Fragrance Perception: Is Everything Relative?

Recent research presents a leap towards a consensus in fragrance mapping

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There are many fragrance lovers—this author included—who focus on the essential truth of perfume, caring little that it "smells different" on everyone. Such fragrance lovers are annoyed by the cult of subjectivity suggesting that a scent may actually smell different to Jim than it does to Jane. For such people, a recent paper by Manuel Zarzo and David Stanton reveals good news: Everything is not relative.[1] Perhaps a rose is a rose is a rose is a rose.

Driven by a desire to better understand the relationships among odor descriptors most frequently used in perfumery, the scientists published a landmark study of fragrance perception. Their conclusions: A standard map of odor descriptors is possible; perfume materials can be presented nicely in two-dimensional space. Despite minor discrepancies, historical and contemporary sensory maps of scent descriptors display a remarkable accord. There is a consistent basis for perfume perception and description despite variations in the way individuals experience scent.

Meaningful Odor Maps—What and Why

The target of Zarzo and Stanton's work was the development of a sensory map with the odor descriptors most commonly used in perfumery. In this type of map, proximity indicates that odors are similar, while distance reflects dissimilarity. The approach to mapmaking may be numeric, with study groups rating attributes of smell on a scale, or semantic, using words that come to mind when smelling a substance. Compilations and analysis of odor profiles form the basis of the sensory maps. Map terminology varies and may, for example:

- Display odor descriptors (floral, balsamic, waxy, fruity);
- Refer to perfume materials according to their common names (vanilla, cedar, bergamot, jasmine);
- Describe sensory perceptions (bitter, sweet, soft);
- Convey the physiological and psychological effects of odors on humans (calming, exciting, exhilarating).

Sensory representations of smell and attempts to define what Zarzo and Stanton call "odor descriptor space" abound in perfume literature, and few have escaped their notice.[5-11] The gap, in their view, has been a reconciliation of the sources. Their response: An energetic attempt to move perfumers toward a standard sensory map for representing those odor descriptors most frequently used in perfumery.

Why bother to plot perfume smells in space? Zarzo and Stanton explain that perceptual maps of odor descriptors "clarify consumer preference, aid in the description of complex mixtures of odorants, enable training of sensory panels, provide certain standards of communication

Author's Lens

In my work as a fragrance coach, I bring the language of scent to the service of consumers overwhelmed by the cluttered fragrance marketplace. Without a practical vocabulary, how can shoppers find the perfect scent, one that will bring them exquisite pleasure? I make recommendations based on individual taste, style, the mood a client is in (or would like to be in), and the fragrance classification scheme developed by Michael Edwards and represented in his Fragrance Wheel.[2]

Fragrance matchmaking is my cover. In reality, I am one of those olfactory theorists who would rather think and talk about perfume than smell it. Manuel Zarzo and David Stanton's fragrance research is rife with linguistic delicacies.[1] I have snacked shamelessly on them, wantonly ignoring the coefficients of correlation and trichotomic matrices that surely reflect the authors' finest scholarship.

This impressionistic review will compensate for missing statistics by serving up anecdotal insights. Here is a tidbit typical of the insights captured by Zarzo and Stanton: While lavender resembles rosemary and mint—think of them as camphoraceous cousins—anise, according to some smell experts, stands in a class by itself.[3,4] Licorice is a loner, it seems. While Zarzo and Stanton attend to the description of a grand olfactory landscape, some of us are mesmerized by the qualities of a few special plants in the garden.

What is green, spicy, metallic, dusty or fresh? The prospects of an accurate odor map hinge on definitive answers to questions like these.

among perfumers, assist in perfume classification, and allow better communication among perfume retailers and consumers." [1,12]

Certainly the marketplace for commercial scent is characterized by ignorance, both on the part of sellers and buyers. Despite the increasing availability of information about notes and fragrance families, marketers default to images of beautiful people, and sales clerks to the reassurance that a bottle is "new," "popular" or "my favorite." Yikes! The *clerk's* favorite? This detail about the seller's taste is about as valuable as her shoe size.

My experience in the retail environment has shown that fragrance shoppers are very responsive to suggestions based on their own olfactory preferences. The retailer's discovery of shopper preferences is essential to intelligent product recommendations: "If you like a, b and c, you may also enjoy x, y or z." A directory or software application listing fragrances by family is useful. So, too, are the basic language of scent and a conceptual map of fragrance families and their unique characteristics.

