

# Practical Perfumery

## The Grammar of Perfumery

Making fragrance development more effective by simplifying and clarifying the language of perfumery

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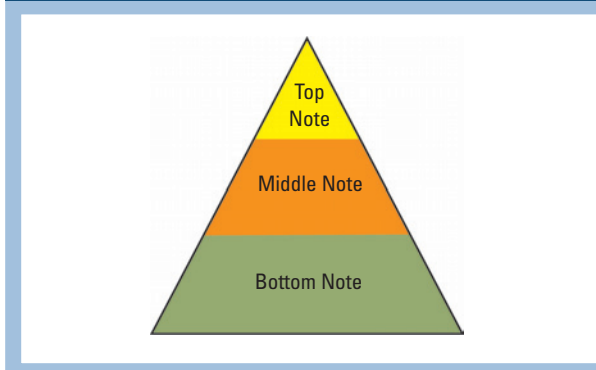
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The topic of how to structure a perfume is not often covered in literature, and so for many it seems an ill-defined process full of randomly chosen materials and proportions. The evaporation triangle (F-1), commonly used to describe the evaporation of perfumes, is the oldest and most accepted representation of a perfume's composition. Its genius is in its simplicity, which is why almost every perfumer, perfume marketer and advertiser uses it. However, if using it for more than the most basic of descriptions, its simplicity becomes a weakness. This is demonstrated in one of the most common questions posed by students: "What should the ratios of the top, middle and bottom notes be?" This is similar to asking a painter how much sky, foreground and background a painting should have. The answer to both has to be a returned question relating to the intention or purpose of the perfume or painting. In quantifying the ratios of top, middle and bottom notes we are merely describing the balance of the three stages. This does not tell us *why* the materials are there, just the position they occupy in the timeline of the evaporation of the perfume.

There are, arguably, as many different ways to compose a perfume as there are perfumers. Each perfumer learns his craft and adapts his or her technique to their environment, availability of materials, experience and field of interest, etc. Within a teaching framework to order to explain the procedure, it is appropriate to systematize the intellectual process so that the method becomes capable of being followed through in logical and reproducible steps. The following technique aims to do this.

Inspiration for perfumes may come in a eureka-like flash, but in the commercial world there are deadlines for submissions and raw material and stability constraints to consider. Time is often not on the perfumer's side, and so creativity must be readily available on demand. The majority of a perfumer's work is in response to a brief or an enquiry from a customer for a particular perfume. The written or verbal enquiry may be in the form of a series of descriptors, a concept or a list of parameters that must be met. Even if the enquiry is a series of vague concepts, it must be translated into written form for all practical purposes. The procedure presented in this article revolves around this concept

Figure 1. The evaporation triangle



and is based on the simple principle that if a question is posed adequately and precisely enough it will already contain the elements of the answer.

The language used for this methodology is English, but the grammar and definitions are used with poetic license for appreciation by perfumers, not grammarians. The principles could be easily translated into other languages.

### A Composition

By definition a composition is the act of creating by arranging several things to form a unified whole. In writing terms, a composition could be any style of

writing — a technical description, a factual account or any type of fiction. If this were an ideal account of perfume it would not just include the smell characteristics, but would also include the feeling it evokes and the message to be conveyed. In this analogy with perfumery the composition is the completed perfume project, as if it already exists. When a consumer uses a perfumed product, not only does the perfume impart a smell, but the smell in turn conveys a message about the product itself. For example, a perfume in a shampoo is normally intended to reinforce the idea that the shampoo is cleansing and caring for the hair, while making the user feel good about the product and branding. Let's look at the building blocks of the composition and how they relate as an analogy to perfumery.

Letters — the elementary characters of the alphabet used to represent speech in written language: These are the indivisible or prime elements of written language that can be mixed and matched to form words. The idea that there might be prime smells in the language of odor is perhaps the "Holy Grail" of perfumery, which for now will have to depend on an experiential approach until the mechanism of olfaction has been finalized. An earlier article, "Training the ABCs of Perfumery," used the classification concept of prime smell groups being represented by letters of the English alphabet A to Z (T-1).<sup>1</sup> This mnemonic method of organizing smells makes the system very easy to remember and readily learned, requiring only the ability to recite the alphabet. The system has now been used with over 2,000 students from more than 40 countries, in person and via Internet training.

