The Psychological Basis of Perfumery

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The Psychological Basis of Perfumery

Translation of the expanded fourth German edition

PAUL JELLINEK

Edited and translated by J. Stephan Jellinek



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Preface to the fourth German edition

When the publisher approached me with the suggestion to update my father's book for a new edition, I immediately agreed to take up the challenge. My professional experience (as my father's pupil I had followed in his footsteps) had shown me that the interest in this book had grown well beyond the confines of the circle of professionals for which it was originally intended.

The first step in preparing the update consisted of a careful re-reading of the text. As I did this, it became increasingly clear to me that an updating in the customary sense was hardly possible in this case and certainly not appropriate. Modification of details, such as the incorporation of recent findings about the chemistry of human body odor or the replacement of perfumes quoted as examples by more up-to-date ones, would have updated the book only in a superficial sense, leaving the core problem untouched.

This problem is the fact that our approach to psychology is different today from what it was in the days when the book was written. Paul Jellinek was a chemist and his basic approach in the book was that of the natural scientist: you observe a phenomenon that cannot be explained by current theories, develop a theory that offers an explanation of the observation and then derive from this theory hypotheses that can be verified or falsified by practical experimentation. A fruitful theory leads to hypotheses that in their scope go far beyond the primary observation. Verification of the hypotheses provides support to the theory. The seminal observation in this case was the realization that all women's perfumes contain components which in and by themselves have an unpleasant odor; men's fragrances and fragrances for functional products only rarely contain such components. Paul Jellinek's attempt to explain this observation led him to a theory which had the key statement: *modern perfumery seeks to create or to reinforce sexual attraction.*

The unpleasant components present in all perfumes are materials that remind us of the odor of the human body. They account for the erogenous effect of the fragrance. We find them repellant when smelled in pure form for two reasons: because strong body odor is a signal of poor personal hygiene and because our culture, to the extent that it retains vestiges of Victorian morality, has an ambiguous relationship to the nude body which is mirrored in our reaction to the odor of the body.

From his basic theory Paul Jellinek derived a series of hypotheses which culminated in the development of the Odor Effect Diagram. This diagram offers plausible explanations for the structure not only of women's perfumes

but of all modern fragrances including men's fragrances, the fragrances used in cosmetics, toiletries and household products, and even the natural scents found in the plant and animal kingdoms. The major part of the book is devoted to the evidence for the correctness of the diagram and this evidence is also proof of the basic theory.

Today we approach questions of psychology in a very different manner, less deductively, more empirically. We do not seek to deduce the purpose of perfumery from a theory based on a single observation but to derive it from a multitude of observations regarding the behavior of people with respect to perfumes and perfumed products, and perhaps from direct questioning. We are beset by questions which only marginally concerned Paul Jellinek in his systematic approach: do the unpleasant components of perfumes really remind people, consciously or unconsciously, of the human body? Do perfumes that contain such materials actually have stronger erogenous effects than fragrances that do not contain them? Pierre Blaizot* pointed out as early as 1963 that it should be possible to measure the stimulating, narcotic or erogenous effects of odor materials or perfumes by means of physiological experiments. Can such effects actually be demonstrated?

Adopting an empirical rather than a deductive approach to the question of the psychological basis of perfumery would, however, involve not an updating of Paul Jellinek's book but a fundamental revision, a new book. This would have meant abandoning the original book. This appeared to me to be undesirable because the original book remains, even today, impressive for the logical coherence of its argument and for the boldness of its theory and hypotheses. Above all, the Odor Effects Diagram appears to me to be as valuable today for an understanding of many aspects of perfumery as it was 50 years ago when it was first developed.

I therefore proposed to the publisher a new edition in which the first edition of 1951 is reproduced in a slightly abridged form (the second and third editions brought only minor additions and modifications) and supplemented by chapters in which key questions of the book are considered anew from today's perspective by internationally acknowledged experts in various disciplines. The publisher agreed and thus the new edition came into being.

The chemist John N. Labows and the biochemist Professor D.B. Gower have contributed two mutually complementary chapters about the chemistry of human body odor and the evidence for the existence of human sexual pheromones. The perfumer Walter Steiner, who has involved himself for many years in psychological research regarding the subjective effects of perfumes, has contributed a chapter on this subject which contains much hitherto unpublished material. The market researcher Hugh Bain reports on consumer interviews regarding the motivation of perfume use which he has conducted in a number of different cultures. The psychologist Professor Rainer Dollase has

* Blaizot, P. (1963) Essai de psycho-physiologie de l'odorat, *Parf. Cosm. Savons* **6**, 448–453.

written a reinterpretation of recent literature regarding subjective considerations and information processing tactics in perfume selection. In a closing chapter, Paul Jellinek's theses are critically evaluated in the light of current information.

I am grateful to the editorial staff of Hüthig Verlag for their willingness to go along with the somewhat unconventional nature of this new edition. My thanks also go to the co-authors for their collaboration in this experiment in spite of the additional strain which this meant for each of them in view of their many other commitments.

This new edition went into print almost exactly on the 10th anniversary of Paul Jellinek's death. I hope that it may help in disseminating his ideas among the ever-growing circle of people interested in fragrance psychology and stimulate further research in this fascinating field.

J. Stephan Jellinek
Holzminden, September 1993

Editor's note

Paul Jellinek's book touches throughout on technical as well as psychological aspects of perfumery and also of cosmetics. It is only natural that quite a number of his remarks are out of date after half a century of development in analysis, the introduction of new research on the safety of both new and established perfume materials, and the evolution of markets and products.

We know far more about the chemistry of flower odors today than was known when Jellinek wrote his chapter on the erotic effect of flower odors. The considerable number of perfume materials that have been introduced and have become key components of the perfumer's palette during the past 50 years are not considered. On the other hand, some materials in common use when the book was written, including balsam Peru, musk ambrette, benzal acetone and costus root oil, have since been banned from perfumery because of negative safety findings. Products such as hair soaps and dental powders are no longer to be found on retail shelves and neither are many of the fashion perfumes to which Jellinek refers.

Re-issued after 50 years, Part I of this book is a historic document, not an up-to-date guide to practical work.

Preface to the first edition

Winter opens the introduction to his *Handbuch der gesamten Parfümerie und Kosmetik* (*Complete Manual of Perfumery and Cosmetics*) with the statement: 'Perfumery and cosmetics are two concepts that are so closely linked that a clear distinction between them is simply impossible.' He continues his argument with, among others, the following remarks: 'Few if any fields of human endeavor place such a varied array of demands upon its practitioners as does perfumery. Not everyone understands the specific nature and the cultural importance of this industry whose history reaches back thousands of years ...

'In its innermost essence, perfumery is an art. As such it demands of its disciples, in addition to a basic understanding of its tasks and of the subtleness thereof, a certain dedication, tact and joy in creating – characteristics which are strongly promoted by a general artistic predisposition and which make it possible also to attain quite rapidly the routine in the technique of manipulation that is required for the most subtle assignments, and a thorough schooling of the sense of smell.

'The prior knowledge that can aid the perfumer in the execution of his tasks pertains primarily to chemistry and pharmaceutical technology; certain basic concepts of medicine can also be very salutary and useful.' Where these remarks pertain to the skills and the prior knowledge required of the perfumer, they also represent the views of all other acknowledged authorities in the field of perfumery and cosmetics. Far from wanting to question the correctness of these opinions of my predecessors and colleagues, I do believe that they need to be supplemented.

We receive from our sense of smell, more than from any other sense, unconscious impressions; unconscious not so much as regards their origin and cause as with respect to the manner in which they affect us physically and psychologically. I regard the elucidation of the relationships between the causes and effects that are mediated by the sense of smell and that are important in human life as one of the most important objectives of a perfumery that aspires to be scientific. The arguments presented in this book address themselves to this problem, the solution of which is to be found largely in the field of psychology. This problem will have been resolved when the perfumer is able to base his creative work, hitherto entirely intuitive, on the perhaps unglamorous but solid foundation of psychological knowledge.

In addition, the results of my investigations are intended to offer consumers the possibility to determine, or to have determined for them, the type of perfume that fits their individual personality, and also to provide directions to the technical solution of the problem of a true 'man's perfume'. For reasons to be discussed later, these investigations owe less to the techniques of depth psychology than to those of behavioral psychology and behaviorism*.

This book should by no means be considered as a definitive study of the topic but rather as a stimulus to consider psychology as an aspect of perfumery. Whether it may also, in a reverse sense, be of interest to psychoanalysis, perhaps also to psychopathology or psychotherapy, is a question to be decided by the scientific communities of psychologists and physicians.

Paul Jellinek

* Thorndike, E. (1922) *Animal Intelligence*; (1913) *Educational Psychology*.
Watson, J.B. (1919) *Psychology from the Standpoint of the Behaviorist*; (1914) *Behavior: An Introduction to Comparative Psychology*.

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Dr Walter Steiner was, until his recent retirement, perfumer and research manager of drom Dr O. Martens Nachf. KG at Baierbrunn, Germany. He has been in charge of the investigations into perfume psychology that have been conducted and sponsored by drom during the past 20 years.

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Part I
The Psychological Basis of Perfumery

PAUL JELLINEK

Part II
The Psychological Basis of Perfumery Re-examined

1 Perfumery and eroticism

All life in nature is characterized by the self-preservation drive which ensures the survival of the individual, and by the sexual drive which causes reproduction and hence the survival of the species. All functions of plant organisms and each animal action can be traced directly to the initiative of one of these drives which also induce, in the final analysis, every human action. Perfumery is rooted in the sexual drive not only by virtue of the origin of some of its most important natural raw materials; it has developed under the dominance of this drive, which has placed its stamp on the perfumer's art, and in all of its creations it unequivocally remains sexuality's servant.

The flower develops its fullest odor at the time of its sexual maturity to attract insects which, as carriers of pollen, are instrumental in pollenation and hence in procreation. The fragrant oils obtained from flowers are the most precious raw materials of perfumery.

Among the perfumery materials of animal origin, civet and musk are preeminent. They stand in the service of procreation with the animals that produce them, since they enable the animal to find its mate by scent.

The erotic effect of 'sultry' odors of flowers such as rose, orange blossom, orchid, tuberose, jasmine, lilac, lime blossom and others has been noted by the poets of all civilizations and all times, and musk has been famed as an aphrodisiac since the days of antiquity.

All higher civilizations have known an 'art of perfumery', the origins of which are characterized by the effort to bring natural odors into a concentrated or manageable form suitable for perfuming the body or garments. Since the days of antiquity, people have anointed their bodies with flower pommades or with fatty oils scented by maceration, they have transferred the odor of dried flowers and herbs to their garments or sprinkled floral waters upon themselves. These actions had the same purpose which modern perfumery attempts to achieve with its plethora of natural and synthetic odor materials and its sophisticated technique of composition: *to create or to enhance sexual attraction.* This aim can be achieved in two ways: through the masking of unpleasant, anti-erogenous odors and through the application of odor materials that possess an erotic effect. Both ways are used more or less consciously and often simultaneously.

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2 The elimination of anti-erogenous odors

With respect to perfumes' effectiveness in eliminating anti-erotic odors, the ground is prepared by the deodorizing action of mechanically cleansing, chemically neutralizing or disinfecting skin-care products. Next to soap, alcohol plays the most important role in this process. These two predominant vehicles of skin-care and beauty products excellently supplement each other because of their different mechanisms of action. Soap is always used in aqueous solution which is alkaline, hence it neutralizes the fatty acids contained in perspiration. By emulsifying insoluble materials such as bacteria and soil particles, it makes their removal by water possible. Alcohol is marked by a strong germicidal effect. It can dissolve soil and skin secretions, and by virtue of its weakly acid action (caused by trace impurities) it can neutralize the ammoniacal products formed by bacterial decomposition of skin secretions. The mechanical and chemical effects of these two vehicles, which result in the removal of anti-erogenous odors and of their causes, can be supported and prolonged by appropriate fragrances. This happens with soap when it is used in the form of toilet soap, shampoo or toothpaste; with alcohol when applied in the form of toilet water, facial lotion, mouth rinse or hair tonic.

In all of these cases the most suitable perfumery materials for counteracting or masking anti-erogenous odors are the ones that are characterized as 'acidic', 'fresh–flowery', 'fresh–herbal', 'fresh–spicy' or 'fresh–fruity', that is materials that share the attribute 'refreshing'. Typical representatives of this group are the oils of bergamot, lemon, citronella, coniferous trees, eucalyptus, lavender, petitgrain, peppermint, rosemary, spike lavender and thyme as well as bornyl acetate, citral, citronellal, cineol, linalyl acetate, menthol, terpinyl acetate, thymol, etc.

Each refreshing sensation entails a stirring of our senses, nerves or muscles, that is a spontaneous intensification of a vital function. If prolonged, such an intensification must of necessity lead to a reaction, i.e. fatigue. Therefore, each refreshing effect must also be 'transitory', i.e. it must rapidly fade or disappear altogether.

This rule also applies to perfumery materials or perfumes. They are experienced as refreshing only if they are highly volatile and their odor effect fades relatively rapidly. Hence the refreshing odor materials listed above are all highly volatile. Perfumes that consist exclusively of 'fresh' components are never long-lasting.

The public, however, usually wants perfumes to be as long-lasting as possible. This forces the perfumer in nearly all cases to add less volatile odor materials to refreshing compositions to serve as fixatives. Their use prolongs

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the effect of the perfume but, to the same degree, reduces its refreshing action. The perfumer must have a clear understanding of this trade-off between a refreshing and a long-lasting effect if he is to succeed in achieving both of these characteristics, usually linked in practical perfumery, to the degree desired.

Since rapid fading is a condition for the refreshing effect, it is evident that this effect depends not only on the volatility of the individual perfumery materials or the composition but also on their concentration, since the lasting effect increases with concentration. For this reason an Eau de Cologne type fragrance, for example, composed solely for the sake of a refreshing effect, is possible only in the form of a dilute alcoholic lotion. In this form, where the concentration of the odor blend dissolved in alcohol is only 1–2%, the refreshment is felt. A perfume of the Eau de Cologne type containing perhaps 10% of the same blend would not be refreshing and would certainly be uninteresting as a perfume.

For the same reason, fresh lavender scents are sold only in the form of lotions, lavender water, while lavender perfumes – for instance, Lavande Ambrée – are a sultry modification of this type. Generally a lotion is experienced as more refreshing than an extract or perfume prepared from the same fragrance blend.

Alcohol also plays an important role in achieving a refreshing effect both because of its fresh odor and because it evaporates more quickly than water. Hence high water concentrations – found in inexpensive colognes and lotions – reduce not the quality but the refreshing effect of the perfume composition used.

The highly volatile terpene hydrocarbons make an important contribution to the refreshing effect of essential oils. Terpeneless oils are always less fresh in odor than the corresponding untreated oils. This explains the outstanding freshness of oils rich in terpene hydrocarbons, such as lemon oil, orange oil, lime oil or the conifer oils.

The less volatile sesquiterpene hydrocarbons, which may be formed by resinification of monoterpene hydrocarbons on prolonged storage of essential oils, adversely affect the fresh effect of the oil. Where this effect is essential, for example with citrus oils and the other components of the Eau de Cologne complex, the use of fresh, preserved or rectified oils is to be recommended. Oils such as vetiver or patchouli on the other hand, whose appeal is their heavy, long-lasting odor, become finer on prolonged storage.