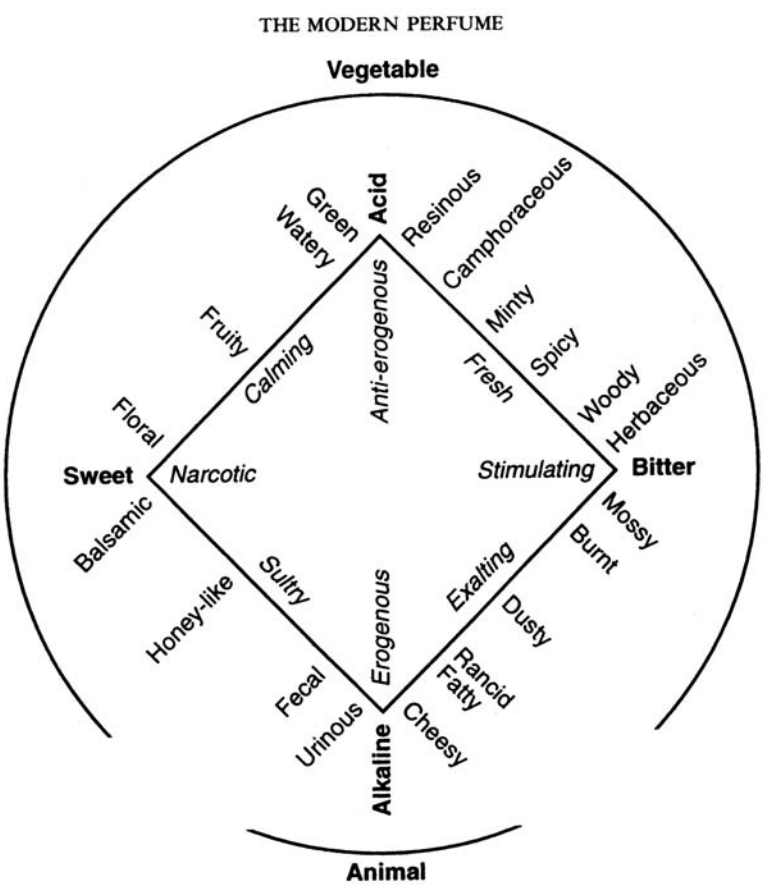
Existing Fragrance Classification Systems

In the quest for accurate low dimensional perceptual fragrance maps, Zarzo and Stanton analyzed two odor databases of perfume materials using a multivariate statistical method called principal components analysis (PCA). Then they compared the results of PCA with the odor map of Joseph Stephan Jellinek (son of perfumer Paul Jellinek), as well as with Michael Edwards' classification system as represented by his Fragrance Wheel. Following some legitimate tweaking to overcome current obstacles to perfect correlation, the authors found a reasonable match among all sources. Eventual creation of a standard map would require consensus about which odorants best reflect specific odor qualities—in other words, identification of substances to serve as the single best references for "floral," "balsamic" and so on.

The Boelens-Haring database contains 309 compounds assessed through numeric ranking by six perfumers against 30 reference materials.[13] Zarzo and Stanton analyzed this database and compared the results to semantic odor descriptors of 820 commercial scents contained in the *H&R Fragrance Guide*.[14] They also studied M. Thiboud's database containing semantic odor profiles of 119 perfume materials (44 natural and 75 synthetic).[5] Rigorous statistical analysis including correlation coefficients, eigenvalues, loadings, "r_{max}'s" and "r_{min}'s" yielded tables, and scatter diagrams that the scientists then compared and contrasted with Paul Jellinek's Odor Effects Diagram (**F-1**).* Paul Jellinek's diagram is a map of scent based on two axes terminating at opposite poles: erogenous versus anti-erogenous (refreshing) and narcotic versus stimulating—four key effects.[7,8]

Informed by his substantial experience as a perfumer, Paul Jellinek wrote about the science underlying perfumery. His intent was to help those who create fragrance and sell it to understand its physiological and emotional effects. His

Odor Effects Diagram proposed by Paul Jellinek (1951) **F-1**



*The original Odor Effects Diagram was published in German, and later modified by Joseph Stephan Jellinek in collaboration with Robert Calkin; P Jellinek, The psychological basis of perfumery. In: *The Psychological Basis of Perfumery, 4th ed.* JS Jellinek, ed, Chapman & Hall, London (1997) 1–162; reprinted with kind permission from Springer Science and Business Media.

book, *The Psychological Basis of Perfumery*, covers such topics as the erotic effects of perfume materials, perfume materials reminiscent of human body odor, perfume and personality, and the masculine and feminine aspects of perfume materials.[7]