Words — units of language that native speakers can identify; language that is spoken or written: Words are made up of letters and form the principle concepts of language and represent in this analogy the building blocks or the odorous materials that are available to us. It is rare that a word consists of just one letter, just as it is that a perfumery raw material displays a single note. Single aroma chemicals usually display more than a single odor facet. For example, the eugenol found in clove bud oil, though mainly spicy, has a phenolic character too. Essential oils display even more complex odor characteristics. Clove bud oil has a principally spicy and phenolic character from its eugenol content (around 80 percent of the oil), but has some fresh

balsamic notes (terpenes) and a rich woody character (caryophellene). Where S = spicy, P = phenol, Q = balsamic, W = wood, the concept eugenol can be represented by "SP" (spicy/phenolic) and clove bud by "SPQW" (spicy, phenolic, balsamic and woody). These can be extended with proportions of each for describing individual material's odor characteristics in detail (e.g. S-70:P-10:Q-15:W-5), but this will not be expanded upon further here. This is not intended to jargonize the language but merely add a systematic approach that can be later used practically. Words as basic building blocks in language fall into many classes according to their function in a sentence.

Nouns — words that can be used to refer to a person or place or thing; words that can serve as the subject or object: Nouns for the purposes of this analogy are used to describe specific odors (odor concepts), such as rose, jasmine, leather, etc. The specific classes of nouns we are interested in for this analogy are:

1. Subjects: the main theme of the perfume in a perfume description.
2. Objects: a modification of the subject or the location as indicated in the sentence by prepositions (e.g. "in an English country garden" in the example that follows later). Location could represent an odor, a setting or an ambiance.
3. Pronouns: names or references to specific branded perfumes (e.g. Fougere-Houbigant; Chypre-Coty; Lux-Unilever; Chanel No 5-Chanel).
4. Compound nouns: where the first noun acts as an adjective or modifier to the second noun, or represents a single concept. "Green rose" is a rose that has a green modification whereas "green tea" refers to a specific Japanese tea note.

Adjectives — words that express an attribute of a noun or describe something: Adjectives are the descriptors that modify nouns. Nouns may be limited in number, but the modification by adjectives increases the variety of possibilities exponentially. So rose becomes fresh rose, soft rose, natural green rose, old rose, etc. Adjectives for the purposes of this analogy are the materials that modify or decorate the odor of other materials. They are not the main theme, but are actually the materials that add the character and differentiation to the perfume.

Conjunctions — words that serve to join or coordinate words or phrases: Conjunctions are the connectors between nouns to form a combination, or group, of subjects or objects. The conjunctions for the purposes of this analogy are the materials that allow the smooth transition of the many odors in a perfume from one to another. They are the materials that blend and form bridges between disparate notes to bring them together in a unified whole.

	ABCs classification	Common description	Classification plus sub classification (a-z, lower case). Generally more practical if these are restricted to two letters for sorting but can be extended with proportional values for individual materials.
A	Ali-fat-ic	Fatty, waxy, soapy, clean	Aa — aliphatic alcohols; Ac — aldehydes C8-10; Ar — aldehydes C11-12
B	Berg - iceberg	Cooling, borneol, mint, camphor	Bh — eucalytus; Bw — borneol camphor; Bg — mint
C	Citrus	Sour, sharp, citrus peel	Ca — orange; Cc — lemon; Ck — lime; Cl — bergamot; Cn — mandarin; Cj — neroli; Cw — petitgrain
D	Dairy	Milky, cream, butter, cheese, lactones	Db — butter milk; Dd — lactone; Dv — coconut
E	Edible	Vegetable, nut, fish, meat	Eg — sulfur; Eh — vegetable; Ep — coffee; Et — meat; Eu — fish; Ew — nut
F	Fruit	Sour and sweet fruits, esters	Fb — blackcurrant; Fd — peach, apricot; Fe — durian; Fg — apple, melon; Fi — raspberry; Fj — banana; Fo — cherry; Fn — grape; Fv — strawberry, pineapple
G	Green	Cut grass, leaves	Gg — fresh-grassy, <i>cis</i> -3-hexenol; Gh — galbanum; Gn — phenylacetaldehyde
H	Herb	Neutral or cool herbaceous notes	Hl — lavender; Hb — sage, rosemary (neutral or cool herbs; Note: for hot herbs see S — spice)
I	Iris	Orris, violet	If — $\beta$ -ionone, damascone; lw — methyl ionone; Ia — orris; Ig — violet
J	Jasmin	Fruity, oily, narcotic, jasmine	Jf — fruity-jasmine; Jn — jasmine absolute (N.B. jasmine is also a sub-group of N — narcotic)
K	Konifer	Conifer, pine, pine- needle	Kl — pine; Kh — pine needle
L	Light chemical floral	Light floral fresh, chemical, metallic	Lw — linalool; Lb — cool cyclic esters; Ll — metallic; Lr — DMBC
M	Muguet	Lily of the valley, green, fresh	Ma — Lilial; Mc — hydroxycitronellal; Mg — green- fresh; MI — flowery
N	Narcotic	Heavy sweet florals, absolutes	Nc — orange flower; Nf — champaca; No — ylang; Nn — narcissus; Nd — tuberose
O	Orchid	Aromatic, deep floral	Oo — salicylates; On — benzoates; Oo — aromatic notes; On — orchid
P	Phenol	Phenol, medicinal, honey	Pp — medicinal; Pf — honey