In summary, it should be noted that highly volatile and refreshing odor materials and their compositions are suitable for the elimination of anti-erogenous odors. Odorant concentrations which are too high prolong the odor effect and thus reduce the refreshing action. Alcohol, which is used as a solvent in perfumes and cosmetics, also serves as a deodorant and enhances the refreshing action. Essential oils rich in monoterpene hydrocarbons but low in sesquiterpenes are particularly suitable for producing fresh odors or

counteracting anti-erogenous odors. To satisfy the popular demand for a certain tenacity of perfumes, the perfumer is usually required to combine fresh and highly volatile fragrance materials with less volatile ones even though this reduces the refreshing effect of the composition.

3 The erotic effects of perfume materials

As all of our sense organs, the nose serves both the self-preservation and the procreation drives. The common assertion that the olfactory sense has regressed in man more than the other senses as human culture developed is, in this undifferentiated form, certainly not true. The thesis, however, that the human sense of smell in the course of cultural evolution has decreased in acuteness but gained in discriminatory ability is true and finds support in observations with children and primitive cultures. Even today, in our advanced civilizations, we experience the scent of burning as a warning, we can often judge the freshness or spoilage of foods by our nose and we are sexually stimulated by the natural odor of the skin and hair of the opposite sex, although these reactions are less acute in us than in tribes that have remained close to nature, and probably than in our own remote ancestors. Additionally, civilized man has learned to lend savor to his food through special methods of preparation (smoking, cooking, etc.) and by the addition of aromatic condiments, and to lend variety to them through fragrant spices. In this way, he transformed the satisfaction of his self-preservation drive into a more or less refined sensory pleasure.

In a comparable way man has probably always experienced the scent of the skin and hair of the opposite sex as a stimulant to his procreative drive. Gradually he learned to enhance the sensual appeal of his body's scent by enriching it with the fragrance of flowers, herbs, etc. which stimulated his senses in a similar way. This was the origin of perfumery. Its further development, to be credited largely to the culture of ancient Egypt, was made possible by the development of skills to collect the odor of natural odorous materials and to preserve and apply it in a different, more or less concentrated but certainly more appropriate form, as a fragrant powder, ointment, oil or water. The use of a specific scent was thus made independent of (flowering) season and of place.

Perhaps at the same time or perhaps only much later, people were no longer satisfied with the scent of a single flower or plant and used several natural odors, blended together in certain proportions, to achieve a special effect. Thus perfumery became an art which progressed rapidly, along with cosmetics, in all cultures of antiquity. In addition to blossoms, the simplest raw materials, the perfumer of antiquity learned to use other plant and animal materials, often originally intended for religious or medicinal application, for his purposes. These included myrrh, incense, benzoe, labdanum, ambergris, musk and civet, all marked by sultry odors and used already in ancient Egypt for the scenting of beauty products.

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In ancient Greece and the Roman Empire, perfumery was initially clearly influenced by the Egyptian tradition. Gradually, it was enriched by new materials and methods, learned from the Persians, the Phoenecians (Cartagans) and Hebrews. They used styrax, cinnamon bark, cloves, vetiver root, a rose oil obtained by maceration (in oil or wine) or pressing of blossoms, and probably quite a few other materials, including the highly popular nard, the nature of which has not been established with certainty.

It is certain that the art of perfumery in antiquity, having originated in the Orient, was based exclusively on sweet- and sultry-smelling materials and that the intended odor effect was an erotic one. In the later development of perfumery, this tendency remained until, towards the end of the Middle Ages, the Italian Farina invented Eau de Cologne and gained world fame with this first refreshing and not directly erogenous product.

Since this time, perfumers have developed a number of other toilet waters that are primarily refreshing for the purpose of masking anti-erogenous odors, such as lavender water and Portugal water. The basic tendency of perfumery, to achieve erotic effects with its products, has, however, remained unaffected.

It is important at this point to draw a clear distinction between perfumery as such and the closely related field of cosmetics, and within cosmetics between beauty products on the one hand and skin-care products and toiletries on the other. Fragrances aiming exclusively at the masking of anti-erogenous odors without any direct erogenous effect are possible only in skin-care products. The scenting of bath salts with coniferous oils, of oral products with peppermint oil and similar materials, of creams, skin oils, talcum powder as well as skin and hair tonics with fresh smelling, highly volatile materials such as lavender oil, lemon oil, petitgrain oil, citral, cineol, etc. are cases in point. It is worth noting that the Greeks and Romans of antiquity were already familiar with the use of lemons, anis, peppermint, balm mint, rosemary, sage, cardamom, pepper, laurel leaf, cherry-laurel, etc. We may assume that these were used primarily for adding savor to foods but it is probable that they were also used for the perfuming of skin-care products.

Cosmetic beauty products, like true perfumes (extraits, eaux de toilette), always require at their core a base with erotic effect, although they often also contain fresh components which may even dominate initially. Such materials that are not directly erotic may be used in cosmetics for any one of several reasons:

1. to achieve a refreshing effect
2. as part of a given odor complex, especially in the imitation of natural flower odors
3. to mask the odor of the product base (e.g. alcohol)
4. to permit an unfettered experience of the perfume's principal notes by masking odors of the body or garments (this also explains the popularity of the Eau de Cologne complex as a component in eaux de toilette)

5. to provide or improve the perfume's top note (initial odor impression)
6. to stress sultry effects through contrast
7. to lessen sultry effects by counteraction.

These are the reasons why nearly every perfume composition in practice contains materials that do not possess an erotic function. While, however, a perfume without fresh components is perfectly imaginable, a perfume, eau de toilette or the fragrance of a cosmetic beauty product without an erotic component would be experienced as incomplete and would certainly be generally rejected as being 'empty', 'insipid', 'uninteresting' or 'lacking in character'. Even Eau de Colognes must, for this reason, contain the clearly erogenous neroli note along with their refreshing components. Other modifiers of the Eau de Cologne complex with the same function are rose oil, jasmine and orange flower absolute, etc.

In the composition of lavender waters it is also impossible to do without erotically active components such as ambergris, musk, civet, clary sage or certain flower oils and other sultry perfume materials. In lavender perfumes the sultry non-lavender note is usually stressed to such an extent that it is incorporated in the perfume's name or a fantasy designation is used in which the word 'lavender' does not even occur. Examples in point are Lavande ambrée or Fougère, the latter being a variant of lavender (fougère is the French word for fern and ferns are practically odorless or possess odors which have nothing to do with the fragrance type named after them). In both of the examples named, neroli oil, rose oil, jasmine absolute, clary sage oil, ambergris, musk and civet are used as 'erotic' components.

The author is confident that the term 'erotic', when used in this connection, will be properly understood by the reader. In view of the importance of the relationships between eroticism and perfumery, however, it appears fitting to define here those common expressions from the psychologist's vocabulary that will be frequently used in what is to follow.

Sexuality is the totality of characteristics and reaction patterns through which the sexual nature of the individual manifests itself. It is the biological link between the individual and the community, and links the biological interests of the individual (self-preservation) with those of the species (preservation of the species, procreation). It is tied to the polarity masculine–feminine.

Eroticism, which in a larger sense includes the entire universe of bodily and spiritual sexual experience, is here taken to mean the sensual and spiritual love life, in contrast to sexuality which in the sense of the procreation drive aims at the bodily coupling of the sexes.

Sexuality can therefore be found in all living beings, with the exception of the most primitive ones that procreate non-sexually; eroticism is a strictly human feature.

Erogenous simply means 'arousing sexual desire'. Impressions or sensations

registered by the senses of sight, hearing, smell or touch, and hence directly experienced, may be erogenous.

The only sense that never elicits erogenous impressions, at least in man, is the sense of taste. This may be taken as proof that the arousal of one drive may render influences from the other one inactive. The use of alcoholic beverages, pungent spices or special drugs (aphrodisiacs) never has an erogenous effect triggered by the direct sensual impression (taste or aroma). These substances act either through purely mechanical stimulation (e.g. the end of the urinary tract in the sexual organ) or by a chemical–physiological mechanism (the stimulation of certain glands, hyperemia of the sexual organs). Substances that elicit such effects are designated as 'erotically active'.

Thus, pure sense experiences may be said to be erogenous while substances absorbed by the body have erotic activity. These observations lead to the conclusion that the mechanism of odor sensations is a borderline case. The fact that chemically active agents (odorants) are involved and that these must react directly with the olfactory organ to generate a sensation points to erotic activity when erotically stimulating materials are smelled. On the other hand, the speed of reaction, that is, the rapidity with which the taking-in of the odor by the nose is followed by the sense of pleasure, contradicts any assumption that the feeling of pleasure must be mediated by the action of some inner organ.

If air laden with sufficient amounts of odorant is breathed in, the corresponding odor sensation and with it perhaps an erotic effect are nearly instantly elicited. The effect of ingested erotically active substances (aphrodisiacs), on the other hand, takes minutes or even hours to develop. Summarizing these remarks, we might state that odorous materials or perfumes should be classified as 'erotically active' or simply 'erotic' due to their material nature and to the necessity of bodily absorption before a reaction takes place, yet their effects must be designated as 'erogenous' because of the rapidity with which the intake of the odor is followed by the sensation*.

A classification of perfume materials into 'erotic' and 'not erotic' ones, analogous, say, to alkali-stable and not alkali-stable ones, would be a matter both of great scientific interest and of the highest practical importance for the perfumer's work. In addition it would be desirable, having defined the appropriate unit, to determine the erotic power of individual materials, even if only in a relative sense. The author has attempted to develop such a characterization of perfume materials but because of the difficulties encountered the experiments and observations have not yet progressed beyond a preliminary stage, and the results of the experiments and observations are as yet rather sparse and imperfect.

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* Where the expression 'erotic effect of perfume materials' appears in this text (e.g. in Chapter 18), it refers to *all* of the possible effects and includes, along with the erogenous effect, the narcotic, calming, anti-erogenous effects, etc.

The main difficulties in arriving at clear judgements regarding the effects of odorants stem from the high degree of dependence of erotic sensations on the momentary bodily and spiritual disposition of the observer. Time of day, season, temperature, lighting conditions, etc. are external circumstances; physical or mental fatigue, freshness, satiety or hunger, happy or depressed mood, etc. are personal predispositions which can critically affect the receptivity for and the judgement of external stimuli, especially in the case of odors.

An additional difficulty arises from the fact that the same external stimulus elicits an erotic reaction in some people and a quite different one in others. It was found that with odor impressions in particular, associations of thought are important and may interfere. Thus, one person reacted to neroli oil with a vivid recollection of travels to Italy, another could not rid himself of thoughts of the dentist when smelling even traces of eugenol, a third person was reminded of her mother by each lavender note, etc. A particularly troublesome and rather frequent phenomenon is the association of a perfume material or composition with perfumed soap.

Apart from such interfering factors of personal origin, the materials to be judged caused considerable difficulties in some cases. These difficulties did not, as in the cases above, arise from the transmission of sensations to consciousness and in their registration, but they made characterization of the effect of individual materials impossible in other ways. Some materials, for example, were judged quite differently in undiluted or highly concentrated form than in dilute solution. This was the case with α-ionone, methyl anthranilate, tetrahydromethyl quinolin, orris oil, patchouli oil, castoreum and others. With some essential oils and absolutes the initial odor impression and the base note observed at the end of the evaporation period elicited very different effects, and the great majority of defined synthetic odorants was ruled out for erotic effects if their odor was found to be 'chemical', 'dry' or 'empty'.

After many attempts a method of investigation was found that built on the familiar experience that it is far more difficult to describe an odor in an absolute sense than it is to describe an impression by means of a comparison. Two experienced perfumers and the author conducted the tests in the following way. Each of the three was given two samples of an Eau de Cologne Russe, a Fougère, a gardenia or a 'Quelques Fleurs' type fragrance. One of the samples contained a single additional material at a level that was just sufficient to create a clearly noticeable difference. Each tester then had to decide by comparison which of the two could be characterized as 'more erotic in effect'. The judgements were made and recorded by each person individually.

The two samples of each pair were coded with a common number but the pure sample was marked with the suffix 'O' and the sample with the addition of the test material marked 'X'. The testers classified each sample 'A', 'E' or '?' according to the following definitions:

A: The added material could be characterized as 'anti-erogenous' or the odor of the original composition was judged 'more strongly erotic'.
E: The added material had increased the erotic effect and the odorant in question was considered to be 'erotic'.
?: The difference in odor (the level of the added substance was raised until the tester clearly noted this difference) was not experienced as a clear difference in erotic effect so the added perfume material could be regarded as neutral in the erotic sense.

Because the effects of the materials investigated differed in distinctiveness or were more or less clearly registered, the testers had to distribute 10 points in each comparison. The test results are presented in Table 3.1. The scores listed were obtained by averaging the three scores obtained. The complexes used as a basis for comparison are indicated for each material.

Table 3.1 The erotic effects of perfume materials

	E	A	?	Complexes
Essential oils				
Alant oil	9		1	G
Ambrette seed oil	10			EdC, F, G
Angelica root oil		10		F
Basil oil, sweet	6	1	3	F
Bay oil	4	2	4	EdC
Bergamot oil	1	7	2	QF
Bergamot oil	2		8	EdC
Bergamot oil	2	5	3	F
Birch tar oil, rect.	8	2		F
Birch tar oil, rect.	10			EdC
Calamus oil		8	2	F
Camomile oil, roman	10			F, QF
Cananga oil		5	5	QF
Cardamom oil		9	1	QF
Cardamom oil	2	8		F
Carrot oil	7	1	2	QF
Carrot oil	8	2		G
Cascarilla oil	5	5		F
Cassia oil	9		1	F
Cedarwood oil	3	4	3	F
Celery seed oil	1	8	1	F
Celery seed oil	6	3	1	QF
Cinnamon bark oil, Ceylon	10			EdC, F, G, QF
Clary sage oil	1	8	1	G
Clary sage oil	3	5	2	F
Clary sage oil	8	1	1	EdC
Clove bud oil	10			F, G, QF
Coriander oil	2	7	1	EdC
Coriander oil	8	2		F
Costus root oil	10			G, QF
Cumin oil	7	3		F
Cypress oil		9	1	F
Cypress oil, terpeneless	10			EdC, F
Geranium oil, African	1	8	1	QF

Table 3.1 (*contd.*)

