, wool, horse hair, exhaust, oil, grease, and gasoline. Eventually, a rich "new-car smell" evolved from the out-gassing of the

FIGURE 4



Source: 1999 Garden State Tanning Seat Clinic

adhesives, paints, lubricants, fabrics, and plastics used to manufacture parts for modern interiors. That smell is now disappearing both by accident and by design.

The biggest reduction in the new car smell was the unintended and secondary result of reducing the out-fogging of the interior's components. More than 15 years ago, Mercedes rushed to isolate and replace a new (but offensive-smelling) low-cost plastic used to make dashboards for their vehicles. Mercedes was spurred to action by an article in Stern about harmful substances in their interiors, and by customer complaints about bad smells. As late as 1995, in their paper presented at the Eastern Analytical Symposium, Stanford V. Overton and John Manura showed they had detected more than 100 Volatile Organic Compounds (VOC's) in a new Lincoln Continental. Of the total, only 50 VOC's could be identified and the remainder were too weak for identification, or strong enough for identification but did not match anything previously discovered. The research team also showed that the presence and degree of specific VOC's varied with the changing interior temperature, and that the VOC's generally faded within two months.

The discovery of VOC's in unwanted concentrations (particularly as deposits on interior glass) had already spurred the domestic auto makers to reduce the fogging caused by all interior components. By 1995 their suppliers had dramatically reduced the VOC's and therefore the fogging deposits on interior glass. Unfortunately, this campaign also greatly reduced and altered the new car smell, which some experts claim was a source of memory-induced good feelings. Clearly, the consumers noticed. Consumers now say that new cars don't smell as good as they used to. Frank Marcus, Technical Director of Car and Driver, thinks that most cars have gotten "less smelly over time" (Moran, 2000).

There is a radically different parallel history here. The contrast causes the authors to wonder how the more important sense of smell was overlooked in favor of the less powerful sense of sight. During the uncontrolled evolution of interior smells, the auto industry graduated from basic black to a highly sophisticated use of colors. But the industry still remains basically dependent on the accidental smell of its interiors. A handful of exceptions have now emerged.

ENGINEERING AN INTERIOR SMELL

Not content with the accidental (albeit, lowered) new car smell, some makers are now employing specific methods to achieve a certain "niceness" for the interior smell.

Volkswagen employs a part-time panel of GE Plastics Europe employees, who have a particularly keen ability to smell. The panel's immediate objective is to remove the intensity of interior smells. Later, the group will increase the pleasance of interior parts. The panel takes its work seriously. Its members eat only bland meals before sessions and they attend meetings wearing no perfume, cologne, or makeup. In their short 15 to 30 minute meetings, panel members smell and rate all interior components and may reject parts that are too strong on a 1 to 6 scale, where "6" is strong. The panel also rates parts as smelling sweet, musty, or acidic.

At Daimler Chrysler AG, in a plant outside of Stuttgart, a "Smell Meister" works to prevent strong new car smells from being accepted in parts for new interiors. Three days a week, the Meister sniffs every part going into a new interior and can require that unpleasant odors be reworked by the supplier. After approval, parts are measured by a gas chromatograph and mass spectrometer to ensure conformance during production.

Ford Motor Company is trying a similar human/machine approach, beginning with the recent launch of the Model Year 2000 Focus. Ford's team of human evaluators sniffs all interior components, considering each one's pleasance and intensity, and then gives each a rating from 1 to 4, where a "4" is disgusting and obnoxious. For the Focus, the team approves only parts with a score of "2" or lower, and then submits the approved parts for imaging with a $75,000 eNose 4000 -- an electronic nose. The e-nose will ensure conformance in mass production. In this first effort to engineer an interior smell, Ford's objective is to prevent any one component from detracting from the overall smell of the interior.