## "The ABCs of Perfumery" (continued)

T-1

ABCs classification		Common description	Classification plus sub classification (a-z, lower case). Generally more practical if these are restricted to two letters for sorting but can be extended with proportional values for individual materials.
Q	Queen of the orient	Resin, balsam, terpenes, polymerized terpenes	Qv — benzoin, Peru; Qs — styrax; Qu — olibanum; Qc — limonene; Qk — pinene
R	Rose	Rose otto, absolute, geranium	Rl — otto; Rr — rose absolute; Ri — flowery; Rb — geranium
S	Spice (hot)	Hot culinary, spice	Sb — anise; Sp — clove; So — cinnamon; Sp/Sh — hot "herbs" (thyme, basil)
T	Tar smoke	Smoke, tar, burnt	Tt — smoke; Tw — birch tar; Te/Tu — smoked fish
U	Urine fecal animal	Animal, fecal, leather	Ue — urine, fishy; Uu — civet-fecal; Uw — ambergris; Up — castoreum, leather
V	Vanilla	Sweet edible, vanilla	Vv — ethyl vanillin; Vt — caramel/furanones; Vd — coumarin; Vn — heliotropin
W	Wood	Wood, oily	Wb — patchouli; Wq — sandal; Ww — cedar; Wy — vetiver
X	X-rated musk	Sexy, musk, sensual, sweet	Xx — macro and polycyclic musks; Xo — nitro
Y	Yeast earthy mossy	Fungal, moss, marine, earth	Yh — moss; Yp — seaweed; Yo — ozone; Yy — mushroom
Z	Zolvents	Low odor or odorless solvents, solubilizers	Zz — DEP; Zo — benzyl benzoate

Verbs — words that denote an action or a state: Verbs are words that describe actions or how something is, or appears. In this analogy, verbs will determine the behavior or actions of the odors in the perfume composition. (e.g. "leave a clean soapy note on the skin" or "give a fresh feeling")

Prepositions — indicate a "relationship" between a noun and some other part of the sentence: Simplified for our purposes these place the nouns in a location so that they exist in time and space — they fix the subject in a setting (the object) and give depth and ambiance. Compare "rose" vs. "a rose in an English flower garden" and the richness provided by the location.

Sentences — strings of words satisfying the grammatical rules of a language: Sentences are the bigger building blocks

consisting of words with a complement of subject, object, adjectives, verbs, etc. For this analogy it is necessary to note which sentence is the most relevant for the odor description in the composition and contains the main theme.

Phrases and idioms — expressions whose meanings cannot be inferred from the meanings of the words that make them up: These are specific words or combinations of words that may have special unique meanings. For the purposes of this analogy these may be accords or specific styles of perfume such as "new mown hay," "wet dog smell," "old church pews" or "floriental."

Paragraphs — distinct subdivisions of a text intended to separate ideas: One area where paragraphs would be appropriate for this analogy is where the fragrance has been divided up into separate sections with top note, middle note and bottom note descriptions.



## The Perfume Enquiry

A good way to explain and demonstrate the practical use of this analogy of grammar to perfumery is to use it within an example of a perfume enquiry. We can then decode the written enquiry to produce a perfume sample using the elements of grammar outlined above. A perfume enquiry, or a brief, represents the composition; this is the customer's representation of the final smell and feel of the product requested. The target or objective of this type of text is to describe the perfume as though it has already been created.

In the following example the customer requests:

"Rose for soap. The target consumer is Japanese, suburban young family, adults are 25-35. The husband is in middle-management and the wife is an active homemaker attending the gym and playing tennis twice a week and involved in community family projects. The soap is a rich white with a hint of rose-pink and is a mid-range product aimed to compete with multi-national brand family soaps but geared slightly towards female preference. The fragrance should be a fresh rose fragrance reminiscent of a rose in an English country garden. The soap should have fresh clean rose otto character, fresh slightly green calyx, slightly clove-spicy. The skin should be left with a faint clean soapy rose type odor after washing."