The Odor Effects Diagram, first published in 1951, instructs perfumers in the choice of perfume materials and combinations to achieve or modify specific psychological impacts of a scent. Beyond the four key effects, Paul Jellinek presents hybrids: narcotic plus anti-erogenous is calming; anti-erogenous plus stimulating is fresh; stimulating plus erogenous is exalting; erogenous plus narcotic is sultry. Jellinek's views were occasionally quirky. He felt that a woman should choose fragrance based on her nature, be she more "mother" or "mistress," her tendency towards naiveté vs. artfulness, and her hair color, even if that came from a bottle. More conventional was the advice for women to suit up with scent according to age and destination, whether office, home, sports or society.

Having allowed that some settings are less conducive to perfume-fueled seduction than others, Jellinek identified attraction of the opposite sex as the single overriding motive for perfume use by women. "Preference patterns in fragrance may change with the fashions but among the benefits the public expects from perfumes the strongest possible stimulation of the imagination in the erotic sense will always rank first." What's good for the goose is not always good for the gander. Jellinek stated that erogenous smells should be avoided completely in men's fragrances. To woo with perfume, in his opinion, was decidedly un-manly.

Joseph Stephan Jellinek is an ardent student of his father's work. He is also a research, development and marketing professional in the perfume, food and cosmetics industries. In the preface to the fourth edition of his father's book, he praised the bold theory and logical coherence of the original text, noting that the Odor Effects Diagram was as useful 50 years later as when first developed.[8] At the same time, the younger Jellinek recognized that approaches to psychology today are more empirical than the deductive approaches of his father's day. As editor of the 1997 update, Joseph Stephan graciously acknowledged anachronisms and added new insights to the original text. The fourth edition added chapters on the chemistry of body odors, effects of odor on human experience and behavior, human pheromones, and motivations for perfume choice.

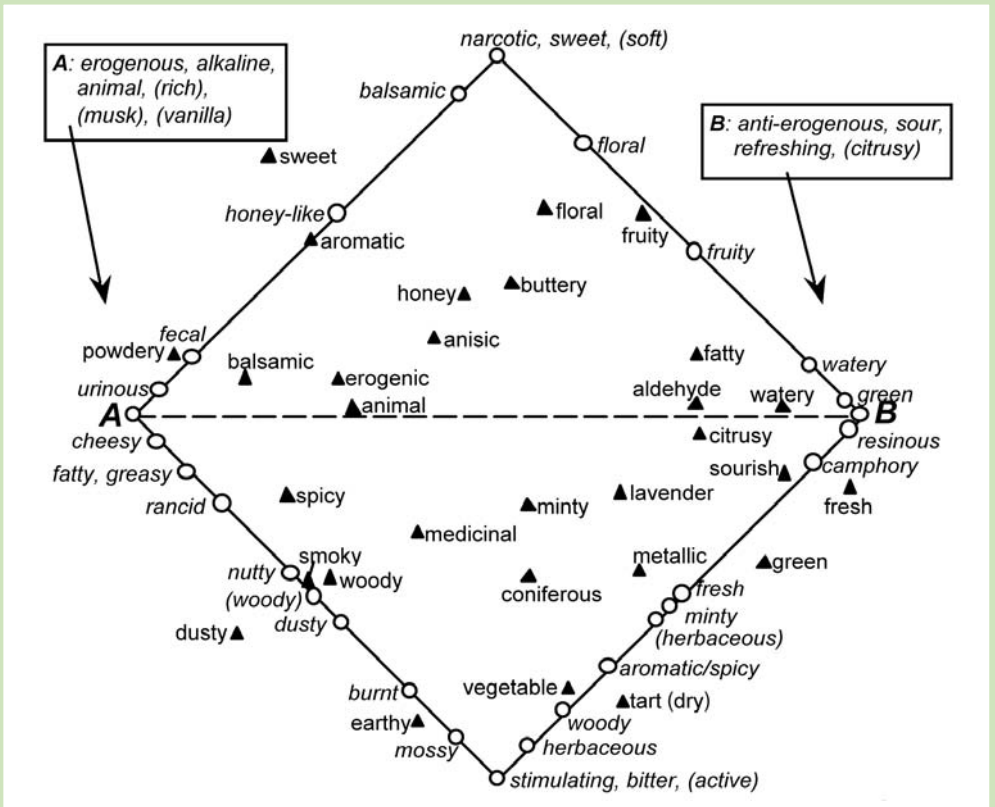
Consistency among Classification Systems