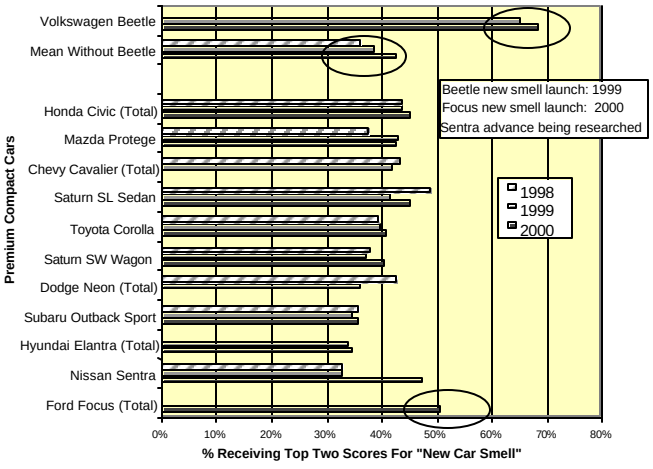
As of May of 2000 these were the only published plans or efforts by carmakers to control the smell of their vehicle interiors.

RESULTS: KUDOS TO VOLKSWAGEN AND FORD!

Results of these efforts can be found in annual APEAL studies. There, new owners are asked to rank their new car smell as either Truly Outstanding, Excellent, Very Good, Pretty Good, Average/OK, or Not Very Good. Measurement of a vehicle's individual success is the percent of respondents who give their vehicle either of the top two scores. Measurement of relative success is the comparison of that value to the mean of the niche in which the vehicle competes. Since the question has been posed in the APEAL study since 1998, and since attempts to engineer an interior smell are very recent, there are now historical data that show changes in some ratings.

VW's first engineered interior smell was in the new Beetle. For the 1999 and 2000 model years combined, 67% of respondents gave their VW Beetle one of the top two scores. This is 68% higher than the score of 40% for the remainder of the niche after the Beetle scores are removed. This difference is statistically significant and it clearly indicates a positive effect that won consumer approval (see FIGURE 5).

FIGURE 5 VW BEETLE AND FORD FOCUS: ENGINEERED SUCCESS



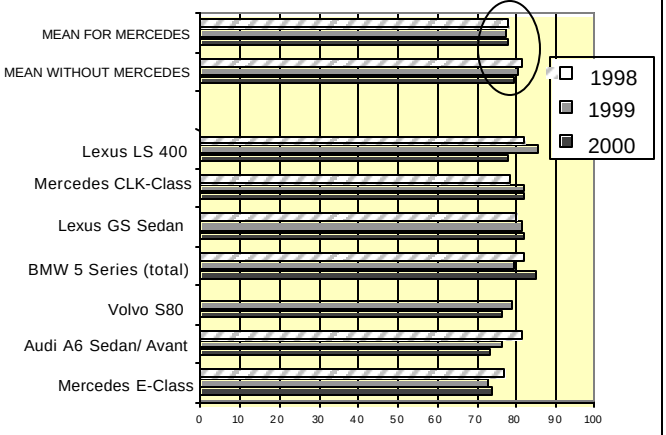
Source: J.D. Power and Associates 1998, 1999 & 2000 APEAL Studies

Actually, the VW's lead in 1999 was greater than the lead achieved in the year 2000. That's because in the second year, the niche contained the great first-year results of the new Ford Focus, which posted a rating of 51%, second only to VW in the entire niche.

Mercedes engineers believe they have eliminated the new car smell, and it shows. Their new car smell scored generally at the mean for International Luxury Cars and Near Luxury Cars in all three years (See FIGURE 6 and FIGURE 7).

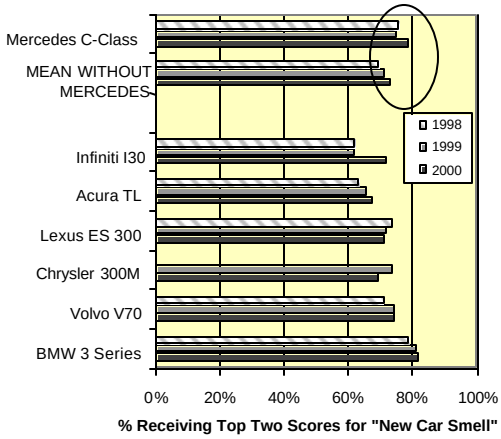
This may confirm success of their strategy to please European consumers, who reportedly don't like the new car smell, without regard to the U.S. consumers, who do.