## Decoding

We will now use the analogy of the elements of grammar to start decoding the enquiry. It is important to approach a perfume enquiry by looking at the complete enquiry — the composition, which forms the whole objective of the perfume project. Then we consider the paragraphs, sentences, phrases/idioms, words, subject(s), objects, adjectives, conjunctions, verbs and prepositions. During these steps we will also be considering the letters (the prime smells) that form each of the word/odor concepts.

Title: First, a title is allocated to the project that should encompass the whole project in a few words and possibly a reference number, as it is likely that more than one sample will have to be made. It may be a summary of the desired odor, the final product application and perhaps the customer's name. So a suitable title might be:

"Rose for Soap Customer Company X Reference TR001/A."

The objective: This is probably the most important part of the process. The fictional customer here has kindly provided us with a detailed objective; in reality, some customers will give more detail, but many will offer much less information to work with. Perhaps the enquiry just requests "fresh floral for soap." The purpose of forming the objective is to identify the smell of the perfume

before running off to the laboratory to start choosing raw materials. It is the yardstick against which we will later evaluate the perfume sample and eventually the final submission, ensuring we have specific and measurable results. This, in some respects, is the hardest part of the creative process and requires the greatest discipline. Anything less than 50 words, I suggest, is insufficient, and a book is not too much. Once the goal has been identified clearly, then the rest is merely steering ourselves towards it. As the customer's enquiry is likely to be insufficient, we can either question them further or add our own notes to expand it. Upon completion, it should be possible for any independent person to evaluate the perfume sample by comparing it to the stated written objective.

So, returning to the customer's initial enquiry we can now add additional notes to the objective (shown in parenthesis):

"Rose for soap. The target consumer is Japanese (can't use DEP), suburban young family, adults are 25-35 (shouldn't be too old fashioned). The husband is in middle-management (shouldn't be cheap smelling) and the wife is an active homemaker attend-



*"What should the ratios of the top, middle and bottom notes be?" This is similar to asking a painter how much sky, foreground and background a painting should have.*

ing the gym twice a week (should have a lively or sporty feeling) and involved in community family projects (homely, loving). The soap (does it have an active ingredient such as a herb extract or anti-bacterial additive?) is a rich white (creamy) with a hint of rose-pink (caring) and is a mid-range product (\$18-22/kg) to compete with multi-national brand family soaps (seems it will compete with Dove, Lux ) but geared slightly towards female preference (should not be too sporty). The fragrance should be a fresh rose fragrance reminiscent of an English country garden (rose with some other flower notes, maybe violet, grass and muguet). The soap should have fresh clean rose otto character, fresh slightly green calyx (trace not too green), slightly clove-spicy. The skin should be left with a faint clean soapy rose type odor after washing.”

**Preparation and research:** At this point it is helpful to see if something similar has already been done or if more information is required. It may not be necessary to re-invent the wheel. Remember the most important step in preparation is getting the objective correct. Recently, while preparing this article, a quality manager said something that drives this point home: “Give me a complete and accurate specification and no matter how difficult I can produce that product — give me a sloppy specification and you will get a sloppy product.”

**Materials:** The next step in the decoding of the enquiry is to list the materials that we are likely to use by relating them to the various word classes present in the objective. The idea in the materials section is to include as many materials as possible. However, with a large range of materials it may be impractical to physically list them all individually, as in this article, without the aid of a computer, but this is the goal.

**Basic materials:** The first group of materials we will look at is the basic materials. This is the subject — the nouns that form the main theme of the objective and will be reflected in the title. In this case, these will be materials that smell of rose. We list here all the materials we have available to us that smell of rose. These are regarded as basic materials because they smell of the subject, and no matter how we mix them the result will always be the same as the

subject. Mix 10 things that smell of rose and the result will be rose. At this point in the process we should not dismiss materials on the basis of cost — this will be determined by concentration. Instead it is important to filter out materials that are definitely unsuitable for the application or target market of the customer. A European customer may require not using materials that are listed under EEC labeling directives, while a Middle Eastern client may require materials to be halal or kosher. Noting the odor facets of each material from “The ABCs of Perfumery” makes later choices of which materials to actually use simpler. In this article we have used only the first two groupings for convenience.