F-2 contains an overlay of the two-dimensional sensory map of odor descriptors developed by Zarzo and Stanton from the analysis of the Boelens-Haring database (triangles in the figure) and the Odor Effects Diagram proposed by Paul Jellinek (1951) (odor descriptors in italics next to white circles). Descriptors within parentheses correspond to the simplified diagram proposed by Calkin and Joseph Stephen Jellinek (1994).[1,8,9]

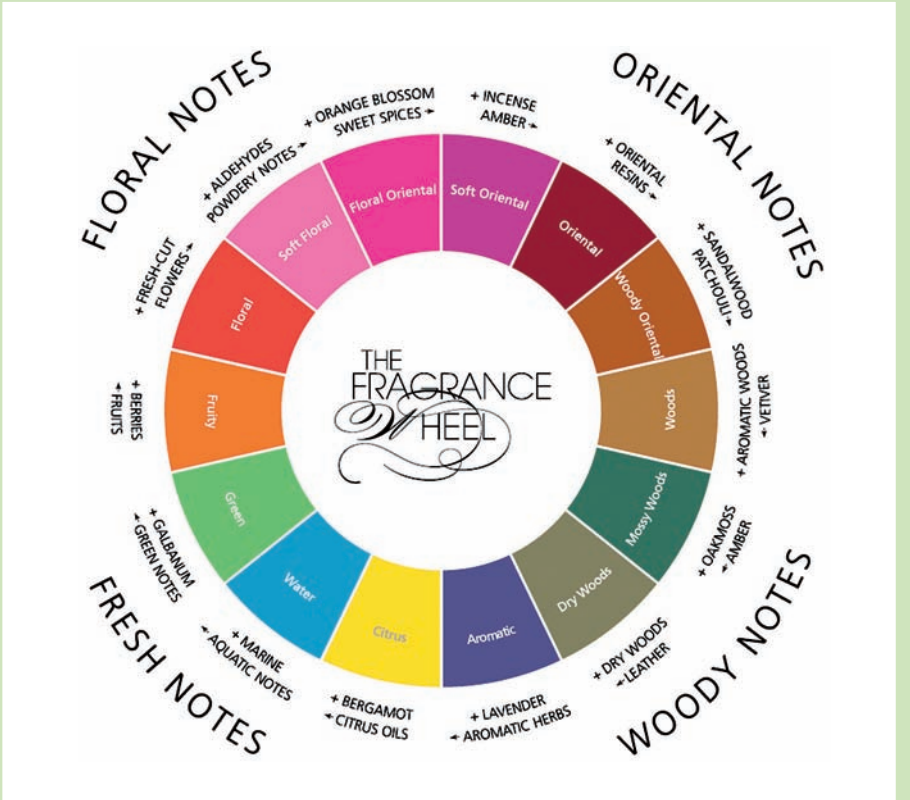
Zarzo and Stanton demonstrated consistency between the Odor Effects Diagram and the odor mapping derived from statistical analysis of two odor profile databases, noting "strikingly similar" positions of descriptors among sources. The scientists then moved to the final phase of their trailblazing olfactory mission, a merger of all findings with Michael Edwards' fragrance classification scheme, which they cite as one of the world's most

An overlay of the two-dimensional sensory map of odor descriptors developed by Zarzo and Stanton from the analysis of the Boelens-Haring database (triangles in the figure) and the Odor Effects Diagram proposed by Paul Jellinek (1951) (odor descriptors in italics next to white circles); descriptors within parentheses correspond to the simplified diagram proposed by Calkin and Joseph Stephen Jellinek (1994)[1,8,9]

F-2



The Fragrance Wheel (copyright 1992–2009, Michael Edwards) as it will appear in the 2010 edition of *Fragrances of the World* **F-3**



comprehensive references for commercial fragrances, simplifying the classification process and showing relationships among fragrance families.

Michael Edwards launched *Fragrances of the World* in 1984. The initial guide was intended for retailers and contained 323 fragrances. Since the inception of the guide, Edwards and his team have personally tested each fragrance and cross-checked the assignment to families with the perfumers and evaluators. The classification is independent and impartial; Edwards accepts no fees or advertising in exchange for fragrance listings.

Today, *Fragrances of the World* has grown to contain more than 6,500 niche, masstige, mass-market and direct sale fragrances cross-referenced by fragrance family, gender, brand and year of launch. Within each of 14 sub-families of the floral, oriental, woody and fresh families, each fragrance is further classified as fresh, crisp, classic or rich. Edwards provides additional breakdowns of select fragrance sub-families based on specific notes and accords.