FIGURE 6 MERCEDES SCORES AT THE MEAN FOR INTERNATIONAL LUXURY CARS



Source: J.D. Power and Associates 1998, 1999, & 2000 APEAL Studies

FIGURE 7 MERCEDES ALSO SCORES AT MEAN FOR NEAR LUXURY CARS



Source: J.D. Power and Associates 1998, 1999 & 2000 APEAL Studies

THE IMPORTANT VARIABLE: THE SIGNATURE SMELL OF LEATHER

Dr. Klaus Herrmann, who heads the Materials-Technology section of the Mercedes plant near Stuttgart, believes that "car stereo systems were perfected only after auto makers eliminated most unwanted noise" (Wessel, 2000). Put another way, when interior car sounds dropped, the value of the radio's sound became more important. In like manner, in a neutral-smelling interior, consumers will now expect to enjoy the smell of their leather upholstery. Of course, as reported earlier, in most cases there isn't a "leather smell" anymore -- there is just the smell of modern, synthetic chemistry. This presents a growing opportunity to please consumers with aroma technology that replicates the rich smells that for thousands of years came from the organic products used to manufacture leather. However, if the leather aroma is the only variable changed, results may be mixed. To evaluate this concern, we have the General Motors Cadillac aroma story.

In the early 90's General Motors asked their Cadillac leather supplier to add a fragrance to their Nuance leather. As noted, there appear to be no other actions by GM to directly affect the smell of the Cadillac interiors, although GM, Ford and Chrysler all indirectly changed their interior smell when they reduced the VOC's of the interior components -- including the leather -- to reduce fogging.

It is good to understand that by one measure, Cadillac chose a great aroma. In a recent clinic commissioned by Garden State Tanning (and conducted by J.D. Power and Associates), the Cadillac Nuance rated very high on pleasance and leather-like smell in a group of California respondents. In fact, those respondents rated the Cadillac leather three times higher than a Lexus leather that contained no manufactured leather scent.

However, in the field there's a different story. According to APEAL studies for the last three years, Cadillac achieved lower scores for their new-car smell than the Lexus imports containing the unscented leather, yet better scores than the Traditional Luxury Car niche in which Cadillac directly competes. In these results the only controlled variable was the Cadillac leather aroma. The uncontrolled variable was the VOC-lowered interiors, whose smell was less strong than before, yet still accidental.

In the last three years, 68% of Cadillac respondents scored the smell of their Deville, Eldorado, and Seville leather interiors as "Truly Outstanding" or "Excellent," whereas 82% of Lexus LS400 and GS sedans gave their leather interiors the same two scores. The Cadillac owners were less satisfied with their interiors that contained the preferred, scented leather than the Lexus owners were with their interiors that contained the non-preferred, unscented leather. By this measure, the Cadillac investment seems disappointing (see FIGURE 8).

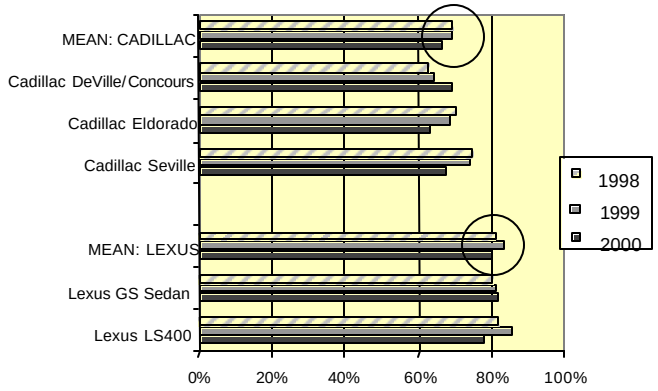
However, due to the likely "halo effect" in some niches, comparing APEAL scores for Cadillac Traditional Luxury Cars to Lexus International Luxury Cars may be unfair. But for this one case, it is interesting to note the results because they are opposite the results from comparing only the cars' leathers -- as reported in the Garden State Tanning California clinic, as mentioned above.