	E	A	?	Complexes
Geranium oil, African	8	1	1	F
Geranium oil, African	10			EdC
Geranium oil, bourbon	6	2	2	F
Geranium oil, bourbon	10			EdC, QF
Ginger root oil	5	5		F
Helichrysum oil	8	2		QF
Helichrysum oil	10			EdC, G
Hysop oil	1	8	1	EdC
Hysop oil	5	3	2	F
Labdanum oil	8	2		F, QF
Labdanum oil	10			EdC, G
Lavender oil		10		F
Lavender oil	4	4	2	EdC
Lemon oil		8	2	QF
Lemon oil		10		EdC
Lemon oil		7	3	G
Lime oil		10		F
Lime oil	1	7	2	EdC
Lovage oil	10			F
Mandarin oil		9	1	F
Mandarin oil	7		3	G
Mandarin oil	10			EdC
Myrrh oil		10		F
Neroli oil		10		G, QF
Neroli oil	2	7	1	F
Neroli oil	10			EdC
Nutmeg oil	7	3		F
Orange oil, bitter		10		EdC, F
Orange oil, sweet		10		F, G
Orange oil, sweet	8		2	EdC
Origanum oil		10		EdC, F
Orris oil	6	2	2	G, QF
Orris oil	8	2		F
Palmarosa oil	3	3	4	G
Patchouli oil	10			F
Petitgrain oil		10		EdC, F, QF
Pimento oil	7	3		F
Rose oil, bulgar.	8	2		QF
Rose oil, bulgar.	10			EdC, F, G
Rosemary oil		10		EdC, F
Rosewood oil, cayenne	3	4	3	F
Rosewood oil, cayenne	2	6	2	G
Rosewood oil, cayenne	3	3	4	QF
Rosewood oil, cayenne	8		2	EdC
Rue oil		10		F
Rue oil	7	3		G
Sandalwood oil, Australian	4	3	3	F
Sandalwood oil, East Indian	8		2	F
Sandalwood oil, East Indian	10			G, QF
Silver fir oil		10		F
Spearmint oil		10		EdC, F
Spike lavender oil		10		EdC, F
Styrax oil	10			EdC, F, G, QF

(*contd.*)

Table 3.1 (*contd.*)

	E	A	?	Complexes
Thuja oil		10		F
Thyme oil		10		EdC, F
Vetiver oil, bourbon		10		F
Ylang-ylang oil	7	1	2	F
Ylang-ylang oil	10			EdC, G, QF
Extracts, resinoids				
Ambergris	10			EdC, F, G
Benzoe	10			EdC, F, G, QF
Broom absolute	10			QF
Carnation absolute	2	4	4	G
Carnation absolute	8		2	QF
Cassie absolute	2	8		QF, G
Cassie absolute	4	2	4	F
Castoreum	10			F
Cistus-labdanum	3	7		F
Cistus-labdanum	5	5		G
Civet	10			F, G, QF
Elemi		10		F, G
Fleurs d'oranger absolute	5	5		F
Fleurs d'oranger absolute	6	3	1	G
Fleurs d'oranger absolute	8	1	1	QF
Fleurs d'oranger absolute	10			EdC
Galbanum		10		F
Hyacinth absolute	2	8		QF
Hyacinth absolute	4	6		G
Jasmine absolute	10			EdC, F, G, QF
Jasmine absolute Chassis	10			EdC, F, G, QF
Jonquil absolute	10			G, QF
Labdanum, brown	10			F, G
Lavender absolute		10		F
Mimosa absolute	5	2	3	QF
Musk tonquin	10			EdC, F, QF
Oak moss absolute	4	5	1	F
Oak moss absolute, decolorized	8		2	F
Olibanum	10			G, QF
Opoponax	2	3	5	F
Orris resinoid	3	2	5	G
Orris resinoid	7		3	F
Orris resinoid	10			EdC
Patchouli resinoid	5	5		F
Peru balsam	10			F, G, QF
Rose absolute	8		2	F, G
Rose absolute	10			EdC, QF
Styrax	10			EdC, F, G, QF
Tolu	10			EdC, F, G
Tonka	5	2	3	F
Tonka	8		2	G
Tuberose absolute	10			G, QF
Vanilla	10			F, G, QF
Verbena resinoid		8	2	G
Verbena resinoid	9	1		EdC
Violet leaf absolute	2	6	2	QF
Violet leaf absolute	6	2	2	G

Table 3.1 (*contd.*)

	E	A	?	Complexes
Aroma chemicals				
Acetophenone	3	5	2	F
Alcohol C8 (octyl)	10			QF, F
Alcohol C9 (nonyl)	10			G, QF
Alcohol C10 (decyl)	2	4	4	G
Alcohol C10 (decyl)	6	1	3	EdC
Alcohol C11 (undecyl)	4	6		G, QF
Alcohol C11 (undecylenic)	2	8		G, QF
Alcohol C12 (lauric)	4	6		QF
Alcohol C12 (lauric)	8		2	G
Alcohol C12 (lauric)	10			EdC
Aldehyde C8 (octyl)		10		QF
Aldehyde C8 (octyl)	5	5		G
Aldehyde C8 (octyl)	8	2		F
Aldehyde C8 (octyl)	9	1		EdC
Aldehyde C9 (nonyl)	10			EdC, G, QF
Aldehyde C10 (decyl)		10		F, G
Aldehyde C10 (decyl)	5	5		EdC
Aldehyde C11 (undecyl)	8	2		G
Aldehyde C11 (undecyl)	10			F
Aldehyde C11 (undecylenic)	7	3		G
Aldehyde C11 (undecylenic)	10			F
Aldehyde C12 (lauric)	10			EdC, G, QF
Aldehyde C12 MNA	10			EdC, F, G, QF
Aldehyde C14 (so-called)	10			G, QF
Aldehyde C16 (so-called)	10			G, QF
Aldehyde C18 (so-called)	10			F, QF
Ambrettolide	10			EdC, F, G, QF
Amyl cinnamic aldehyde		5	5	G
Amyl cinnamic aldehyde		10		F, QF
Amyl salicylate	10			F, QF
Anisic alcohol	5		5	QF, G
Anisic aldehyde		10		QF
Anisic aldehyde	6		4	F
Anisyl acetate		10		F, QF
Benzaldehyde		6	4	QF
Benzyl acetate		5	5	G, QF
Benzyl acetate			10	F
Benzyl acetate	5		5	EdC
Benzyl butyrate	10			G, QF
Benzyl isoeugenol	10			EdC, G, QF
Benzyl propionate			10	QF
Benzyl salicylate	10			EdC, F, G
Borneol		10		F
Bornyl acetate		10		F
Bourbonal	10			F, G, QF
Bromstyrol	3		7	QF
Cinnamic acid esters	10			EdC, G, QF
Cinnamic alcohol	10			F, G, QF
Cinnamic aldehyde	10			F, G, QF
Citral		10		EdC, F, QF
Citronellal		10		EdC

(*contd.*)

Table 3.1 (*contd.*)

	E	A	?	Complexes
Citronellol		2	8	G, QF
Citronellol L	10			G, QF
Citronellyl acetate		10		EdC, G, QF
Coumarin	3	3	4	F
Coumarin	8		2	G
Cyclamen aldehyde		10		G, QF
Dihydrojasmone	8		2	G
Dihydrojasmone	10			QF
Dimethyl anthranilate	7		3	G
Dimethyl anthranilate	10			EdC
Dimethyl benzyl carbinol	10			G, QF
Dimethyl benzyl carbinyl acetate		10		G, QF
Dimethyl hydroquinone	10			F
Eugenol	10			F, G, QF
Eugenol methyl ether	10			F, G
Exaltolid	10			EdC, F, G, QF
Geraniol		10		F, G
Geraniol			10	QF
Geranyl acetate		10		G, QF
Geranyl butyrate	10			G, QF
Heliotropine		8	2	QF
Heliotropin	5		5	F
Heliotropin	10			G
Heptine carbonic acid methyl ester		10		G, QF
Hydratropic aldehyde			10	G, QF
Hydrocinnamic alcohol	10			G, F, QF
Hydrocinnamic aldehyde	10			G, F, QF
Hydroxy citronellal			10	G, QF
Hydroxy citronellal	10			EdC
Indol	10			G, QF
Ionone, 100%		3	7	QF
Ionone, 100%		10		G
Ionone, alpha	6		4	G
Ionone, alpha	10			QF
Ionone, beta		10		F, QF
Ionone, beta	2	4	4	G
Isobutyl quinolin		10		F
Isobutyl salicylate	10			F, QF
Isoeugenol			10	F
Isoeugenol	5		5	G
Isoeugenol	10			QF
Isoeugenol methyl ether	10			F, QF
Linalool		4	6	G
Linalool			10	F
Linalool		10		QF
Linalool	5		5	EdC
Linalyl acetate		10		F, G
Linalyl acetate			10	EdC (without neroli oil)
Linalyl butyrate	3	2	5	F
Linalyl butyrate	5		5	G
Linalyl butyrate	10			EdC
Linalyl propionate			10	F, G
Linalyl propionate	3		7	EdC
Methoxy acetophenone	1	4	5	QF

Table 3.1 (*contd.*)

	E	A	?	Complexes
Methyl anthranilate	10			EdC, QF
Methyl hexyl acetaldehyde		10		G
Methyl ionone, 100%		8	2	QF
Methyl ionone, 100%	2	5	3	G
Methyl ionone, 100%	7		3	F
Methyl ionone, delta (H&R)	7		3	F
Methyl ionone, delta (H&R)	10			G, QF
Methyl ionone, gamma	5		5	F
Methyl ionone, gamma	8		2	G
Methyl ionone, gamma	10			QF
Methyl naphthyl ketone	10			EdC, G
Methyl salicylate	1	8	1	F
Methyl salicylate	10			QF
Musk ambrette	10			EdC, F, G, QF
Musk ketone	10			EdC, F, G, QF
Musk xylol	10			EdC, F, G, QF
Nerol	10			EdC, G, QF
Para-cresyl acetate	10			QF
Para-cresyl methyl ether	10			G, QF
Para-cresyl phenylacetate	10			F, G
Para-methyl quinolin	10			F, G
Phenyl acetic acid	10			G
Phenyl ethyl acetate	5	1	4	G, QF
Phenyl ethyl alcohol	10			EdC, G, QF
Phenyl ethyl butyrate	10			G, QF
Phenyl ethyl formate	10			G, QF
Phenyl ethyl isobutyrate	10			G, QF
Phenyl ethyl propionate	6		4	G
Phenyl ethyl propionate	10			QF
Phenylacetaldehyde		1	9	G
Phenylacetaldehyde	2		8	QF
Phenylacetaldehyde dimethyl acetal		10		G, QF
Rhodinol	4	1	5	G
Rhodinol	7		3	QF
Rhodinol	10			EdC
Santalol	7		3	F
Santalol	10			G
Styrolyl acetate		10		G, QF
Terpineol		10		G, QF
Tetrahydromethyl quinolin	10			F
Vanillin	10			F, G, QF
Vetiverol		2	8	F
Vetiverol	8	2		G
Vetiverol	10			QF
Vetiveryl acetate	5	3	2	G
Vetiveryl acetate	5	5		F
Vetiveryl acetate	8	2		QF

Key: E, erogenous; A, anti-erogenous; ?, erotically neutral.
G, gardenia; EdC, Eau de Cologne; F, Fougère; QF, Quelques Fleurs.

Only the most important and most interesting perfume materials have, so far, been tested in this way. Some of the collected judgements were valuable because of their unanimity or the clear patterns they revealed. With many materials, however, the differences in individual judgements made an unambiguous characterization impossible.

The first thing that is noticed on critical examination of the table is the fact that the effect of most perfume materials is specific in the sense that it depends on the complexes in which the perfumes are employed. If, for example, neroli oil is judged to be erotic when used in the Eau de Cologne complex but anti-erogenous in a gardenia or Quelques Fleurs composition, this can easily be explained by the observation that this essential oil is in the first case the most sultry, least volatile component of the entire odorant blend while gardenia and Quelques Fleurs are characterized by complexes that are far more sultry, sweet and long-lasting. Hence neroli oil acts in these cases as a relatively fresh component, i.e. anti-erogenous. Similar phenomena can be observed in the case of verbena extract in Eau de Cologne or gardenia, respectively, and, more or less distinctly, in several other cases.

It is more difficult to explain findings such as occur with heliotropine, which in the gardenia complex is considered erotic by all judges yet in quelques fleurs is experienced as anti-erogenous in 8 out of 10 cases and as neutral in the remaining 2, or with isoeugenol, unanimously characterized as erotic in Quelques Fleurs but neutral in Fougère. An explanation for these cases, which are far from unique, can be found by studying the perfume materials that are variable in their effects when in conjunction with specific components (single odorants or complexes) of the perfumes in question.

In the gardenia complex bergamot oil, linalool and benzyl acetate play an important role along with styralyl acetate and the higher fatty aldehydes. The addition of heliotropin to these materials has a distinct sweetening as well as a fixing effect which explains the erogenous effect of heliotropin in these cases. In the Quelques Fleurs complex heliotropin acts as a freshening agent to the rose and jasmine complexes which are dominant.

Isoeugenol lends a sultry, sweet–spicy note to the rose–jasmine complex in this same perfume and is therefore characterized as erotic. In Fougère, this effect is overshadowed by components which are, in and by themselves, sultry and heavy, such as oak moss, patchouli, synthetic musks and sandalwood, and by the sweet–aromatic coumarin. Hence the neutral effect of isoeugenol in this context.

These experiences and considerations led to the idea of testing the effect of the individual perfume materials not in perfumes but with other defined odorants. In place of the complexes on which the earlier tests had been based, linalyl acetate, geraniol, hydroxy citronellal, phenyl ethyl alcohol, santalol, benzyl salicylate and cinnamic alcohol were used, and the evaluations were conducted in the same fashion as with the perfume complexes, i.e. by comparison.

Several problems soon became apparent. The laymen participating in the evaluations whose judgements were, for obvious reasons, considered particularly valuable, found nearly all samples to be rather unpleasant and fatiguing, and hence felt unable to provide the subtle observations required. Another problem which was also experienced by the expert (the perfumer) was caused by the differences in volatility between the test and base materials. Because of these differences a complex unified odor impression, a true blending of the odors, occurred only in rare cases and even then only for a short time. Experiments in which essential oils and extraction products were used in place of single chemical entities offered better possibilities for observations but remained far inferior to the tests with perfumes.

The difficulty or even impossibility of obtaining good results with essential oils, extracts or single chemicals is the more regrettable because the work with perfume compositions has the great disadvantage that each designation, 'Eau de Cologne', 'Fougère', 'gardenia' and 'Quelques Fleurs' defines a certain range of perfumes without being absolutely unequivocal in a perfumery sense. Within each of these complexes different interpretations are possible and the different variants may in many cases lead to different results in the characterization of added materials. Thus, the effect of an odorant in the Eau de Cologne complex may be decisively affected by the question of whether the citrus note or the neroli note is dominant in the complex. In the Fougère complex the emphasis may be on the fresh lavender note, the heavy woody components (sandalwood, patchouli, oak moss, etc.) or may be more neutral thanks to the lavish use of coumarin. Bergamot oil may lighten the complex; musk, civet, labdanum, etc. may make it more sultry. In the gardenia complex the effect of the materials tested depends, among other things, on the level of the higher fatty aldehydes. The Quelques Fleurs complex, usually characterized by a strong muguet note, may be made more sweet by an emphasis on rose and jasmine, made softer or more fresh by violet or lilac, or made more sultry by the use of orange flower, tuberose or carnation. Due to this latitude of variation within a given complex, the degree of erogenous action can vary considerably as will its relation, with respect to erogenous effects, to the added material to be characterized.