The database underlying *Fragrances of the World* also drives "The Fragrance Finder," Edwards' interactive Web application for consumers and retailers such as Nordstrom and Sephora.* Automated, interactive search is becoming ever-more sophisticated, allowing for search by olfactory note in addition to inquiries by fragrance name, brand, fragrance family and gender.

Zarzo and Stanton's odor mapping analysis culminated with scientific reinforcement of Edwards' classification system and Fragrance Wheel. In the course of their study, they suggested rearrangement of the fruity sub-family between floral and green from its previous location between green and citrus. They also suggested, from a perceptual standpoint, that aromatic/fougère scents should be located between dry woods and citrus on the rim of the wheel. Edwards concurs with this suggestion and plans to publish the modified wheel in his introduction to the 2010 edition of *Fragrances of the World*. This version, reflected in **F-3**, is the representation of aromatic/fougères Edwards has historically used with perfumers.

Still, placement at the hub of the wheel effectively portrays this universal masculine family—comprising a full third of men's commercial fragrances—to retailers and consumers. The aromatic/fougères, which Edwards describes as "a stew consisting of floral notes of lavender, sweet, spice floral oriental nuances, oriental ambery accents, chypre touches and citrus/green freshness," will continue to appear in the center of the wheel as an illustration within the aromatic/fougère section of *Fragrances of the World*.

Smells Like …

Specific, vivid articulation of similarities and differences among odor descriptors is an enjoyable byproduct of Zarzo and Stanton's literature review and analysis. As they reconciled various perfumery databases and odor maps, associations among odor descriptors for neighboring smells on the odor map emerged, including:

- Smoky - burnt - birch tar - toasted - leather
- Camphoraceous - pine - lavender - mint - conifer - rosemary
- Herbaceous - chamomile - lavender - rosemary - sage - clary sage
- Resinous - olibanum - gum from trees - conifer
- Earthy - dust - moss - forest - soil - mold - must - roots - yeast - mushrooms
- Sweet - balsam - vanilla - heliotropin - honey - syrup

These word groupings enable us to forge connections between perception and language. While they may be well-known to diligent students of perfumery, other readers will relish new connections.

*See:
- *http://shop.nordstrom.com/C/6021050/0~2377897~2377898~6021050?mediumthumbnail=Y&origin=leftnav&pbo=2377897*
- *http://shop.nordstrom.com/C/6021051/0~2377897~2377898~6021051?mediumthumbnail=Y&origin=leftnav&pbo=2377897*
- *http://www.sephora.com/browse/section.jhtml?categoryId=B23*

Percentage of fragrances (women's, men's and unisex) listed under the 14 categories of Edwards' guide;[2] seven of the categories (as well as "fresh") are odor descriptors commonly applied in perfumery; the frequency of occurrence of these descriptors in the *H&R Fragrance Guide* is also indicated **T-1**

	Percentage of fragrances by gender[a]			Frequency of occurrence, by gender, of descriptors used by the *H&R Fragrance Guide*[b]					
				Top notes		Middle notes		Base notes	
Category	$\%_{women's}$	$\%_{men's}$	$\%_{unisex}$	$\%_{women's}$	$\%_{men's}$	$\%_{women's}$	$\%_{men's}$	$\%_{women's}$	$\%_{men's}$
Floral	41.8	1.0	8.0	18.5	0.5	96.0	67.0	10.4	0.0
Soft floral	10.2	0.6	4.2						
Floral oriental	15.4	0.1	1.1						
Soft oriental	2.8	1.0	3.5						
Oriental	4.2	0.9	5.6	0.0	0.0	0.0	0.0	0.7	0.0
Woody oriental	10.2	21.0	11.8						
Woods	2.1	15.3	11.5	0.0	0.8	5.5	38.4	34.2	40.9
Mossy woods	5.1	4.1	2.7						
Dry woods	1.4	9.1	7.8						
Aromatic/fougère	0.2	33.3	3.8						
Citrus	4.2	8.0	30.4	3.5	11.2	0.0	0.0	0.0	0.0
Water/marine	1.0	4.7	3.8	0.0	0.0	0.2	0.0	0.0	0.0
Green	1.0	0.9	5.3	34.2	23.2	5.3	3.0	0.2	0.0
Fruity	0.6	0.0	0.5	32.5	1.1	4.6	0.8	0.7	0.0
Total	**100.0**	**100.0**	**100.0**						
Fresh[c]	6.8	13.6	40.0	52.1	92.6	2.9	13.6	0.2	1.9

[a] Based on 5,730 fragrances (3,463 women's, 1,717 men's and 550 unisex) contained in the 2008 edition of Edwards' guide.