Here’s an example of how the list of basic materials might look:

- Rose: phenyl ethyl alcohol (Rg), citronellol (Rm), geraniol (Rl), nerol (Rc), rosalba (Ra), rose otto (Rl), rose absolute (Rr), rose oxide (Rl), citronellyl acetate (Rl), geranyl acetate (Rl) and other esters, geranium oil (Rb), and phenyl ethyl acetate (Rl).
- Rose otto: Rose Otto Fleuressence (Perfumers-World) (Rl), diphenyl oxide (Rl), geranium oil (Rb), and rose oxide (Rl).

Note for the purposes of this example that we have used a simple subject. More complex subjects would be ones that have two or three prime note characteristics or employ an accord as a basic [e.g. lime (citrus + pine = Ck), fougere (herb + oakmoss + coumarin = Hyv). In these cases a perfumer can either decide to 1) use only one of the notes as the basic and treat the others as modifiers, or 2) develop the basic as a separate run of the system. In the examination of thousands of complex perfumes at PerfumersWorld, we have found the basics of any type can be expressed in four or less prime notes, almost without exception.

**Modifier materials:** The second group of materials to list is the adjectives (or compounded nouns) — the modifier materials. Modifying materials are defined essentially as materials that smell differently from the subject (the basic material). Modifiers will add the style, character, naturalness, freshness or diffusion to the perfume. As they will have a modifying effect on the basic materials of the subject, the most interesting modifiers will tend to be higher impact materials, having relative odor impacts (the odor impact of a material expressed as a value compared to linalool synthetic with an allocated impact of 100) greater than 100.

Referring back to our example, here’s how the list of modifier materials might look:

- Fresh: menthol (Bb), eucalyptus oil (Bh), lemon oil (Cc), citral (Cc) and cis-3-hexenol (Gg).
- Clean: aldehyde C11 undecylenic (Cr), Lilial-Givaudan (Ma) and ethyl phenyl acetate (Pf).

- Green calyx: cis-3-hexenol (Gg), melonal (Fg), helional (Gf) and cyclamen aldehyde (Mg).
- Clove-spicy: eugenol (Sp), clove bud oil (Sp), acetyl iso eugenol (Sq), bay oil (Sq) and cardamom (Sh).
- Sporty: dihydro myrcenol (Ck), peppermint (Bg), spearmint (Bg), lime (Ck), pine needle (Kh) and eucalyptus (Bh).

Blender materials: The third group of materials to list is the blenders. In the objective these are conjunctions — the words that connect the nouns and aid the flow of words. Looking at the first two lists of materials above, the basics and modifiers, one can see by definition that they are different in odor character. When two materials differing in odor type and odor life (time in h that a material dipped on a smelling strip takes to lose its characteristic odor) are mixed, one tends to get a pronounced “step” in the odor instead of a harmonious transition from one note to the next. Blenders, the conjunctions, are the materials that smooth over, or bridge, these differences.

Blenders:

1. Frequently share some of the character of the basics and/or some of the character of the modifiers. They may be formed

from a combination of more than one material.

2. Tend to have relative impacts around 100 or lower because they are not modifying the basic character or style of the perfume.
3. Tend to have odor lives longer than the shortest odor life of the pair they link.

For example, phenyl ethyl alcohol has mainly a rose odor, but with green and phenolic notes. It is a basic for rose, yet with its low impact and long odor life it is also useful for smoothing out a rose fragrance in which there are modifiers with green or phenolic notes. One blender may assist with more than one basic-modifier pair, and some of the blenders may already be in the materials chosen as basics.

Referring back to our rose example, here’s how the list of blender materials might look with their functions in parenthesis:

- Rose-fresh: menthol (Bb — link rose to mint notes in geranium) and nerol (Rc — rose to citrus).
- Rose-clean: linalool (Lw — fresh

to light chemical floral notes found in geraniol, rose oxide).

- Rose-rose otto: phenyl ethyl alcohol (Rg — rose to green notes) and citronellol (Rm — rose to geranium).
- Rose-green calyx: Helional-IFF (Gm — green to muguet) and cyclamen aldehyde (Mg — muguet to green).
- Rose-clove-spicy: acetyl iso eugenol (Sv — rose to spice) and benzyl salicylate (Oo — aromatic-heavy floral).
- Rose-sporty: dihydro myrcenol (Cl — citrus to linalool) and terpineol (Kl — heavy lime to light chemical floral).
- Rose-violet:  $\alpha$ -ionone (Iw — rose to violet-iris),  $\beta$ -ionone (If — rose to violet), orris concrete (Ia — rose to aldehydic fatty) and methyl ionone (Iw — floral to woody violet).
- Rose-grass: Helional-IFF (Gm — green to muguet) and cis-3-hexenyl benzoate (Go — green to aromatic).
- Rose-muguet: hydroxycitronellal (Mc — muguet to citrus), cyclamen aldehyde (Mg — muguet to green) and Dupical-Quest (Ma — muguet to aldehyde).
- Musks (general non-specific blenders and fixatives): pentadecanolide (Xu) and other macro or polycyclic musks.