All of these difficulties could be avoided if fixed complexes, clearly defined by a given formulation, were consistently to be used in the investigations. This, however, was purposely avoided since practical experience showed that variations within a given type are necessary to make the effects of the added materials more distinct. To observe the effect of neroli oil, for instance, an Eau de Cologne complex with a distinct neroli note would not be suitable. For this investigation an Eau de Cologne without neroli, actually an incomplete Eau de Cologne, was therefore used. To investigate the effect of coumarin a Fougère complex without coumarin was employed. Similarly, the effects of musk ambrette, patchouli oil, vetiver oil, etc. were observed in Fougère complexes that did not contain the materials in question. In other words the

investigation of the effect of materials that make up an essential part of a complex was conducted by comparing a complex made incomplete by omitting this material from the completed complex. In this way, the effect of many important perfume materials could be clearly demonstrated.

In testing certain materials that closely approach basic components of a complex in their odor effect, these basic components were – to the extent that this was possible while maintaining the fundamental character of the complex – reduced to a minimum or omitted altogether. This approach, to adjust the base to the specific material tested, not only facilitated the observations but was necessary in many cases to make them possible at all. The effect of benzyl salicylate, for instance, could be observed only in complexes that contained neither amyl nor isobutyl salicylate. The investigation of the effect of benzoe resinoid was made nearly or entirely impossible by the presence of vanillin, that of geraniol by citronellol, that of anisic alcohol by heliotropin, etc. In other cases, however, the effect of individual perfume materials was made far more distinct by the presence of materials of similar odor character. Examples of this type were the higher fatty aldehydes, the different synthetic musks, coumarin with dimethyl hydroquinone, cyclamen aldehyde with hydroxy citronellal, and others.

For these reasons, the basic complexes were always varied in ways designed to make the effects of the materials tested as distinct as possible. The standardization of the complexes by using one fixed formula was abandoned. In fact, the complexes Eau de Cologne, Fougère, gardenia and Quelques Fleurs were chosen because they permit a wide range of variation.

The method of comparison within the context of a fragrance composition led, for the great majority of perfume materials, to the observation by the testers of a positive or negative erotic effect even if it rarely led to total unanimity. This intriguing phenomenon certainly deserves further study, especially with a view to removing the flaws and ambiguities inherent in the data generated thus far. In such future studies, it will be essential to become thoroughly familiar with the notion of 'odor effects', which must be clearly distinguished from the concepts of 'odor' or 'odor sensation'. A more precise definition of these concepts, their relation to one another and the differences between them will be given later (Chapter 11) but first some clarifying notions must be introduced. Here it is necessary only to state briefly that 'odor' is considered to be a sense perception which can generate certain psychological or physical reactions designated 'odor effects'. The guidelines for future tests, derived in part from the flaws and limitations of the method described above, are as follows:

1. The tests conducted thus far have yielded relative values for the individual perfume materials; that is, their erotic effect was established in relationship to a complex that was tested at the same time. The goal must be to obtain absolute measures of odor effects.

2. In many cases, including important and frequently used materials such as the absolutes of cassie blossoms, oak moss, orange flowers, lavender oil, coumarin and vetiveryl acetate, the judgements of different testers directly contradicted each other. This phenomenon could be explained only by supposing that certain types of effect are considered to be erotic by some people but anti-erogenous by others and are therefore probably neither the one nor the other.
3. The supposition that some effects are neither distinctly erotic nor directly anti-erogenous finds further support in the observation that some materials whose odor is quite characteristic, such as benzyl acetate, benzyl propionate, citronellol, geraniol, hydroxy citronellal, isoeugenol and linalool, were judged to be 'neutral' in effect by the majority of judges. The question of whether odorants might not elicit effects in the erotic realm in addition to the directly erotic and opposite effects should be investigated. If such effects exist, it would be desirable to characterize them as clearly as possible.
4. Where erotic effects are found, the question arises of whether they are physiological or psychological in origin. The answer might, in doubtful cases, provide clues regarding the type of effect produced by individual perfume materials.
5. Leaving aside purely individual differences in odor sensation that can be traced to personal idiosyncrasies, the generally recognized 'objective' effects are probably the result of biochemical processes; this means that the chemical structure of the perfume materials must play a crucial role here. An understanding of the relationship between the chemical nature of materials and their odor effects would be of great interest indeed.

In summary, the objectives of our continuing investigations must be:

1. to establish what are the basic types of odor effects
2. to explore which perfume materials elicit them
3. to determine the relationship between the chemical nature of odorants and their odor effects.

In the sections that follow an attempt will be made to achieve these objectives by drawing on physiological and psychological experiences in the field of perfumery, always with our ultimate aim in view: to attain a deeper understanding of the relationship between the effects of perfume materials and their blends, and the lovelife of man.

4 The sense of smell and sexuality

The investigations of the erotic effect of perfumery materials or of perfume compositions could succeed only to the extent that the evaluators were able to judge to which of two perfumes a stronger erotic effect could be ascribed. It turned out that those concerned could, after having received some brief comments regarding the purpose of the test, intuitively orient themselves and give usable judgements which were, of course, purely subjective. Since it was the author's intention that the comparisons be conducted on an intuitive basis, scientific arguments regarding the physiological and psychological conditions and relationships required for the generation and recognition of an erotic sensation were not given. However, knowing these conditions and relationships is interesting not only for its own sake but also because it provides the basis for an understanding of any observed erotic or anti-erogenous effects of perfumes or perfume materials.

It is commonly known that commercial 'perfumes' are solutions of mixtures of different odorous materials. Less generally known is the fact, only recently established, that the great majority of the natural scents of flowers, herbs, fruits, woods, etc. are also the result of the harmonious blending of individual chemical substances, most of which have been identified and some of which can even be synthesized. These substances are commonly called 'aroma chemicals'.

A systematic use of raw materials requires not only knowing them in terms of their properties and functions, it also requires, or is at least greatly facilitated by, a classification into a manageable number of groups characterized by common features. Several investigators have attempted to characterize the basic constituents of all natural and man-made fragrances by means of a small number of fundamental odor descriptions so that they can then be classed into groups.

Rimmel classified 57 of the essential oils and extracts known to the perfumers of his day (with the exception of mirbane oil (nitrobenzene) no synthetic aroma chemicals were then known) into 18 odor classes. In his book *Die Physiology des Geruchs* (1895), Zwaardemaker distinguishes 14 different fundamental odors. Henning (1916) postulated 6 basic odors: 'spicy','flowery', 'fruity', 'resinous', 'burnt' and 'foul'. In recent times, Crocker and Henderson (1927) believed they could make do with 4 basic odors: 'fragrant', 'acid', 'burnt' and 'caprylic'.

Zwaardemaker (1895), Henning (1916) and Crocker and Henderson (1927) designate some odor classes as pleasant and others as unpleasant, which in the psychological sense means eliciting feelings either of pleasure or of aversion.

P. Jellinek, *Psychological Basis of Perfumery*
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Zwaardemaker counts the odors of his class VII, the 'caprylic' or 'goaty' odors (odores hircini linne) and of his class IX, the 'nauseating' odors (odores nauseosi linne) among the unpleasant ones. In Henning's classification, the unpleasant odors belong to the 'foul' group, in Crocker and Henderson's to the 'acid' and 'caprylic' groups.

There can be no doubt that the odors characteristic of the human body and all of their components must be assigned to the above groups of unpleasant, i.e. aversion-generating, odors. On the other hand, it is an equally established fact of human experience, known throughout history, that 'the scent of the beloved one's body stimulates love'. Not only have the poets of all ages and cultures praised this 'scent magic', the erotic effect of human body odor has also been scientifically established by renowned scientists, e.g. by Haeckel in his *Anthropogenie oder Entwicklungsgeschichte des Menschen.* In his *Beiträge zur Ätiologie der Psychopathia sexualis*, Bloch concludes that 'odor sensations are the prime factor in the genesis of sexual attraction and its ultimate cause'. To arrive at an explanation of the clear contradiction inherent in the fact that the odors of the human body, demonstrably unpleasant and aversion-generating, can elicit the greatest sexual pleasure, a critical observation and analysis of the causes and effects involved is needed.

4.1 Personal odor

Löhner (1924a, 1926), discussing the odorous aura emanating from a clothed human being, observes that this 'total odor' consists of two components, the 'personal odor' and 'variable incidental odors'. The personal or 'endogenous' odor is defined as the 'individual odor, noticeable from some distance, of the clean naked body'. It in turn is composed of the 'regional odors', which are 'the odor emanations of the individual regions of the body, to be observed from nearby'. Löhner's remarks in a discussion of 'the sexual role of the human regional body odors' (Löhner, n.d.) are highly interesting:

> 'The various parts of the body of a given individual produce odors that differ both in quality and quantity. Depending on the site of origin, the skin surface and its appendages or the body's orifices, two groups, "skin odors" and "orifice odors", can readily be distinguished. The differences between the odors of different regions are quite considerable. If persons with an acute sense of smell conduct tests according to the patch method, in which woolen patches are worn upon certain body areas for some time, the body region can usually be recognized but not the individual. Whenever the odors are clearly perceived, it is possible to sort the patches by body regions but not to recognize which patches had been worn by the same person on different regions. This has led to the thesis that the difference between two different regional odors of the same person appears greater to the human nose than the difference between a given regional odor of two different individuals. Organ specificity outweighs individual specificity.

All relevant tests have confirmed that man is capable of distinguishing the different regional odors of an individual but that, in contrast to the dog, he does not analytically sense any component that is common to them all and that characterizes the individual (personal index)'.

Adopting the distinction between 'skin odors' and 'orifice odors' we can state at once that the odors detectable at the orifices of the human body cannot ever, as such, be considered erogenous. The outer ear, the eyelid, the nasal and oral cavities normally exude no perceivable odors. Such odors only occur as the result of pathological conditions or of the decomposition of soil or foreign substances. The oral cavity and the air exhaled through the mouth or the nose can also, at times, carry the odors of foods or beverages that have been consumed.

The mucilaginous secretion of the large intestine, which is found in the anal orifice and has the physiological function of lubricating the rectum, is when clean, practically odorless. Soil from traces of fecal matter which possess a scatol-like odor has, sexually pathological cases apart, a disgusting, repellant and highly anti-erogenous effect. In the urogenital region also, the orifice odors are not the ones that possess an erogenous function. Traces of secretions and excretions which may adhere to the urogenital orifices are often characterized by the trimethyl amine odor typical of the secretions of the vagina and the uterus. Traces of urine, on decomposing, cause an ammoniacal odor; the foreskin secretions cause cheesy odors. The odor of sperm has been compared to the scent of chestnut flowers, of berberis flowers and of cadaverine.

After the orifice odors of the skull, the anal and the urogenital region, Löhner (1924a, 1926) distinguishes five 'skin regional odors', those of:

1. the palm and sole surfaces of hand and foot
2. the trunk and the extremities
3. the scalp region and the beard
4. the axillary region
5. the pubic region.

This classification is useful in the context of the sexual effects of odors since it 'clearly demonstrates the close interrelations that exist between the distribution of sebaceous glands and the hair, of the most important sites of formation of odorous materials and the structures for their dispersion'.

The palm and sole region is characterized by the absence of both hair and sebaceous glands but is richly provided with sweat glands. The trunk–extremities region is furnished with glands of both kinds and sparse hair growth. The odor of these two hairless or sparsely hirsute regions is, with normal hygiene, scarcely noticeable. For the three regions with dense hair growth, the situation is quite different.

The hair of the scalp and the hair of the axillar and pubic regions, which appears only at puberty, possess not only a protective function against mechanical friction, cold and radiation but also serve as a device for drying: by

enlarging the surface they promote the evaporation of the skin gland secretion (Löhner, 1924b). Since in this way they also facilitate the diffusion of odorous substances, the densely hairy regions also serve sexual functions. Jäger, Bölsche, Schiefferdecker and other authors have drawn attention to these facts, indicating numerous analogous devices in the animal world that are 'designated as odor-spraying devices or odor brushes and whose relationship to the diffusion of sexually stimulating odors is established beyond doubt'.

Building on the investigation of Jäger, Hagen, in his *Sexuelle Osphresiologie*, stresses 'the generally known fact that the hairy parts of the human body exhibit stronger odor emanations than do the hairless ones, and that these odors stimulate desire'. A peasant saying goes: 'Where there is hair there is joy'. It is also generally acknowledged that very hairy persons have a much stronger odor than less hairy ones and that usually their erotic aura is stronger. Löhner has demonstrated that 'the regional odors of the three densely hairy regions are stronger than those of the hairless or faintly hairy ones. This is due to the particularly large number of sebaceous glands, proportional to the number of hairs, in these regions and to the density of hairs as odor diffusers.'

The regional odors of the skin can, as mentioned above, be readily distinguished from one another:

- The palm and sole areas are practically odorless due to the lack of hair and of sebaceous glands.
- The regional odors of the trunk and the extremities are, as a result of their sparse hair cover, relatively weak. They are strongly influenced by the odors from the adjoining densely hairy regions.
- The much more distinct odor of the three densely hairy regions is determined by odorants which Zwaardemaker (1895) assigns to Section A of class VII of his system, the caprylic, goaty odors (odores hircini linne), and by the saturated fatty acids with 4–9 carbon atoms, i.e. butyric, valeric, capronic, heptylic, capric and nonylic acid. Comparisons with cheese, rancid fat, sweat, decaying bones and myrtle complete the odor description.

The axillary odor is distinguished in particular by its sharp fatty acid nuance caused by the predominance of fatty acids with 4–7 carbon atoms. The pubic region is characterized by the odor of the higher fatty acids (7–9 carbon atoms). According to Löhner, it occasionally 'suggests class IV, the amber–musk odors (odores ambrosiaci linne)' of Zwaardemaker's classification. Possibly the sweeter and more sultry nuance referred to here, which the perfumer would characterize as 'animal', is actually the result of traces of materials produced by the adjacent urogenital orifice.

The regional odor of the hairy scalp is mild and rather unobtrusive in character. This may be due to the fact that the odorants that are formed here are far more exposed to the influence of light and air than is the case at the other hairy regions. This results in the rapid evaporation of the particularly

pungent lower fatty acids. In addition, it promotes the polymerization of lower fatty aldehydes formed in the decomposition of sweat and contained in the fatty secretion of the skin glands. As such, these aldehydes possess an unpleasantly pungent, rancid odor that is also an important component of 'perspiration odor'. The products of their polymerization , on the other hand, smell, if at all, far more mild and unobtrusive, in some cases even pleasantly sweet.

In summary, the regional skin odors rather than the orifice odors are the determinants of personal odor and they in turn are dominated both in their formation and their diffusion by the odors of the densely hairy regions.

In exploring the sexual effect of personal odor we must also bear in mind that this odor is distinctly influenced by clothing, which can effectively suppress the participation of each of the regional odors in the total complex. While the skin and orifice odors of the scalp and skull region are freely diffused in a normally clad person, the skin odors of the axillary region are suppressed as are, to an even greater extent, those of the pubes region and the regional odors of the urogenital and anal orifices. The 'total odor' of a clothed person is therefore largely determined by the odor of his scalp and his breath while the other components, filtered by garments, play a distinctly lesser role. Whatever specific designs the vagaries of fashion may dictate, a woman's evening dress nearly always leaves large parts of the body totally uncovered or at least more lightly covered than her daytime or working attire. Its erotic charm consists not only in revealing more of the body to the eye but also in the less obstructed diffusion of the scent of the female body. Liepmann presumes in his book *Psychologie der Frau* that the fashion of the decolleté had its origin in the particularly enticing effect of the scent of the nape of a woman's neck, in which the odor of her hair mingles with that of her skin. The creation of sleeveless garments which permit the free diffusion of the axillary odor probably has similar origins.