[b] Percentage of times categories on this chart are used as descriptors of top, middle and base notes of the 820 commercial fragrances (453 womens' and 367 men's) contained in the *H&R Fragrance Guide*, by fragrance gender.

[c] Fresh = citrus + water + green + fruity, according to Edward's guide.

His and Hers

Zarzo and Stanton's work helps clarify the odor characteristics typical of fragrances identified by gender. They observe the distribution of men's, women's and unisex fragrances over fragrance categories—Edwards' 14 subfamilies—as well as the frequency with which odor descriptors are used to describe top, middle and base notes of men's and women's commercial fragrances.[2,14]

T-1, reflecting these observations, was extracted from Tables 6, 7 and 8 of Zarzo and Stanton.[1] Based on these data, the authors concluded that floral is clearly a feminine category—42% of women's fragrances in Edwards' guide are classified as floral, and just 1% of men's fragrances. Moreover, the middle note of 96% of the 453 women's perfumes contained in the *H&R Fragrance Guide* is described as floral, while the floral descriptor is applied to describe the middle note of 67% of men's fragrances.

Another stark gender-based distinction appears in the woody family, with 15% of men's fragrances showing up in this category, compared to 2% of women's fragrances. Middle notes display an even more dramatic skewing of woodiness towards men, with 38% of men's scents described as having a woody heart, compared to 6% of women's scents.

Fresh scents, an aggregate category based on Edwards' citrus, water, green and fruity families, are twice as likely to be men's scents than women's; 14% of masculine fragrances appear in the category vs. 7% of feminine fragrances. Top notes of men's scents are characterized as fresh in 93% of cases, while only 52% of women's fragrances have top notes identified as fresh. Likewise, fresh middle notes characterize 14% of men's fragrances, but only 3% of women's.

Water/marine scents tend to be masculine, with 5% of men's scents falling in this category vs. 1% of women's. Only one perfume out of the 820 contained in the *H&R Guide* presented a watery note. This seems low compared to the proportion of watery fragrances in Edwards' guide, and surely reflects evolution of aquatics during the 17 years that have elapsed between publication of the two sources.

Certain odor characteristics are obviously more prevalent in scents geared toward a single sex. Zarzo and Stanton draw a boundary line between masculine and feminine odor descriptors as a horizontal axis between points A and B in F-2. Exotic blossom notes, sweet, sensual and warm scents are generally considered to be feminine, while masculine scents tend to be dry—the

term "dry" in this context indicating non-sweet rather than powdery—and fresh, featuring leather, tobacco, herbs, spices, mosses and woods.[15]

While some scents seem clearly masculine or feminine, others sit closer to the boundary between masculinity and femininity. "Citrus" is considered by many smell authorities to be a masculine descriptor. Data in T-1 support this association. Nevertheless, citrus appears in F-2 on the border with feminine descriptors (dashed line); interestingly, more than one-third of those fragrances marketed to both men and women are classified as citrus—this category swings both ways. Meanwhile, about 1% of both women's and men's scents fall into the green category, another gender-ambiguous scent family.

As a global category, woody scents (woods, dry woods, mossy woods and aromatic/fougère subfamilies in Edwards' scheme) are predominantly masculine. The mossy woods fragrance category (chypre), however, is a gender bender (T-1), breaking stride with the other woody subfamilies. As a chypre lover and fan of the original *Ma Griffe* by Carven, *Y* by Yves Saint Laurent and *Femme* by Rochas, I know that a woman can fall hard for oakmoss. In my case, the love of moss may be genetic. Then again, perhaps it is a Skinnerian response to happy adolescent capers in the New England woods.

Ever the devil's advocate, I have challenged the scientific basis for assignment of gender to scent. What, I wonder, is the role of culture over genetic determination of perception and preference? Islamic and Pacific cultures, according to Paul Jellinek, don't even distinguish between men's and women's scents.[8]

If a man enjoys a "feminine" scent on a woman, does this make the wearer or the male admirer more feminine? Perhaps this is an unfair question, since the man may find the scent pleasant, but would refuse to wear it himself. "Smells good on *you*," he might say. The whole issue remains bothersome. Isn't there something circular and faintly fishy about the logic that calls floral smells feminine simply because most floral scents on the market are promoted to women?