**Fixative materials:** The last group of materials to list is the materials that form the prepositions and their objects in the sentence. Fixatives are the materials that fix the fragrance or note in time and place. Fixatives in perfumery are often described by default as materials that make the perfume last longer. A far more powerful way to think of fixatives is as materials that provide the setting for the perfume — materials that complete it, that make it perfect and whole. They tend to be materials that are long lasting, though probably lower impact because at very high impact and in sufficient concentrations they will tend to operate more as basics or modifiers. In terms of odor they will ideally be materials that display some of the characteristics of the basics and modifiers and have the desired dry-out of the perfume. The fixative property is referred to in our example by “the skin should be left with a faint clean

soapy rose type odor.”

Referring to our example, here’s what the fixative materials might look like:

- Rose: rose crystals (syn. trichloro methyl phenyl carbonyl acetate) (Rl) and guaiacwood oil (Rw).
- Violet:  $\alpha$ -ionone (Iw),  $\beta$ -ionone (If) and orris concrete (Ia).
- Grass: cis-3-hexenyl benzoate (Go).
- Muguet: hydroxycitronellal (Mc), cyclamen aldehyde (Mg), Lilial-Givaudan (Ma) and Lyril-IFF (Mm).
- Clove-spicy: benzyl iso-eugenol (So).
- Musks (general non-specific blenders and fixatives): pentadecanolide (Xx) and other macro or polycyclic musks.

## Method

The next step is to construct the perfume sample. Each step will call on the perfumer to minimize the number of materials used. There is no rule to the minimum or maximum number of materials that should be in a perfume compound, although the manufacturing departments and your boss would prefer that there were! However, each material should be there for a specific purpose and not have any negative impact on the total composition. The methodology here ensures that not only are the minimum number of materials used but that each material’s function in the structure of the perfume is understood.

**Tip:** In the initial stages of this process it is far quicker and economical to use drops from standardized droppers or pipettes, perhaps using only 1/10 of the time of weighing and only 1 g or so of materials per experiment. This will later be converted to w/w proportions for production purposes.

**Basic step — form the basic structure or heart:** In this step the perfumer smells and selects only two or three materials from the list made above for basic materials. He or she chooses them by smelling and evaluating each material against the subject, choosing those that most closely represent the subject in themselves. The groupings for each material from “The ABCs of Perfumery” make this choice simpler, allowing for organization via sorting in order of fit to the objective. The perfumer then mixes together the two or three chosen basic materials. How much one mixes is a matter of choice; the amounts of each may be intuitive, but the lack of intuition need not be a stumbling block. If a perfumer doesn’t know where to start, he or she should simply mix equal proportions (e.g. in the ratio of 1:1:1), smell and evaluate the combination against the subject. It should then be apparent if one of the materials is incorrect, over- or under-dosed, and then simply replace, increase or decrease each component in new samples until the required effect is obtained. This basic mixture may form an accord in which synergy or harmony occurs. If one determines that more than three materials are necessary, they may either be added one by one, or the formulator can



choose to wait for the next experiment. Adding many materials too soon will make it difficult to track where future problems — lack of diffusion or disharmonies — come from.

Here's an example of how the selection of a basic mixture might look for the sample:

- Rose: 10 drops phenyl ethyl alcohol (Rg).
- Rose: 15 drops citronellol (Rm) .
- Rose: 20 drops geraniol (Rl).
- Rose otto: 2 drops rose otto (Rl) 10 percent.

Modifying step — decorate the basic structure: In this step the perfumer chooses just one material from the list for each modifier (adjectives and noun combinations) by comparing the basic blend produced above to the written and mental visualization of the objective. It is wise to start with the modifiers in order of importance, which may well be in the order in which they occur in the written objective. The perfumer must choose one material for fresh, one for clean, etc. As modifiers tend to be higher impact materials, fragrance creators may want to consider using solutions to control the additions. Additions to the mixture should be executed drop by drop until the required effect is achieved. Perfumers should smell each addition before moving on to the next modifying material and must start again in the case of an overdose. Each sample should be labeled and kept for reference. If appropriate, the perfumer should rearrange the order of mixing. It is key to take notes so as to learn from each step.