Dancing and embracing, patterns of courtship which can be found in the animal kingdom and which have persisted in civilizations up to our time, lead to increased scent diffusion due to raised body temperature. In a perceptive paper on 'neglected hormones', the psychologist Bethe (1932) has designated the erogenous odoriferous materials formed and diffused by the human body as 'hormones which, as messenger substances, induce important stimulant effects. While up to now attention has been paid only to those hormones that act within the organism itself and are nothing but products of metabolism, in nature an important role is played not only by these endo-hormones but also by externally active ecto-hormones. These are not used and broken down inside the releasing organism but are released to the outside, to affect other organisms in ways that are useful for the hormone-producing organism or for the species'.

Additional scientific support for the close relationship between eros and odor can be found in the fact, established by comparative anatomy and

neurology, that the oldest part of the cerebrum, the gyrus hyppocampi which serves the sense of smell, is directly connected to the gyrus formicatus which, according to Henning's findings, is concerned with 'sex life, reproduction, nutrition and excretion'. This purely anatomic relationship between sexual functions and odor sensations is confirmed by direct anatomic and physiological correspondences between the nose and the genitals. Pathological cases have often been observed and recorded in medical literature in which the various states of excitation of the sexual organs are regularly accompanied by changes in the physiological state of the nasal mucosa. Cases in which menstrual bleeding is accompanied or replaced by nose-bleeds or in which men suffer nose-bleeds at each intercourse are not at all rare; young men are even more often afflicted by a stuffed-up nose, etc. Of special interest in this connection are the reports by Fließ that menstrual as well as parturition pains can be relieved by touching specific sites of the nasal mucosa with cocaine.

The erotic sensitivity of the nose explains the popular belief that the size of the nose is indicative of that of the penis. It is in fact the case that in a large external olfactory organ the approach and absorption of odorous materials is facilitated. Accordingly, their effect is experienced more intensively and is expressed in a higher degree of sexual excitation. As Fischer (n.d.) points out, this increased excitation is further enhanced, in a self-reinforcing cycle, by the deepened and accelerated breathing which occurs during erotic stimulation causing an intensification of metabolism and a rise in body temperature which in turn leads to increased release of odorous materials and a heightening of their aphrodisiac effect.

It is a well-known fact that under some conditions the odorous materials produced and diffused by the human body can exert a powerful anti-erogenous effect, the natural utility of which can usually be readily explained. Apart from the nauseating effect of soil and the decomposition odors associated with it, the 'fishy' odor of trimethyl amine which occurs during menstruation is certainly intended to deter the male from disturbing the repose which the female sexual organs need during this period. Similarly, the distinct changes of personal odor which accompany a number of diseases may be regarded as natural repellents with the physiological purpose of ensuring that the afflicted is left alone. Examples of this kind are the odors indicative of acute infectious diseases such as scarlet fever, measles, typhoid fever, malaria, etc., the decomposition odors that emanate from the oral orifice as a result of catarrhal conditions or abscesses, the 'onion' odor of tuberculosis patients or the sweetish fruity odor, caused by acetone and acetoacetic acid, of diabetics.

Because of the possibilities for variation provided by the qualitative and, more important yet, by the quantitative differences in the odorous materials that may make up personal odor, the sharing of identical odor by different people is probably as rare as are true 'doppelgängers'. The dog's scent tracking ability is proof of this specificity of personal odor. Nevertheless, the human

species must usually make do with the ability to distinguish a small number of groups from one another by peculiarities in odor.

We are probably most clearly aware of the difference between the personal odor categories 'male' and 'female'. This is readily explained by the difference in regional odors of the urogenital orifice and the pubic region. In addition, because of the richer head hair growth and hair fashions, in most races and individuals, the odor of the scalp region accounts for a larger component of the total personal odor in women than in men.

Apart from the two odor categories based on sex differences, a distinct odor differentiation of the three human races ('caucasian' or 'white', 'mongolian' or 'yellow', 'negroid' or 'black') must be considered. Several authors have pointed to its existence and to the possibility of its detection. The most extensive discussions of this problem are to be found in Stoll's book *Geschlechtsleben in der Völkerpsychologie* (*Sex Life in the Psychology of Races*), in an investigation of the scent of Europeans by the Japanese physician Adachi (1903) and in a chapter entitled 'Le succès des négresses à Paris' in Galopin's book *Le Parfum de la Femme et le Sens Olfactif dans l' Amour*. The question of whether the odor of a foreign race is particularly erogenous or repellent shall be left unanswered here; it has given rise to conflicting reports and most contradictory judgements.

It is certain that the specific odor differences between the sexes are more pronounced than those between the races. This fact has been confirmed by several authors and was illustrated by a charming example given by Hagen in his book *Sexuale Osphresiologie:* the French girlfriend of the botanist Commerson who accompanied him on his travels, going ashore on a Pacific island was recognized by the natives as a woman by her scent in spite of the fact that she was dressed in men's clothing.

Within the white races it is, moreover, possible to distinguish between three personal odor groups which are clearly marked, especially among the females of the groups. Man as a visually biased animal prefers to use his sense of vision to collect knowledge about the world surrounding him as well as to describe this knowledge and to integrate it with prior experience. He also uses vision in his recollections and imaginings. Because of this, certain things are often characterized, compared, evaluated and perhaps classified according to their visual appearance, i.e. by characteristics such as size, form or color, even though the most pertinent characteristic that distinguishes them from similar things pertains to a different sense modality. The attribute or distinguishing trait observed by the eye is often only a secondary one, a consequence of a typical property occurring in a different sense modality, often not of necessity connected to this property and therefore not absolutely specific. We distinguish, for instance, white bread from brown bread, a distinction which literally refers to color but is in truth meant to convey a difference in taste. The difference in color between light and dark beer is used in designating the different types even though it is nothing but an incidental concomitant

phenomenon of the sweet taste determined by the malt content of the beverage. When the members of the caucasian race are classified by hair color into blondes, redheads and brunettes, it turns out that a specific hair color is usually associated with a certain appearance of the skin and with certain activity patterns of its organs, and therefore also with a specific type of personal odor.

However, just as the various natural basic hair colors can manifest themselves in a nearly infinite range of shades which by their subtle gradations blur the transition from one basic color to another, so also do the pure skin types in terms of physiological functions and personal odor exist only in theory. These pure types might be described as follows:

1. The skin of the *blonde* type (platinum blonde, golden blonde, dark blonde) has a pronounced pink component. In the personal odor, the two lowest members of the 4–9 carbon atom fatty acid range that occurs in human skin odor, i.e. butyric acid and valeric acid (with 4 and 5 carbon atoms, respectively) predominate with their odor reminiscent of cheese. The personal odor may hence be characterized as 'sour–cheesy' and is usually weak and unobtrusive.
2. The *redhead* type (Rubens blonde, fiery red, auburn) has a whitish skin tone often marked with darker spots (freckles) and a skin which is extremely sensitive. The personal odor is dominated by the two middle members of the fatty acid range, capronic and heptylic acid (with 6 and 7 carbon atoms, respectively) and their rancid–fatty odor. It may be characterized as 'pungent–burnt' and is very marked and penetrating.
3. The *brunette* type (dark brown, black brown, bluish black) has a skin color tending towards tan. The personal odor is characterized by caprylic and nonylic acids (with 8 and 9 carbon atoms, respectively) and is reminiscent of sweat. It may be designated as 'sweetish–rancid' and is usually more pronounced than that of blondes but less so than the redhead personal odor.

In summary, let us note once more that personal odor – defined as 'the individual odor of the clean unclad body from some distance' – is a composite of the regional odors of skin and orifices. This odor complex, the individual components of which are generally felt to be malodorous, can in its natural state of dilution be distinctly erogenous, an effect that, however, always remains highly personal.

4.2 Incidental odors

According to Löhner (1924a, 1926) (compare p. 23) the total odor of humans is formed by the personal odor and the variable incidental odors that accompany it. As was discussed in depth in the preceding section, the personal odor

owes its existence and its composition to certain biochemical processes that are specific to sex, race and to the individual. The incidental odors, on the other hand, are not naturally linked to the person to whom they adhere and from whom they emanate but become components of his or her total odor in an accidental and transitory manner or may be made part of it at will.

Löhner (1924a, 1926) also distinguishes between endogenous and exogenous incidental odors. The *endogenous* incidental odors are sometimes due to certain odorous substances which are ingested as part of foods, beverages, smoking or drugs and which are secreted unchanged. In other cases, metabolic or biochemical transformations may lead to the formation of odorous materials that were present as such neither in the body nor in the ingested matter. The endogenous incidental odors in which the ingested odorous substances occur unchanged are largely carried in the exhaled air and emanate from the oral and the nasal orifice. New or modified odorous materials are formed in the body after eating certain foods, such as mutton, cod liver oil, truffles, radish and asparagus, and affect various regional odors. The ingestion of drugs containing sulfur can lead to an odor reminiscent of rotten eggs (hydrogen sulfide), drugs containing phosphorous compounds or arsenic lend an obnoxious odor reminiscent of garlic. Roman ladies gave their urine a violet scent by ingesting turpentine which was transformed in the body to terpineol. With the exception of the last example, endogenous incidental odors are hardly ever pleasant, sometimes distinctly unpleasant and probably never erogenous.

The *exogenous* incidental odors are made up exclusively of odorous materials formed outside the body, although in some cases the starting materials for their formation are furnished by the body. As Löhner (1924a, 1926) correctly notes, the decomposition odors are of prime importance here and among these perspiration odor is probably the most important. Perspiration freshly excreted by the healthy, clean body is practically odorless. Together with dust particles and epidermal flakes, however, it forms a favorable nutrient for bacteria. After some time, decomposition sets in and with it comes the onset of the unpleasant sweat odor. This odor is, therefore, not due to perspiration as such but to its decomposition and that of other substances. Leaving pathological conditions aside, the variations in sweat odor are due not only to the varying composition of the substrate for decomposition but also largely to differences in the microbial flora residing on the skin surface which are the agents of decomposition. At skin folds, which are often marked by higher temperatures (between the toes, at the axilla, in the pubic and anal region), bacterial species have been identified that are typical for each site and that cause specific transformations in the stagnant skin secretions, resulting in the formation of characteristic odorous substances.

The skin secretions that, as a result of their decomposition, cause sweat odor adhere not only to the skin but may be transferred as such or in the form of odorous decomposition products to underwear or to outer garments. Their

ability to absorb and retain body odor apart, the materials from which garments are made play an important role in the genesis and persistence of incidental odors, not only by virtue of their own typical odor but also as a result of their physical properties such as thermal isolation and permeability to air and to water vapor. Porous materials favor the access of dust which, as stated above, can mix with the absorbed perspiration and thus become a source of malodors. Animal fibers, such as sheep's wool and silk, strongly block the radiation of heat from the skin, thus increasing the intensity of secretion and the activity of bacteria. In addition, sheep's wool has a marked propensity for absorbing odors. These characteristics are far less pronounced in plant fibers such as cotton or linen.

The offensive odor of unkempt, i.e. sweaty and dirty clothing, too rarely washed and aired, is generally known. Equally familiar is the propensity of clothing, and also of the hair, to absorb odors from the environment. A kitchen, stable or laboratory odor is indicative of the profession or activities of its carrier. A tobacco or beer odor, etc. can betray where the carrier has been.

The exogenous incidental odors mentioned thus far usually have, like the endogenous ones, no effect or an inhibitory effect on sex life, leaving aside their effect on people with pathological or fetishistic inclinations. The incidental odors which people acquire intentionally, the ones which are used in the form of perfumes and cosmetic preparations to achieve an erogenous total odor, represent quite a different case. Prior to an extensive discussion of this important topic, an attempt shall be made to explain the erogenous effect of certain fragrance materials and fragrance complexes.

5 Preconditions for erogenous odor effects

The discussion of the human personal and regional odors clearly shows not only that the individual odorants which have been found or are believed to be components of these odors must be designated as 'malodorous', but also that the odor complexes emitted by the body are usually regarded as unpleasant, more rarely as indifferent and never as pleasant if they are critically smelled as such in concentrated form. Only when highly diluted are the individual regional odors (collected by the wool patch method according to Löhner) no longer regarded as markedly unpleasant.

Every perfumer knows the phenomenon whereby certain odorous materials have an unpleasant, occasionally even a disgusting effect, in concentrated form but are experienced as indifferent or even clearly pleasant when highly diluted. Examples of such materials are musk tonquin, civet, castoreum, indol, *para*-cresol, methyl anthranilate and *para*-methyl quinolin, to name but a few.This pattern of finding weak stimuli pleasant but rejecting strong ones of the same qualitative kind is not specific to the sense of smell; it can be observed with all sensory modalities. The sound of church bells or of brass instruments is pleasing when attenuated by the appropriate distance, i.e. dilution of the sound waves but is often literally painful from nearby. The term 'glaring' for light or color effects denotes an unpleasant experience elicited by excessive intensity within a given context. The sense of touch registers gentle patting as loving but a strong blow to the same part of the body as pain. The erogenous zones of the human body are so named for their reaction to gentle stimulation. Striking, scratching or rubbing these same sites with force elicits only a sense of pain. We find warmth pleasant, coolness refreshing, but heat and cold disagreeable. The disparate reactions elicited by different concentrations of the same materials can be readily observed with the sense of taste: too salty dishes are rejected; a pungent, bitter or acid taste is registered as unpleasant if too strong, but is pleasant in appropriate dilution. Just like the other sensory organs, the nose may respond pleasurably to a given stimulus if it is gentle, yet find a qualitatively identical stimulus in more intensive, concentrated form unpleasant and reject it.

The second condition that must be met in order that an odor impression be experienced as erogenous pertains to psychology and has to do with mental associations and with memories. Odors, or tastes, may be experienced as pleasant or at least acceptable in substances or objects where they normally occur, yet be considered unpleasant, disturbing or even offensive when they adhere to substances in which their presence is unexpected, surprising or odd. This is a familiar experience that can be confirmed by simple experiments. It is,

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however, consciously registered and associated with pronounced feelings of pleasure or displeasure only in those cases where the odorous object or substance serves some natural or habitual purpose which is monitored by the sense of smell. In a pencil we are used to the gently piny odor of cedarwood. We would, however, hardly be upset if this pencil had some different scent as long as this is not unpleasant in itself, for the wood only serves to protect the graphite lead and to provide a handle and even though it is, because of its softness which facilitates sharpening, particularly well suited to its purpose, this purpose has nothing directly to do with the function of the pencil as a writing implement.With leather, however, the precious base material of many everyday or luxury products, we expect a specific odor and would experience, say, a floral scent as offensive, even though we usually prefer it to a leathery odor.