Manuel Zarzo wrote the following to dispel my concern: "In my opinion, there is an increasing body of evidence about the perception of scents as masculine or feminine. The key issue seems to be that sweet scents are basically perceived as feminine, while those not sweet are men's. Calling a scent 'sweet' is a cross-modal association between taste and smell, because the term obviously refers to the description of taste. There are different

studies supporting the establishment of this cross-modal association. Classification of scents as masculine or feminine is not simply an arbitrary marketing artifact."

My conclusion: Despite the surge in "shared" scents (the trendy new term for unisex), there is no need to get tied in a knot over perfume gender politics, nor to bury conventional wisdom completely. Sometimes in life it is fine simply to ride the horse in the direction it is going. Do perfumes have a sex? Probably.

Nursing the Nasal Nuances

Just as Eskimos have words that specifically distinguish various types and intensities of snow—fallen snow, fall*ing* snow, blizzards, flurries, drifts, frosty and sparkly varieties, and sleet—Zarzo and Stanton articulate the field they call odor perception space with exquisite detail. While pioneers in the quest for the ultimate sensory map employing the odor descriptors most commonly used in perfumery, they freely admit to challenges with its development. Foremost is the absence of agreement among perfumers on the substances that exemplify specific odors.[11] Patchouli, for example, is considered fundamentally dusty by some and the quintessence of earthiness by others.[10,13]

Green scents often contain pine, dried herbs such as sage and rosemary, grasses, leaves, lavender, basil, and chamomile. Edwards identifies galbanum as the material best representing green smells, while the Boelens-Haring database calls this resin the reference for tart, dry smells.[2,13] To best describe green, should one refer to phenyl acetaldehyde dimethyl acetal or to methyl heptine carbonate? Smell cartographers do not hold the greenness of cut grass, with its dry qualities, in the same category as that of violet leaf. Though most leaves smell green, violet leaf has a relatively floral aspect.[5] When does an otherwise green-smelling odorant become too flowery for consideration as the perfect reference for "green?"

Is the eugenol in clove the best embodiment of spicy? Yes, according to Boelens and Haring.[13] Paul Jellinek chooses safrole, instead, as a typical spicy/aromatic scent.[7] In yet another variation on the spicy theme, H. Zwaardemaker classifies eugenol as aromatic/spicy, and safrole as aromatic/aniseed.[16] (Are you getting this? Have you taken a side yet?)

Zarzo and Stanton observe, according to the Boelens-Haring database, that safrole's herbaceous, anisic qualities are more prominent than any spicy warmth. This would explain the distance between positions of "spicy" and "aromatic/spicy" in F-2. The reference materials for these descriptors clearly smell different. Meanwhile, Paul Jellinek's "aromatic" qualifier seems to add more heat than light to the discussion. In the Boelens-Haring database, vanillin, a sweet odorant, was the reference for "aromatic," but this term, stemming from "aroma," seems to suggest that one is simply dealing with any pleasant smell. Aromatic is one of the least helpful smell descriptors on the planet.

Certainly, "fresh" is the chief mischief-maker among smell descriptors.[5,9,15] Zarzo and Stanton note that Thiboud's database of semantic odor profiles reflects the descriptor "fresh" as the most common among the 85 odor descriptors it contains. Fresh appears as a primary or secondary attribute of 54% of odorant materials in the database.[5] In Edwards' scheme, fresh is a family that comprises water, green, citrus and fruity sub-families. My clients in the general public use the term "fresh" with shocking liberality, often as another way of saying "a smell I like." That oriental is fresh? I bite my tongue.

Then, too, one must think about clothes just washed, a load bouncing out of the dryer. The musk that everyone has come to expect in laundry products is probably an ideal olfactory mask for the harsh, synthetic aspect of the products' fresh-smelling odorants or less pleasantly scented active ingredients. The musky note in detergents, softeners and dryer sheets is so common that one associates it directly with freshness. This is the height of irony: Before today's synthetic imitations, musk was harvested from a gland perilously close to the anus of a small deer.

Sci-fi Scent: Works Better on Paper

It is intriguing to consider taking a two-dimensional map of perfume materials to its theoretical extreme. If each scent map points to one and only one point on a flat grid—a private address that smell can call home—we may wonder if the converse holds true: Would the x-y coordinates on this map conceivably predict every scent in the universe? The answer is no. In the two-dimensional odor map developed by Zarzo and Stanton from the Boelens-Haring database, the plot explains only about 33% of total

data variability.[1] Thus, two similar but distinct odors may be located on the same point in the map.