Here's an example of how the selection of modifiers might look for the sample (added drop by drop and smell at each stage):

- Fresh: geranium oil (Rb) 10 percent — 6 drops.
- Clean: Lillal-Givaudan (Ma) — 5 drops.
- Clean: ethyl phenyl acetate (Pf) 10 percent — 1 drop.
- Green calyx: melonal (Fg) 1 percent — 3 drops.
- Clove-spicy: clove bud oil (Sp) 10 percent — 6 drops.
- Sporty: dihydro myrcenol (Cl) — 5 drops.

Blending step — harmonize the composition: The perfumer should choose one material from his or her blenders list for each of the basic-modifier pair, or less if required (use less rather than more). Add blenders drop by drop, and mix and smell until the required smoothing effect is obtained. In cases in which two smells in a perfume, such as a spearmint note and an orange note, would tend to clash (try drinking orange juice after brushing your teeth!), the conjunctions are the materials that would link the smells and make the union harmonious (in this case maybe linalool). Even though linalool now has an uncertain future due to EEC labeling requirements, one of the reasons that it has been one of the most widely used perfumery raw materials is its ability to blend. Despite its chemical

character, linalool has fresh notes that go well with citrus, green or herbal notes, and a floral and slightly woody background, which means it acts as a bridge between fresh top note notes and the floral heart of many perfumes.

Here's an example of how the selection of blenders might look for the sample (one should add drop by drop and smell at each stage):

- Rose-fresh: menthol (Bb — cooling link rose to mint notes in geranium) 50 percent — 2 drops.
- Rose-fresh: nerol (Rc — rose to citrus of dihydro myrcenol) — 1 drop.
- Rose-clean: linalool (Lw — fresh to light chemical floral notes in geraniol, rose oxide) — 2 drops.
- Rose-rose otto: phenyl ethyl alcohol (Rg — rose to green notes) — 5 drops.
- Rose-green calyx: Helional-IFF (Gm — green to muguet) — 2 drops.
- Rose-clove-spicy: acetyl iso eugenol (Sp — soft spicy) 10 percent — 6 drops.

Fixation step — add background and depth: The perfumer should now pick one or two fixatives from his or her fixatives list. Although they are regarded as



*In quantifying the ratios of top, middle and bottom notes we are merely describing the balance of the three stages — this does not tell us why the materials are there, just the position they occupy in the timeline of the evaporation of the perfume.*

## Rose for Soap Customer Company X Reference TRO01/A (1st Run)

T-2

Basics <i>Build the character of the title/subject</i>	Title	10 drops	phenyl ethyl alcohol ( <i>Rg</i> — <i>rose</i> )
	Subject	15 drops	citronellol ( <i>Rm</i> — <i>rose</i> )
	Theme	20 drops	geraniol ( <i>Rl</i> — <i>rose</i> )
		2 drops	rose otto 10 percent ( <i>Rl</i> — <i>rose otto</i> )
Modifiers <i>Decorate the basics</i>	Adjectives (Object may be here)	6 drops	geranium oil 10 percent ( <i>Rb</i> — <i>fresh</i> )
		5 drops	Lilial-Givaudan ( <i>Ma</i> — <i>clean</i> )
		1 drop	ethyl phenyl acetate 10 percent ( <i>Pf</i> — <i>clean</i> )
		3 drops	melonal 1 percent ( <i>Fg</i> — <i>green calyx</i> )
		6 drops	clove bud oil 10 percent ( <i>Sp</i> — <i>clove-spicy</i> )
		5 drops	dihydro myrcenol ( <i>Cl</i> — <i>sporty</i> )
Blenders <i>Link the basics and modifiers</i>	Conjunctions	2 drops	menthol 50 percent ( <i>Bb</i> — <i>link rose to mint note in geranium</i> )
	Verbs	1 drop	nerol ( <i>Rc</i> — <i>rose to citrus of dihydro myrcenol</i> )
		2 drops	linalool ( <i>Lw</i> — <i>fresh to light chemical floral</i> )
		5 drops	phenyl ethyl alcohol ( <i>Rg</i> — <i>rose to green</i> )
		2 drops	Helional-IFF ( <i>Gm</i> — <i>green to muguet</i> )
		6 drops	acetyl iso eugenol 10 percent ( <i>Sp</i> — <i>rose to spice</i> )
		Fixative <i>Give depth and ambiance</i>	Prepositions and their objects
1 drop	$\alpha$ -ionone ( <i>Iw</i> — <i>violet</i> )*		
3 drops	<i>cis</i> -3-hexenyl benzoate 10 percent ( <i>Go</i> — <i>grass</i> )*		
1 drop	Lilial-Givaudan ( <i>Ma</i> — <i>muguet</i> )*		
2 drops	Lyral-IFF ( <i>Mm</i> — <i>muguet</i> )*		
2 drops	pentadecanolide 10 percent ( <i>Xx</i> — <i>musk</i> )		
* for English country garden			