Our rejection becomes even more pronounced if specific cosmetic products in which we expect to find a certain type of odor exhibit a different scent. Thus, for example, the range of odorous materials that can be used in perfuming or flavoring toothpaste or mouthwash is relatively restricted because the public is used to only a few odor types and rejects others. Oral-care products flavored with even the finest flower odors or the most popular fantasy perfumes would remain on the store shelves. Even the repeated experiments of manufacturers with various fruit flavors, generally quite popular, were unsuccessful. Peppermint oil (menthol), anise or star anise oil (anethol), oil of wintergreen (methyl salicylate) and eucalyptus oil (cineol), the major components of oral-care flavors, play a negligible role in other scented toiletries. A jasmine fragrance finds little acceptance in bath salts while the finest pine needle composition would probably be widely rejected in a facial powder or brillantine fragrance, etc.

Our rejection is most definite if we encounter unexpected odors in foods or beverages. Butter and other shortenings or oils readily absorb odors from the environment. Such off-odors always render these fats unpalatable, even if they come from the most precious perfumes or the most popular fruits. Certain exceptions may be noted but these, on closer examination, only confirm the rule. A touch of bitter almond odor is tolerable in a fat or edible oil because it suggests, usually unconsciously, that the fat or oil was prepared from almonds or similar oily seeds. A slight frying or onion odor is associated with certain meat dishes and can therefore be accepted in fats. We would, however, hardly be tempted by a meat dish that smelt of strawberries, raspberries or oranges, nor in the reverse case, by fruits smelling of broiling fat or smoked meats. Nobody would find pleasure in an odor of tobacco smoke in the kitchen nor of food odors in a library or a study.

These peculiar phenomena find their explanation in psychology. Every stimulus that is registered by one of our senses elicits a *sensation* that is characterized by its quality (red, green; sweet, bitter; soft, hard, etc.) and by its intensity (loud, soft; intense, weak, etc.). The juxtaposition of all of the

sensations which an object elicits in our various senses leads to its *perception.* The cognition of reality which results from our collection of perceptions is what we call *experience.* Based on earlier perceptions or on experience, people can recollect an object before their mental eye, that is, they can have a specific *conception* of it. The free construction of new conceptions from existing ones that may be combined or separated, enriched or simplified we call *imagination.*

These definitions are so important for what is to follow that we shall illustrate them by an example. The *perception* of an apple lying before us may be composed of the *sensations* 'fist-sized', 'spheric', 'yellowish-green', 'hard', 'cool', 'sour–rosy smelling'. We can now have a *conception* of the apple even after it is removed. The record of our *experience* tell us that the size of apples may vary between that of a walnut and that of a man's fist; their form may be that of a near-perfect sphere, it may also be flattened or oval; their color can include nearly all shades of green, yellow, red or brown, they may be uniform in color, multicolored, specked, etc. By being purposely or inadvertently careless about our experience we can also *imagine* an apple as big as a head or golden-colored, etc.

In reality, all our conceptions are affected by our imagination and only in the rarest cases do they correspond precisely to our perceptions. Our experience, constantly confirmed or enriched by new perceptions, enables us to have a check on our sensations and thus protects us from flagrant tricks of the senses. We know by experience (empirically) that more distant objects appear smaller, that faint light makes them seem darker, etc. We initially experience new perceptions that conflict with our experience as 'striking'. Such a conflict with experience can, of course, arise only if part of the sensations that constitute a new perception correspond to those that occurred in earlier perceptions of similar objects so that we are reminded of these and are led to group the new perception with the earlier ones. The sense of conflict can arise only from a comparison of the conception of earlier experiences (recollection) with a new one which we attempt to assign to the same group. When encountering such a conflict we usually first check our sensations to see if there is an illusion or trick of the senses. If this possibility can be eliminated, we are forced to accept the new perception as a fact and to modify our experience-based views which, incidentally, amounts to an enrichment of experience.

A confirmation of our experience by new observations does not greatly move us; in fact, such observations are usually registered quite unconsciously. Observations that contradict our experiences, on the other hand, nearly always elicit a strong effect, be it positive or negative. We speak of pleasant or unpleasant surprises. When confronted with an object that is totally new to us, we muster all our senses in order to add the sum of the experienced sensations, i.e. the perception and, after its mental processing, the 'knowledge' of the object, to our store of experience.

As adults, it is more common to come across an object which is new to us but which elicits a number of sensations that remind us of a certain field of observation. In such cases, we feel justified, on the basis of our experience, to expect in the object the other sensations to which we are accustomed in that field. If, on checking our sensations, this expectation is not fulfilled, we feel disabused. It is natural for us initially to experience each disabusement as unpleasant. This observation explains why we experience unaccustomed attributes of an object, such as odd odors, in familiar things *a priori* as unpleasant, annoying or even offensive. We speak of pleasant disabusements or surprises only if we succeed, on closer examination of our sensations, to accommodate them in our customary field of observation after all, i.e. if our disabusement turns out to have been only apparent or temporary, or if we can assign the object to another field of observation than the one initially assumed, or if we recognize the new observation as original in kind, as a totally new experience.

It is important to remember, in the argument which follows, that the adult individual who possesses a certain store of experience consciously uses this store in all new experiences in such a way that an object is often considered as perceived after having used only one sensory organ and registered only one single sensation. This single sensation suffices for the generation of a conception which replaces the true sensory perception. An example may serve to illustrate this point. A person seeing an apple for the first time in his life will call into action all senses to arrive at a perception of the apple that is as complete as can be. He will handle the apple, look at it from all angles, smell it, take a bite of it , etc. A person for whom the percept 'apple' is part of his store of experience will be satisfied with a mere visual examination. He deduces from this that the round, fist-sized yellowish-green object is an apple, and knows that it is fairly hard, possesses a sour–rosy odor, etc. Such an incomplete observation can be the source of disabusements. If, for instance, the apple, in order to be eaten, is brought within range of other senses, it may turn out to have an unexpected odor or taste. Conceptions of an object that we form on the basis of a single sensation, coupled with recourse to our store of experience but not with additional observation, obviously leave a great deal of scope to the imagination.

Since man is a visual animal, sensations originating in the sense of vision are far more compelling than those from audition, taste, olfaction or the sense of touch. On the other hand, vision sensations are less effective in mobilizing the imagination. In the face of the continuous stream of impressions from his environment that besiege him, man must nearly always make do with incomplete perceptions, that is, with isolated sense impressions, and rely on his experience. This places great demands upon his imagination. He also loves consciously to enjoy the play of his imagination. This also explains his love of the arts which generally appeal directly to one sense modality only. There is always something primitive about works of art that direct themselves to several senses; the cultivated connoisseur does not hold them in high esteem.

Thus, the experienced music lover prefers the pure enjoyment of harmony and melody to an opera performance which, by appealing to his eye as well as to his ear, leaves little room for his imagination. When listening to music, we often close our eyes to shut out other external influences which might interfere with the flow of our imagination. The same goes for smelling a beautiful scent or for the gourmet enjoying a fine dish or wine. The inclination of cultivated, imaginative persons to use their imagination goes so far that often even a single sense modality tells them too much for their taste. Hence the love, in works of art, of the simple, the merely suggested and the incomplete. To our present taste – in contrast to that of antiquity – colorfully painted sculptures or works of architecture are less beautiful than works that speak to us only through their form and their material. In paintings, we gladly forego the photographically precise rendering of details which gives us more to see (perceive) but less to think (imagine). In short, man loves to give his imagination play and he loves things or experiences that aid him in this. We experience as pleasant any sensation that can stimulate our imagination to conjure up pleasing fantasies, even if this sensation in itself, apart from the fantasies and secondary sensations to which it gives rise, would have to be considered unpleasant. The smell of cheese, for instance, can certainly not be considered beautiful in itself. However, if it is linked to the concept 'cheese' by means of one or more additional sensations – such as seeing the product or its packaging (visual), hearing it being named (auditory) or tasting it (gustatory) – that smell is considered pleasant, at least by cheese-lovers. By the same token, nobody would like the pungent odor of decay that is typical of cattle and horse stables were it not for the associations with a stay in the country or with holidays which it evokes in many people.

In the same way, the personal odor of sexually mature people, which in itself certainly does not figure among pleasant fragrances, may be experienced as ravishing since it stimulates fantasies which are pleasurable in the highest degree.

In summary, the prerequisites for erogenous odor effects consist of the capability of the odor experience to elicit sexual associations. This requires the odor not to exceed a certain concentration (intensity).

6 Erogenous odors

The personal odor emanating from the clean nude body of a sexually mature person is an odor complex whose natural purpose and effect consists in animating the desire for sexual approach in the opposite sex. This approach eventually leads to sexual union and thus to a satisfaction of the procreative drive which is coupled with intensive feelings of pleasure. As soon as man became conscious of the erogenous quality of this odor he began to attempt not only to use at will this stimulant with which nature had endowed him but also to reinforce it by the use of other odorous materials that had not been produced by his own body.

The use of perspiration odor as an aphrodisiac is recorded in the most ancient literature of nearly all languages. Garments impregnated with perspiration were smuggled into the proximity of the desired sexual partner or played an important role in the preparation of magic love potions. The natural odor of the hair or the hair itself was used in similar ways.

The 'intellect befogged by the sexual drive' (Schopenhauer), however, did not content itself with using and relishing the odors of skin and hair. 'To assume that people who can be sexually stimulated by the odor of urine or faeces must be mentally deficient would be erroneous. Scatology, i.e. the nearly always sexually tinged role of the end products of human metabolism and of the processes associated with them, in the folklore, the superstitions and the literature of all cultures proves that coprolagnia, the sexual practices that link processes and products of human excretion with sexual libido and with its satisfaction, is to be found in all peoples at all times' (Englisch, n.d.). The French philologists Jannet, Payen and Veinant have published excerpts from a *Bibliotheca Scatologica* compiled by them which demonstrate the important role of the odor of excrements in the arousal of sexual desire. Thus, all odors reminiscent of the human body and its functions can be erogenous just because they are associated with images of the body, of the 'flesh'.

The great majority of literary documents regarding the aphrodisiac effect of body odor are written by men. The only plausible explanation for this lies in the fact that, especially in earlier ages, literature was a domain reserved largely or exclusively for the male. In addition, the modesty that inhibits the public display of sexual feelings is probably more strongly developed in women than in men. Taking into account also that this modesty was held in high esteem or was even demanded by men, the paucity of psychological literary records of female sexuality becomes understandable. For a woman to write about such things not only required gifts of expression but also a higher degree of personal

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courage. One of the exceptions is the Danish writer Karin Michaelis who admits in her successful book *The Dangerous Age*, 'It is a shameful thing to admit, but I am attracted to men, as I am to flowers, according to their odor.' She also writes, 'Men should not use any fragrance. The Creator has amply endowed them. With women it is, I think, quite different.' With these words this courageous woman openly expresses what are probably the feelings and thoughts of many.

Because of the more protected position of the sexual organ and its specific excretion, the natural production of odorous materials is stronger in women than in men, and their hair is a richer source of scent. Hence men emanate a far weaker personal odor. On the other hand, the female sex, being closer to nature, is more receptive to sensory impressions and is more oriented towards feelings than towards reason. In the absence of exact proof we may assume that body odor plays a roughly equally important role as an erogenous factor for both sexes.

This statement could be countered by the argument that, in amorous wooing, women use the magic of odors more frequently and more intensively than men. In our present-day cultures this is manifested by the predominantly female use of perfumes. The following facts, however, shed doubt on this reasoning even though at first glance they would seem to confirm it. Natural disposition, as well as the tradition of millennia, has taught women a form of wooing which is different in many ways from that of men, more gentle and apparently less direct but nonetheless purposeful. Physically and psychically, a man attains his goals through strength, a woman through beauty. Physically, a man triumphs as the vanquisher; a woman, addressed as a member of the 'tender sex', does not feel offended since she seeks and finds the fulfillment of her desires in being vanquished. A man pursues the road to success armed with his spirit, a woman owes her power to the richness of her soul. A man fights with his reason, seeks and cherishes in a woman the recognition of his superiority; a woman trusts her feelings, which enable her to share in the spiritual life of the male, and the expression of her feelings with which she can influence him, consciously or unconsciously. A man wants to awaken the woman and to make her see things his way; a woman wants to enchant the man and to make him feel. That is why men in courtship become fighters or poets, while women wooing decorate and perfume themselves.

A woman counters a man's deeds and words by forms, colors and fragrances; these are her most successful weapons and she uses them with a confidence founded on her experience of their effectiveness on herself. The fact that a woman in her courtship counts on the erogenous effect of odors on a man may also be seen as evidence that she, like he, is sensitive to the exhilarating effect of fragrances. The use of the feminine weapons by men is a sign of decadence in individuals, nations and cultures. In the waning days of the Roman Empire, for example, and in the age of rococo the use of perfume was as popular and common among men as among women.

The art of perfumery has undergone profound changes in the course of time, but in all cultures it has enabled people, especially women , to emphasize, mask or refine the odor of the body and its garments and thereby act as a weapon in the conquest of the sex partner.

7 Perfume materials reminiscent of human body odor

Once man had come to recognize the stimulating effect of his own odor, the most obvious way to enhance this odor was by enlisting the help of odorous materials that are in some way reminiscent of it and that could therefore intensify and enhance it. This explains why the odor materials of animal origin, musk, civet and ambra, were among the first odorants used by man in the cultures of antiquity.

The exceedingly delicate, warm, soft, perhaps somewhat balsamic scent of *ambergris* is reminiscent of the odor of the scalp and may also be considered a component of the odor of the pubic region, especially of the brunette type. In high dilution, the scent of animal *musk* exhibits, on close examination, different nuances that could be described as pungent–ammonia-like, sweet–nutty and bitter–animalic. The pungent–ammonia note is sometimes to be found on the human body in the orifice odor of the urogenital region where it is formed from the decomposition of traces of urine. The sweet–nutty nuance can be considered as kindred to the odor of the scalp and of the slightly hairy regions of the body, while the bitter–animalic component can be found in the hairy axilla and pubes regions, especially of redheads. The pungent–sweet, in high dilution also somewhat nutty and fatty, odor of *civet* has some similarity with the odor of perspiration but is primarily reminiscent of faeces.

The resins of labdanum, myrrh, styrax and incense were also known and used as perfume materials in antiquity. In the odor of *labdanum* resin we find a balsamic note reminiscent of the scalp, a somewhat pungent sweaty nuance and a component that is kindred to ambergris in its soft animalic character. *Styrax* resin has a distinctly sweet, animalic–balsamic odor with a note that is clearly reminiscent of perspiration and that is caused primarily by the presence of phenyl propyl alcohol (hydrocinnamic alcohol). The odor of *incense* exhibits something of the sweet–acrid effect of some of the higher fatty aldehydes and is thus reminiscent of the perspiration odor of brunettes and redheads, while the scent of *myrrh* resin, slightly acid, comes nearer to the perspiration odor of blondes.

Among the extracts widely used in contemporary perfumery *castoreum* clearly betrays its animal origin by that sweet nutty note found also in musk and civet, and caused probably by the presence of lactones which often exhibit this nuance. An animalic–nutty, somewhat burnt, odor, similar to castoreum, is also to be found in the hairy body regions of redheads and, less distinctly, in the axilla of brunettes. *Balsam tolu* possesses, in addition to its sweet vanilla-like odor, a distinct sweaty nuance.