Those envisioning the next generation of computerized scent generation applications should not adopt the fantasy I briefly entertained while awaiting correction by Zarzo and Stanton. It seems so easy to mix colors in my favorite graphics software simply by adjusting the relative contributions of red, blue and green. Alas, mixing smells from diagrams, even heavily commented ones, will not necessarily work.

We humans have about 350 olfactory receptors, compared to the three types of receptors for vision. As Zarzo explains in his review of the molecular basis for odor recognition, a combinatorial coding scheme allows humans to discriminate among thousands of distinct odor molecules with just a few hundred odor receptors.[17] Multiple receptors may respond to a single odorant and a single receptor may respond to multiple odorants.[18] Engineering odors for humans is much more complex than Paintbox games on a PC.

Conclusion: Closer, but Still No Cigar

What is green, spicy, metallic, dusty or fresh? The prospects of an accurate odor map hinge on definitive answers to questions like these. Zarzo and Stanton articulate the fine points as they seek a standard perceptual representation of scents in two dimensions. The rest of us, meanwhile, maintain blissful oblivion to such issues in our day jobs on the fringes of smell science. Despite thorny topics mentioned by the scientists, their success in aligning sensory odor maps from different sources is impressive.

As the impatient type, one bored with talk of how unique we all are, how perception is subjective and we don't really know much about anything—I was frankly exalted by Zarzo and Stanton's statement that the "perception of a given odorous material is basically the same for all people if the odor is perceived under a similar context and concentration." A rose is, once again, a rose. Thus, my giddy conclusion: Everything is not relative.

While basically true, and a nice finish to this story, the conclusion is premature. Perfumery's plot is thicker than this. Try as one might to categorize them, odor materials stubbornly resist a happily-ever-after ending. Seekers of perfume truth must, alas, contend with some complications.

Zarzo has published an extensive review of odor recognition theory and research findings including molecular weak-shapes and vibration, metalloproteins, chromatography, enzymes, amino acid residues, and other topics that only a smell scientist—or his or her mother—could love.[17] The perfume industry might, however, take an interest in olfactory receptor variability and the knowledge that each human nose has its own olfactory "bar code" with unique thresholds and sensitivities. Two people exposed to the same odorant may, indeed, have a different perception.[19,20]

It turns out that those 350 olfactory receptors (plus or minus) that humans have presumed to come standard in fact aren't standard at all. Zarzo cites a 2006 study revealing that 10% of human odor receptor genes are not functional in all humans.[21] The human olfactory receptor genome is degenerating fast, perhaps due to a diminished survival need for smell and increased evolutionary reliance on sight and sound.[17,22] Approximately 50% of human olfactory receptor genes are considered pseudogenes and do not encode functional olfactory receptor proteins. In layman's terms, these are pieces of our genome that don't do anything anymore—a sensorial appendix or tailbone.

It is now understood why humans vary in general olfactory thresholds and sensitivities. At least 90% of what we perceive when smelling odors is more or less the same for everybody. Still, there's that other 10% to wonder about. A closer look reveals that humans' sense of smell reflects some of the greatest biological diversity in the genome.[23] The harder one searches for olfactory certainty, the faster everything falls apart.

The absence of objective metrics for scent—metrics that are universal, unambiguous and do not rely on aggregation of opinions gathered from panels of humans—presents yet another difficulty in nailing the details of odor descriptors and perception to the wall. Stanton explains: "Our five senses do not cooperate equally well with scientific measurement. The frequency of light neatly describes color. Temperature is a perfect metric to convey the warmth or coolness of a surface. By contrast, smells and tastes resist capture by scientific instruments. Odor description forces us to translate perception into words—words tainted by biases of experience, culture, biology and gender." That old relativity excuse again.

The research discussed here began with a bold objective—to find the best possible sensory representation of perfume odor descriptors in two dimensions. Progress was great, odor maps cross-referenced and refined. Peer-review and substantiation of what olfactory cartographers have independently suspected for a long time were discussed in fine detail. There were pleasant side trips into smell terminology and stimulating conversation about perfume gender and sex appeal.

As for finding final answers? Unfortunately, all is not cut and dried in odor descriptor space. Variations in our individual bodies, absence of agreement on reference materials for odor types, lack of unambiguous scientific metrics and reliance on language to represent one's perceptions continually confound. Smell under scrutiny refuses to divulge indisputable truth. Still, one smells on and enjoys the quest.

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