the bottom notes, fixatives will be present throughout the life of the fragrance — first in the top note and then increasingly present as the top and middle notes evaporate. Fixatives add depth to compositions, transforming a flat two-dimensional smell to a perfume with a third dimension. In short: a timeline that gives change with the impression of life and movement. The chosen fixatives should be added to mixtures drop by drop, then mixed and smelled (and tweaked) until the required effect is achieved. Fixatives, particularly the macro or polycyclic musks, will add diffusion at lower levels, but if overdosed may cause the fragrance to become flat and lifeless. Thus, care is required in the dosing.

Here's an example of how the selection of fixatives might look for the sample (add drop by drop and smell at each stage):

- Rose: rose crystals (syn. trichloro methyl phenyl carbonyl acetate) (*Rl*) 10 percent — 15 drops.

- English country garden:  
Violet:  $\alpha$ -ionone (*Iw*) — 1 drop.  
Grass: *cis*-3-hexenyl benzoate (*Go*) 10 percent — 3 drops.  
Muguet: used Lilial-Givaudan (*Ma*) above for clean modification, add 1 drop more here for muguet.
- Muguet: Lyrall-IFF (*Mm*) — 2 drops.
- Musk: pentadecanolide (*Xx*) 10 percent — 2 drops.

See T-2 for summary of the first run at decoding the formula.

## Result

At this point the perfumer should evaluate the sample on smelling strips against the objective. If reasonably satisfied, he or she should then test the formulation in the finished product application. For example, the sample may be added to an un-perfumed soap base at 1 percent concentration. Testing in the application is not to say that the project is completed; this is done to evaluate the effect of the product base on the odor. The results of smelling the perfume compound in the base will help the perfumer adapt the strategy on the next run to get it closer to the goal. Referring to the detailed objective, the perfumer may use it like a checklist, going through it step by step.

- Rose? Yes/No
- Lively or sporty? Yes/No
- Homely? Yes/No
- Clean soapy rose after washing? Yes/No
- Etc.

Perhaps the evaluation of the first sample will come up with something like this: “The smell is weak in soap. A bit too green, so it does not seem to go with the concept of a rich white slightly pink soap. Not diffusive enough, a bit too soapy. After washing with the soap, the smell on the skin is pleasant and musky but not very clean.”

## Conclusion

This is the point where the decision as to whether the decoding is complete is made. Either: 1) suggest modifications to the next experiment, which might improve the fit to the objective. For instance, within our example we might take out melonal and try cis-3-hexenol. Then: increase aldehyde C11 to add more soapy smell, lower the phenyl ethyl alcohol level as it is too soft, reduce the Lilial and add rose oxide to improve diffusiveness. Or: 2) decide that the sample is sufficiently close to the objective and conclude the trials. In this case convert the formula to a percentage by weight formula. Make 10 times as much by counting the drops using the same droppers or pipettes onto a two decimal place balance, record the weights and calculate the percentages. Then make a pilot batch (e.g. 100 g or 1 kg) for further stability testing and submission to the customer.

## Summary

This systematic method of formulating by analogy to written language gives the perfumer a powerful approach to perfume composition. This system is especially effective when that “eureka” moment of inspiration is elusive. The practical applications of the system are:

1. Systematic aid in formulating a structured perfume compound, identifying and minimizing the materials required and optimizing their use.
2. This analogy can be a powerful tool to apply to a customer’s enquiry and helps to ensure a fit to the requirements.
3. By using this system we can create a perfume from stated objectives. If we can write it we can make it!
4. Using algorithms, rather like a word processor’s grammar checker, a perfume formulation proposal can be generated automatically by computer from a written enquiry or objective.

## Acknowledgements

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## References

1. S.V. Dowthwaite, Training the ABCs of Perfumery. *Perfum. Flavor.*, 24, 31-45 (1999).

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