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Among the essential oils, the following exhibit an odor character or certain nuances which are reminiscent of those of the human body. *Costus root oil* with its sultry odor, slightly akin to rancid fat, is strongly reminiscent of the odor of the scalp region and, but this only at high levels, of the axillar odor of brunettes. *Terpeneless cypress oil* has a distinct likeness to ambergris but with a somewhat acid nuance which makes it similar to the scalp and pubic regions of blondes. In the untreated, terpene-rich oil this delicate note is almost completely masked. *Carrot seed oil* has a somewhat acid fatty note that is to be found also in all hairy body regions of the blonde type. *African geranium oil* possesses in its top note (terpenes) the cheesy note that, as a nuance, is characteristic also of the pubic odor of blondes.

Orris root oil exhibits, along with its dominant odor of violets, a sweet–fatty–sweaty nuance reminiscent of scalp hair that is more pronounced the higher its content of 'orris butter'. This consists largely of myristic acid which is odorless in its chemically pure form and contains in addition traces of the pleasantly sweet–fatty smelling esters of myristic and oleic acid as well as furfural and diacetyl, the key component of butter aroma. Langlois and Goby (1924) have, in addition, demonstrated the presence in this oil of the strongly fatty or sweaty smelling aldehydes of the saturated fatty acids with 8–13 carbon atoms. Orris concrete contains 85–90% myristic acid along with the above-mentioned components and therefore exhibits the animalic note most strongly among all orris products. Liquid orris oil is prepared by removing the odorless myristic acid by one of several methods. The myristic acid obtained from orris concrete always possesses a very distinct, agreeably fatty and somewhat sweaty odor owing to remaining traces of auxiliary materials. Therefore, the myristic acid from orris is far from worthless to the perfumer. Highly purified orris absolute is almost identical to the ketone irone which has also been prepared synthetically. It possesses an extremely powerful odor reminiscent of violets and practically free from any animal nuance.

Ambrette seed oil contains more than 80% palmitic acid that, like the myristic acid from orris oil, always contains admixtures which, because of their strong fatty and sweaty notes, make a major contribution to the characteristic odor of the oil. Ambrette seed oil from which palmitic acid has been removed and which consists of 100% odorants possesses the sweet–nutty, animalic lactone note that is present in musk, civet and castoreum as well as in the odor of all skin regions, and is a particularly characteristic component of scalp odor. Kerschbaum has isolated and identified a high-molecular C18 lactone as the source of this animal lactone-like note; with reference to its origin he named it 'Ambrettolide'. (A homologous substance, first synthesized by Ruzicka, was named 'Exaltolide'.) It is understandable that this lactone, being one of the key odor principles of the animal and hence highly erogenous odors, plays a preeminent role in perfumery. Apart from a delicately floral nuance which is particularly conspicuous in the base note and which is due to farnesol, the odor of native ambrette seed oil consists, therefore, of a fatty–sweaty compo-

nent that comes from palmitic acid and its auxiliary materials, and the sweet animal scent of Ambrettolide. Hence the complete odor complex possesses a fatty–sweaty and sweet–animalic character that is similar to the skin and scalp-hair odor of blondes and brunettes.

There are also a number of defined aroma chemicals that are reminiscent of human personal odor or of specific regional odors. The saturated *fatty alcohols* and *fatty aldehydes* with 8 or 9 carbon atoms possess waxy or acrid–fatty odors, respectively, reminiscent of the perspiration odor particularly of the blonde type. *Ambrettolide* and *Exaltolide* were discussed in connection with ambrette seed oil.

Nearly all the *butyrates* and *isobutyrates* used in perfumery exhibit, more or less clearly, the rancid fatty odor characteristic of butyric acid which is present also in perspiration odor.

Hydrocinnamic alcohol and, to an even stronger degree, *hydrocinnamic aldehyde* possess a sweetish decaying note reminiscent of the perspiration of brunettes and redheads.

Indol, which has been identified in human faeces, is certainly one of the most interesting aroma chemicals with an animal note. It plays an important role as a component of many natural, and hence also of artificial, flower oils in perfumery. Winter (1927) remarks, 'Indol, although present in small amounts only, is a major factor in the scent of certain flowers. This is the more curious since it possesses a faecal odor.' After our remarks about the 'prerequisites for erogenous odor effects' (Chapter 5) and about the 'erogenous odors' (Chapter 6), it is difficult to doubt any longer that it is precisely the odor of indol, reminiscent of decay and faeces, that lends orange blossom, jasmine, tuberose, lilac and other blossoms that putrid–sweet, sultry–intoxicating nuance which has led to the use of these flowers and of their extracts as delicate aphrodisiacs, today as in the past.

To both the expert and the layman, the term 'French' perfume has lost its original, literal meaning and has come to designate that sweet–erotic cachet which today characterizes, along with the specific character of each individual type, the finest perfume creations of all countries. The expert knows that this phenomenon has not come about by chance but is simply a result of the fact that in the classical creations of French perfumery, and subsequently in the French-type perfumes of all perfumers without exception, the absolutes of jasmine, tuberose, fleurs d'oranger, etc. are among the key components and contribute to these perfumes the erotic effect of indol. While some natural flower extracts contain surprisingly high levels of indol (in jasmine absolute it is 2.5%), the perfumer must, in creating artificial absolutes, content himself with indol levels of a fraction of 1% lest the indol note becomes unpleasantly dominant. This observation, surprising at first glance, has given rise to various speculative explanations. The most widely held among these are that the natural indol that occurs in flowers has a different odor from synthetic indol, or that indol is present in the flowers and their absolutes not in its free form but

partly or wholly chemically bound. A different explanation is offered here. Every perfumer knows by experience, and can readily confirm by simple experiments, that the odor strength and effectiveness of natural flower absolutes and oils is never equalled or even approximated by artificial compositions of the same complexes. This can be explained by the well-established fact that nature, in the composition of its odor complexes, likes to use, in addition to the quantitatively predominant and largely identified components, small or minute amounts of materials which, by virtue of their characteristic odor notes of great intensity, play a decisive role in the character of the entire complex and its delicate 'naturalness'. These materials are hard to identify due to the exceedingly low levels at which they occur.

Analytical chemistry has succeeded in the course of the past few decades in identifying a number of such natural modifiers, e.g. Ambrettolide (musk lactone), jasmone (jasmine ketone), indol, scatol and the higher fatty aldehydes. So far, however, the chemical composition of a single flower extract has not been fully elucidated nor, for that matter, have any other natural odor complexes. This does not necessarily mean that the as yet unidentified components are always unknown materials. In many cases, perhaps in most, the unidentified odor components may be natural complexes of known odorants, whose ideally balanced harmonious odor effect precludes their analysis or identification by the experienced nose. The odorants also pose enormous, hitherto mostly unmet challenges to analytical chemistry due to the minute levels at which they are present.

The outstanding strength and effectiveness of the natural flower essences is a practical consequence of these facts and may come about in one of two ways:

1. The great strength of a natural flower essence (or of another complex) is due to the direct action of hitherto unknown aroma chemicals or odor material complexes, or of materials that have not previously been used in this context.
2. The presence of such chemicals or complexes makes possible, by a kind of smoothing effect, the use of high levels of very powerful (known) aroma chemicals that would otherwise spoil the overall effect by their obtrusiveness or by the unpleasantness of their odor character in high concentration.

One of these mechanisms, perhaps both at once, makes possible the high level of indol in natural jasmine flower extract that may, according to Macé, reach 5%. This is only one of many instances of this phenomenon.

Methyl nonyl acetaldehyde possesses a balsamic note, somewhat reminiscent of incense, and also a burnt sweaty nuance that recalls the axillary odor of redheads.

Para-cresyl acetate has, in addition to its floral scent, a putrid, urine-like note that is to be found also in *para-cresyl methyl ether*. The animal note predominates in *para-cresyl phenyl acetate*. This ester has a dry–sweet, putrid odor reminiscent both of urine and of feces.

Para-methyl quinolin is honey-like, with an alkaline touch and a distinctly fecal character, a note that is to be found also in different types of tobacco.

Phenyl acetic acid has, by contrast, an acidy honey scent. Because of its auxiliary fecal nuance this material has been recommended as a substitute for indol in cases where the strong red discoloration which the latter material undergoes under the influence of light is undesirable. Phenyl acetic acid is found widely in nature and its use at low levels in various flower compounds may well be justified. However, it can never functionally replace indol in any composition.

Scatol, a methyl derivative of indol, has been detected in civet and in human feces. This exceptionally powerful, penetrating and difficult-to-smooth material possesses a characteristic, pungently fecal note that, in contrast to indol, is offensive even at high dilution. It is therefore rarely used in perfumery except in the composition of artificial civet bases. However, it deserves interest because of its ability to produce and reinforce erogenous odor notes.

Tetrahydro para-methyl quinolin has a strong alkaline–sweetish fecal odor somewhat reminiscent of civet.

In summary, the odor materials reminiscent of personal odor or of specific regional odors can be classified into two groups. The first group contains those materials whose odor character is akin to *regional skin odors:* ambergris, castoreum, labdanum, styrax, tolu and incense; costus root oil, terpeneless cypress oil, carrot seed oil, African geranium oil, orris concrete and ambrette seed oil; aldehyde C8 and C9, alcohol C8 and C9, Ambrettolide (Exaltolide), hydrocinnamic aldehyde, hydrocinnamic alcohol and methyl nonyl acetaldehyde. Natural ('tonquin') musk occupies a special position since its odor fits into both the first and the second group.

The second group includes those materials that exhibit odor similarities with human excrements or with the regional odor of the anal and the urogenital orifices. To this group belong indol, *para*-cresyl acetate, *para*-cresyl methyl ether, *para*-cresyl phenyl acetate, *para*-methyl quinolin, phenyl acetic acid, scatol and tetrahydro *para*-methyl quinolin.

It is important to stress that the materials reminiscent of human body odor do not usually possess any erotic effect in and by themselves. Their effect is, just like that of perspiration or feces, often quite unpleasant. The odors of perspiration and feces as such are repulsive; they become erogenous only if accompanied by thoughts and imaginings of an erotic nature that may or may not have been elicited by these very odors. In the same way, the odor impressions generated by the perfume materials discussed here become erogenous only if accompanied by other simultaneous sensations. These accompanying sensations which are, to repeat, absolutely essential for activating the latent erogenous character of certain, often distinctly unpleasant, materials, may be supplied by some other sense modality or they may themselves be caused by odor materials. In the latter case, which is of special interest to us, it is therefore necessary that:

1. the odor sensations elicited by the body odor-like material and by the accompanying materials must be experienced at the same time; in other words, there is just one complex effect
2. in this odor complex the proportion of body odor-like materials is limited so that their unpleasantness never becomes dominant.

To state this in words more familiar to the perfumer: when using materials reminiscent of aspects of human body odor, special care must be given to smooth their impact and their level must be kept so low that their odor does not become obtrusive during any phase of evaporation. To find the right way in this, as in all things, nature is the best guide.

8 The erotic effect of flower odors

In studying the erotic effect of odor materials reminiscent of human body odor, the best examples are some of the ideal complexes which nature offers us in the odors of flowers. The first step must be to determine which flowers have erogenous odors. This determination is not as simple as might appear at first glance, for the aphrodisiac effect attributed to a considerable number of flowers is not always due solely or primarily to its odor but is often inspired by visual impressions.

Certain colors or forms of flowers can be reminiscent of bodily forms or colors which are linked, in our imagination, to sexual experience. Red, the color of blood, of lips and of blushing cheeks, symbolizes life and love. As the color of fire it also stands for sensual passion. Doubtlessly, red is *the* erogenous color even if other colors are also associated with lovelife. Thus white, the sign of purity, is also the color of innocence and of virginity. Blue, the heavenly color, is the symbol of faith and hence also of fidelity.

The shapes of flowers can also be linked to sexual imaginings. Thus, the swelling curves of the rose in full bloom recall the mature female body, the delicately curved lines of the closed bud – the Greeks called it 'nymph' – are reminiscent of the body of an adolescent girl. Women have been compared to flowers at all times and in all languages, not only using colors and shapes as comparison but also certain phenomena of life. 'In full flower' means 'ready for love', what 'blooms in hiding' calls for discovery. Defloration is the loss of innocence, fading flowers mean the end of love, etc.

This delicate symbolism has found its expression in countless fairy tales and folk songs. The 'language of flowers' is a form of wooing that was permissible even in puritan ages. Among all the attributes of flowers, the fragrance is most closely linked to human lovelife. Superficially, this observation could lead to the simple conclusion that *every* agreeable odor sensation, being pleasurable, would be erotic if it is experienced simultaneously with some other erogenous sense impression. This is by no means the case, as can be demonstrated by the following simple facts of common experience.

Nearly all familiar odors of foods and beverages which we consider pleasing, e.g. the aroma of most fruits, are not just erotically indifferent but may even be anti-erogenous, i.e. attenuate or even paralyze another erogenous sense impression that is experienced at the same instant. The overall effect of a complex of sense impressions consisting of components of different erotic activity is determined by the subjective physical and psychic disposition of the moment. This is greatly influenced by the degree of saturation of the drive of self-preservation (food intake) on the one hand and of the drive of procreation (sex)

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on the other. These work in opposite directions. The drive for food intake stimulates the accumulation of energy while the procreative drive urges us to spend excessive energy. A given complex of experiences may be erogenous if the nutrition drive is satisfied while the procreative drive is not, and be erotically indifferent or even anti-erogenous in the reverse situation. The normal life of man in civilized society entails a more regular satisfaction of the nutrition drive so that a general disposition towards erogenous experience is to be expected. Nevertheless, we know from experience that a pleasing odor such as that of food or beverages may be erotically indifferent or even (due to its distracting effect) anti-erogenous. This shows that *pleasing odor sensations are not necessarily erogenous; they may be indifferent or even anti-erogenous.* Hence the assumption that each pleasant floral odor must be erogenous is also incorrect.

At least one of the following conditions must be met for a floral odor to be designated as erogenous:

1. the odor complex of the flower contains one or more components that are reminiscent in their odor of the human body or its secretions
2. the visual shape of the flower is reminiscent of human body forms
3. its color evokes erotic images

In the latter two instances visual experiences give rise to imagery whose erotic character is then also projected on the odor.

4. Certain aspects of the biology or life processes of the flower are compared to human characteristics linked to sexuality and then live on in tradition as attributes of the flower so that the mere name or appearance of the flower gives rise to erotic associations. These are subsequently evoked also by the flower's scent which in turn is then considered erogenous.
5. Certain flower odors may, just as any other odors, give rise in certain people to associations which result in sexual images. In contrast to the others, this type of erogenous effect is purely individual.

It is possible to assess for individual types of flowers which of the five alternatives explains the erogenous effect of their odor complexes.

The odor of the flower oils obtained by various methods from *jasmine blossoms* probably plays the most important role of all flower odors in modern perfumery.They owe this privileged position to their distinctly erogenous and highly pleasant character. Their erogenous effect is due primarily to their relatively high content of indol. The chemical investigation of the jasmine blossom extracts obtained by enfleurage and hence entirely volatile, conducted by Hesse, Müller, Soden, Baccarini, Cerighelli, Elze and others, has revealed the following approximate composition:

Benzyl acetate	60–65%
Linalool	15.5%

Linalyl acetate	7.5%
Benzyl alcohol	6.0%
Jasmone	3.0%
Indol	2.5%
Methyl anthranilate	0.5%

In addition, the presence of geraniol, farnesol and *para*-cresol could be demonstrated. The presence of low levels of eugenol, alcohols and aldehydes of the higher fatty acids is suspected but has not been confirmed to date.