In its own niche the Cadillac investment produced good results. APEAL studies show that Cadillacs with leather interiors received better ratings for their new car smell than the other Traditional Luxury cars with leather interiors. In the same three years when 68% of Cadillac owners rated their new car smell in the top two categories, the niche (with Cadillac removed) posted a score of only 58% (see FIGURE 9)

These data indicate some positive result from affecting the leather smell, but a far less effect than VW's stunning

FIGURE 8

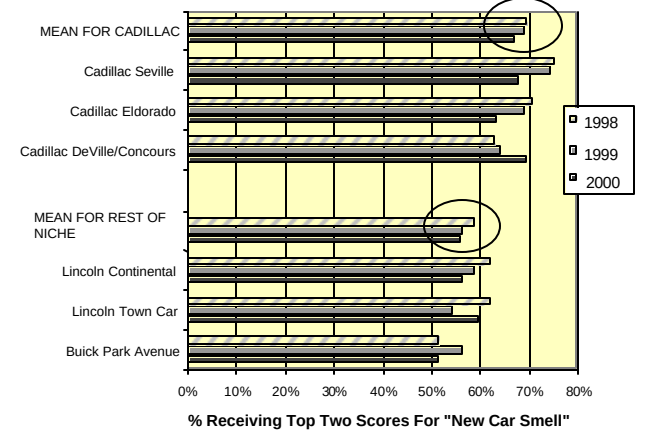
SCENTED CADILLAC INTERIORS SCORE LOWER THAN NON-SCENTED LEXUS



Source: J.D. power and Associates 1998, 1999 & 2000 APEAL Studies

FIGURE 9

CADILLAC INTERIORS GOT BETTER SCORES THAN TRADITIONAL LUXURY NICHE



Source: J.D. Power and Associates 1998, 1999 & 2000 APEAL Studies

results in their niche from controlling the smell of all interior parts.

This comparison leads to the strategy of giving the leather an aroma that best blends with the rest of the interior. No matter where any auto maker is in its control of the new car smell, it can ensure now that the added leather aroma blends with the rest of the cabin smell, even if that smell is accidental.

STRATEGY FORWARD – THE SMELL OF SUCCESS

Some specialists predict that after a neutral interior smell is achieved, specific smells will be inserted to help sell the vehicle. In fact, Textron recently announced R&D efforts towards that specific objective. Our strategy is also inspired by that vision but offers solutions for auto makers at any stage of progress (or lack of) to engineer a new car smell.

The strategy assumes that, because consumer expectation for a leather smell is both genetic and learned, it is vaguely individual. This means the expectation can be satisfied within a range of pleasant leather aromas, from the rich smell of an old Spaulding

glove to the refined smell of a new Coach purse. Data from Garden State's California clinic, reported above, reinforce this belief. While the Cadillac aroma in that clinic got much better scores than a non-scented leather, so did three other perfumed leathers. Could one of those leather aromas have worked better inside the Cadillac interiors (see FIGURE 10)?

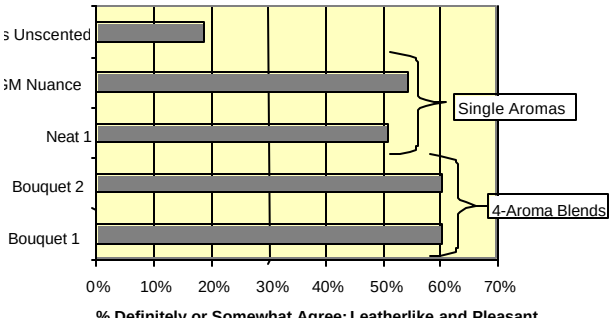
That possibility could have been tested. If Cadillac had tested various leather aromas inside of prototype interiors, they may have found a more compatible leather aroma and achieved greater consumer satisfaction. We believe in a strategy to do that. The strategy urges each OEM (or OEM brand) to pre-approve a range of leather aromas. Then, at prototype stage, the auto makers could select the two aromas that best blend with the rest of the interior -- and then test those two interior aromas in drive-arounds where consumers can rate the resulting blend along with other variables being tested. Ultimately this could mean using aroma as scientifically as we use color.

The biggest concern about being as specific with aroma as we are with color is the issue of "blend." What will consumers think if they walked into a showroom where there is more than one leather smell? (A question never asked about color.) As suggested earlier, the answer is at the mall. They'd most likely feel about the same as when we walk into a leather goods store and smell a bouquet of aromas instead of the aroma from a single product. In fact, some data from Garden State's California clinic reinforce that belief. Remember that the Cadillac aroma scored statistically better than a non-scented leather, but at parity with other, scented leathers? Two of those scented samples were in fact blends -- a bouquet from four different leather samples placed into the same container (see FIGURE 10).

CONCLUSION

Just as we differentiate and create excitement with color -- appealing to our consumers' relatively limited sense of vision -- we will achieve great results when we add aroma to their leather. The one aroma that best blends with the smell of the rest of the interior will achieve the best results. This strategy will unlock the key to our consumers' most powerful yet mysterious sense, and will generate a higher level of excitement and satisfaction.

GURE 10 **SCENTED LEATHER TRUMPS UNSCENTED & BOUQUET SCENTS TRUMP SINGLES**



REFERENCES

Adams, C. (1999, May 28). What Exactly Causes "New Car Smell?" The Chicago Reader (@ thestraightdope.com

Axel, R. (1995, October). The Molecular Logic of Smell. Scientific American, pp. 154-159.

Baron, R. and Kalsher, M. (1998, July). Effects of a Pleasant Ambient Fragrance On Simulated Driving Performance – The sweet smell of safety? Environment and Behavior, 30, pp. 535-552.

Garden State Tanning. (1999, February). Garden State Tanning Leather Seat Research Clinic – U.S,

Herman, S. (1992, August). The Art and Science of Fragrance. Chemtech, 9, pp. 458-462

Herman, S. (1997, February). The Effect of Age on Olfaction. Cosmetics & Toiletries Magazine, pp.79-82.

J.D. Power and Associates. (1998, October). 1998 Seat Quality Report. Used with permission

J.D. Power and Associates. (1999, October). 1999 Seat Quality Report. Used with permission.

J.D. Power and Associates. (2000, October). 2000 Seat Quality Report. Used with permission

Jellinek, S. (1994, October). Aroma-Chology, A Status Review. Cosmetics & Toiletries Magazine, pp.83-101.

Kachadourian, G. (2000, September 25). Textron Plan Would Turn Auto Scent Into Dollars. Crain's Detroit Business, pp. 30.

Moran, T. (2000, May 14) , The Mysterious Human Sense of Smell , So Primitive and So Powerful. The New York Times, pp. 40.

Moran, T. (2000, May 14). Sniffing Car Parts: Yes, the Job Stinks. The New York Times, pp. 40.

Moran, T. (2000, May 14). , Ah, the Aroma of a Just-Baked Sedan. The New York Times, pp. 40.

Overton, S. and Manura, J. (1995, September). Identification of Volatile Organic Compounds in a New Automobile
http://www.sisweb.com/reference/applnote/app-36-a.htm

Picard, C. (2000, August) Pleasing The Senses. Power Report, pp. 1.

Place, J. (2000, March). Personal Fragrance. Soap and Cosmetics, pp. 26.

Thorftensen, T.C., & Krieger, R.E. (1985). Practical Leather Technology, 3rd Edition. Malibar, Florida, Krieger.

Wessel, D. (2000, April 13). The Nose Knows When Something is Rotten in a Mercedes. The Wall Street Journal.

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