The odor functions of the various components within this complex are as follows. The odor character and erogenic effect of indol have been discussed (p. 42). It should be pointed out once again that levels of indol of 2.5%, commonly found in jasmine absolute de pommade (enfleurage), can never be employed in a synthetic absolute; here the perfumer must be content with far lower levels. The natural indol content of jasmine absolutes obtained by solvent extraction is far lower. An essence absolue jasmin de chassis contains no indol or only traces so this product can be used only in special cases or must be supplemented with synthetic indol if the typical jasmine effect in the composition is desired. Methyl anthranilate is, like indol, a nitrogen compound; it is related to indol in certain ways. Both chemicals are probably formed from phyllopyrole which is present in the chlorophyll-containing green parts of the plant. It is interesting to note that in the quantitative fluctuation of the flower oils' composition due to air temperature or season, a higher indol content is accompanied by a higher level of methyl anthranilate and vice versa. The same phenomenon has been observed with all flower oils that contain both of these nitrogen compounds such as jasmine, orange blossom and acacia (robinia pseudo-acacia). At great dilution, the sweet flowery odor of methyl anthranilate is distinctly reminiscent of orange blossom although it does not possess the 'sultry' character of this flower nor the sultriness of jasmine.

It should be noted at this point that the term 'sweet flowery' is an odor characterization: a certain odor sensation gives rise to the notion that what is smelt is the emanation of sweet smelling flowers. 'Sultry', on the other hand, designates a bodily feeling which may be elicited by a certain type of odor sensation but also by other sense impressions. The term does not refer to a causative agent but to an effect. To express matters precisely – and we shall have to do this in the course of the arguments that are to follow – we must speak of a 'sweet flowery' *odor* but of a 'sultry' (*odor*) *effect*.

If a jasmine oil is prepared in accordance with the analytical findings but omitting methyl anthranilate and this incomplete jasmine complex is compared with a complete one containing methyl anthranilate, it will immediately be clear that the latter has a much more sultry effect. This shows that methyl anthranilate is involved in the generation of a sultry effect even though by itself it does not have such an effect. Since the frequent joint occurrence of methyl

anthranilate with indol in natural complexes (flower extracts) is accompanied by a sultry odor effect the conclusion that this effect may be characteristic of the combination is obvious.

To test this conclusion it is not necessary to prepare an indol-free jasmine complex since such a complex is naturally available in the form of essence absolue de chassis. Comparing this practically indol-free natural product, whose low content of methyl anthranilate was boosted beyond nature by the addition of 1% of the synthetic material, with the indol-containing jasmine flower oils obtained by enfleurage and extraction, it became clear that only the latter oils could be called sultry while the essence absolue de chassis smells equally flowery but has hardly any sultry effect. This experience was confirmed by the comparison of an indol-free and a complete indol-containing synthetic jasmine complex. In this case, the difference in effect was even more apparent. Hence it can be taken as established that indol is essential for the achievement of the sultry odor effect of jasmine and that methyl anthranilate contributes to this effect.

Additional experiments were then conducted to test the effects of the individual components of the jasmine complex, using only the scientifically demonstrated aroma chemicals as components of the compositions used. Only jasmone, which has not yet been prepared synthetically, was replaced by the similar smelling dihydro jasmone (isojasmone). To start with, the components of the complex were divided into four groups, each of which was composed of aroma chemicals that showed a certain similarity in odor effect. These four groups were composed and designated as follows:

Group I: fecal odor reminiscent of a human body odor component, erogenous – indol
Group II: sweet floral odor with a soft effect – methyl anthranilate, benzyl acetate, benzyl alcohol, linalool
Group III: acidy flowery odor, soft and somewhat refreshing – linalyl acetate
Group IV: spicy odor, hard and pungent in effect – dihydro jasmone.

The erogenous odor effect of the human personal odor, its components and perfume materials with similar odors (Group I) have already been discussed. An attempt will now be made to characterize the odor effects represented by the other groups. To start it is helpful to reflect on the underlying original meanings of the descriptors used for these groups. The descriptions 'soft' (for Group II) and 'hard' (for Group IV) are clearly indicative of contrasting effects. Originally the description of the tactile sensation 'soft' was commonly also used to designate characteristics such as 'lacking in energy', 'submissive', 'yielding' and 'sensually receptive', which may be related to 'intoxicating' and 'narcotic' causative agents. Therefore odors that possess narcotic (intoxicating) effects are also experienced as 'soft'. By way of contrast, 'animating', 'arousing', 'exhilarating' or 'stimulating' effects are designated as 'hard'.

A physiological explanation for soft and hard odor sensations is provided by considering the way odor experiences come into being. The olfactory organ, situated at the upper end of the nasal septum in the upper part of the middle concha, consists of a mucous membrane in which the nerve endings, the so-called 'sensory cells', are embedded. These sensory cells possess at their surface fine hairs which freely protrude into the nasal cavity. These are extensions of the nerve axons which pass through the cribiform plate and lead into the neurons of the brain. Certain stimulations of the sensory cells, transmitted through the axons, are experienced as odor (leaving aside the question of whether these stimulations are chemical or physical in nature). (Recent medical research has arrived at a somewhat different theory of the mechanism of olfaction. Although the hypothesis which is to follow can also readily be adapted to the new theory of olfaction, the author has chosen to build on the older theory because it is simpler.) It can be imagined that certain odorants stimulate only very few or isolated sensory cells while other odorants can stimulate a larger number of sensory cells. This is, let this be stressed, simply a hypothesis of the author and leads to the following assumptions. The smaller the number of sensory cells that are simultaneously stimulated by an odorant or an odor complex, the 'harder' the odor sensation; the more sensory cells that are stimulated simultaneously and equally strongly, the 'softer' the sensation. At a given intensity, the effect caused by an odor is narcotic to the extent that it is soft, and stimulating to the extent that it is hard.

The expressions 'soft' and 'hard' have their origin in the sense of touch and suggest an analogy with tactile sensations. If a given constant pressure is applied to the skin, it is experienced as softer the larger the area over which the pressure is distributed, and harder the smaller the area. At the extreme, we speak of sharp or stinging sensations. A comparison with the sense of hearing may clarify our hypothesis even better. A single tone struck on a piano is experienced as hard, a harmonious chord sounds soft. If, however, the chord contains a note which breaks its harmony, i.e. its even distribution over a large part of the sensory organ, it is again experienced as hard and unpleasant. This phenomenon is comparable to the odor effect of an odor complex that is not 'well-rounded'. Thus, single odor notes have a hard effect if they occur in isolation, as in single aroma chemicals, or if they dominate conspicuously in certain stages of the evaporation of a poorly rounded complex.

As ideally constructed complexes, natural odor complexes, such as essential oils or flower extracts, possess soft odors in nearly all cases. Odorants and odor complexes with soft, narcotic effects play a very important role both in nature, where they occur as either 'floral' or 'balsamic' scents, and in the composition of fantasy perfumes.

Narcotic effects in the physiological sense result from the action of chemical agents on the central nervous system which they may attain by different routes. Narcotics applied at high levels pass into the blood stream. Liquid or solid narcotics, usually applied in solution, enter the blood from the intestines,

which they reach either by way of the mouth and the stomach, or by direct injection. Gaseous narcotics enter the body by inhalation through the lungs. The longer the route which the narcotic agents have to follow, the greater the time lag between ingestion and effect, and the greater the loss of substance before it reaches the central nervous system, hence the need for higher doses to achieve a certain effect if the route is long. Rapid effects are achieved with relatively small doses if liquid or dissolved narcotics are directly injected into the blood from where they reach the central nervous system without any great detour.

In the course of the normal process of smelling, odorants enter the body in minute, hardly measurable amounts. Their ability to elicit an effect and the fact that this occurs nearly instantaneously, can be explained only by assuming that the odorant vapors do not take the detour through the blood stream but enter the central nervous system directly by way of the sensory cells, through the cribiform plate and the olfactory nerve. Although this route leads to the strongest effects with the smallest doses, the amounts of odorant involved are so minute that the narcotic effect occurs in a highly attenuated manner. The power of logical thought is dulled, 'sober' reason gives way to an enhanced sensitivity to feelings, sharp-edged images of reality are mixed with the images of fantasy and are colored or displaced by them. In this numbed or somewhat somnolescent state of consciousness, the subconscious stirs and as learned inhibitions such as sense of duty, shame, etc. are suspended or at least weakened, the primitive drives gain influence.

At this stage, the effect of narcotic odor materials, as that of the other narcotics, is not directly erotic but it strongly increases the receptivity for erotic stimuli. In his remarks on 'odor gratification, artificial fragrance and its evaluation in literature' Englisch (1932) notes: 'Perfume is not only able to arouse, it can also, through a momentary interference with the capacity for logical thought, strongly stir the feelings and thus predispose the subject to suggestive influences.' We can, therefore, find in the narcotic odor effect a slackening, a heightened passivity, a tendency to 'let go' or to submissiveness and, especially in the male, a suspension of inhibitions.

The hard effect (Group IV), which we have also designated as 'exhilarating' and which is here associated with a spicy odor, can be characterized in exactly the opposite way. The sensation 'hard' or, stronger yet, 'sharp' or 'stinging' also has exhilarating, animating, arousing and stimulating effects, and hence results in heightened activity. The sense of taste also provides stimulation through sharp, stinging, spicy sensations. These lead to enhanced secretion of digestive juices, which is why we season our foods. Coming back to the tactile sense, on closer consideration of phenomena which have already been mentioned, the following conclusion can be drawn. We experience a pressure exerted on a two-dimensional area of our skin as 'hard', a one-dimensional sensation caused by a line such as a knife's edge is said to be 'sharp' while the zero-dimensional pressure exerted by a pointed object such as a needle is

'stinging'. As stated previously, with constant pressure the sensation 'hard' becomes weaker the larger the areas exerting and experiencing this pressure until finally it passes into the sensation 'soft'. The series of expressions 'hard', 'sharp' and 'stinging' indicates an increasing power of penetration or of piercing on the part of the objects causing the sensations. 'Penetrating' or 'piercing' can therefore be considered as functions of 'hardness'. Pursuing this line of thought, it is found that the pairs of opposites penetrating–receiving, and hence also male–female, correspond to hard–soft, animating–slackening and stimulating–narcotic. Accordingly, stimulating odor effects can be associated with 'male' odor materials and odor materials which elicit narcotic effects can be characterized as 'female'. We shall make use of this conclusion later in the determination of type on the basis of the Odor Effects Diagram (Chapter 14).

The odor of linalyl acetate, which represents Group III of the jasmine components, was previously characterized as 'acidy flowery' and its effect as 'soft and somewhat refreshing'. Thus, this odor, as with 'sultry', has a combined effect consisting of the components 'soft' or narcotic and 'refreshing' or anti-erogenous. The anti-erogenous properties of refreshing odors are familiar to us from experience and have been discussed earlier.

Surveying the odor effects that have been observed and characterized up to this point, it is now possible to picture their relationships to one another. As this is done, the following facts should be borne in mind:

1. Erogenous odors are directly opposed to refreshing odorants, which are therefore designated as 'anti-erogenous'.
2. A second pair of contrasting effects has been characterized by the terms 'narcotic' and 'stimulating'.
3. The 'sultry' effect was found to be based on the combination of a narcotic and an erogenous odorant. These two effects must, therefore, be adjacent to one another in some way.
4. The narcotic effect must also be adjacent to the anti-erotic one, as witnessed by the odor of the single aroma chemical linalyl acetate which unites these two effects.
5. The narcotic effect must, therefore, lie directly between the erogenous and the anti-erogenous effects.

These considerations lead to an unequivocally fixed configuration which is graphically presented in Figure 8.1. The components of jasmine flower oil have been inserted into the sketch of odor effects shown in Figure 8.1. It is, therefore, also a graphical representation of the analysis of the odor effects of jasmine.

Popular tradition values the *rose*, the 'queen of flowers', higher than jasmine. In perfumery, the rose comes next to jasmine in importance. Its odor character can be considered, in many respects, as jasmine's counterpart. For this reason, rose and jasmine are frequently used in perfumery as complementary notes. The odorous components of the rose are collected from the flower

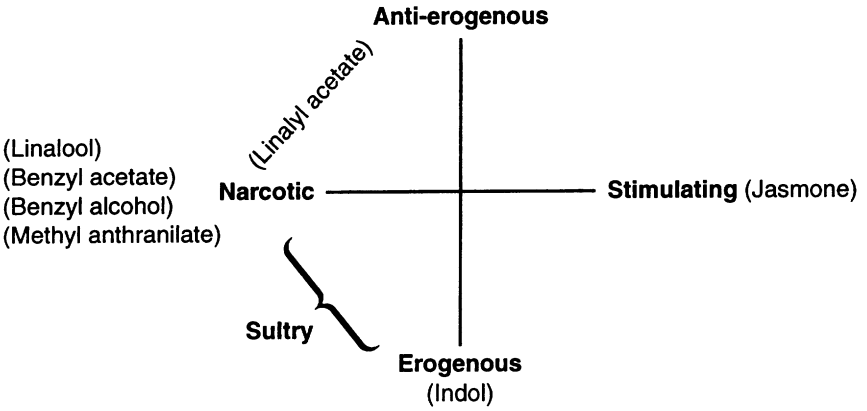


Figure 8.1 The erotic effects of the main components of jasmine.

Table 8.1 The natural rose complex

Component	Essential oil obtained by steam distillation (%)	Essence absolute obtained by solvent extraction (%)
Geraniol and citronellol	63–84	30–34
Nerol	5–10	5–10
Phenyl ethyl alcohol	1	46–60
Eugenol	1	1
Linalool, farnesol	Trace	Trace
Nonyl aldehyde, citral	Trace	Trace
Stearoptene	7–25	0

either by means of steam distillation or by extraction with volatile solvents. The difference in odor between the two products is due largely to their different content of phenyl ethyl alcohol which in steam distillation is nearly completely lost by dissolving in the water ('rose water'). The composition of the natural odorant complex of rose blossoms is shown in Table 8.1. In addition, phenyl acetic acid or its esters are suspected to be present.

The erotic effect of rose odor is quite different from that of jasmine. This is due more to a quantitative than to a qualitative difference between the components contributing to their overall effect. As an aid to understanding this phenomenon, the components of the rose complex can be classified according to their effects, as was done with jasmine, using the same designations of odor effects.

Group I (erogenous): fatty–sweaty body-related odor – nonyl aldehyde
Group II (narcotic): sweet–floral – geraniol, citronellol, nerol, phenyl ethyl alcohol, linalool, farnesol
Group III (narcotic and anti-erogenous): not present
Group IV (stimulating): spicy – eugenol; sharp – citral.

Comparing these groups to those present in jasmine, the following differences are observed. Indol is present in the jasmine complex at far higher levels (25-fold or more) than is nonyl aldehyde in the rose. The two are about equally intensive but because of its much more pronounced animal character indol is more strongly erogenous. The erogenous note, reminiscent of human body odor, is in fact hardly perceptible in the natural rose oils. While jasmine absolute contains about 3% of the exceptionally strong and stimulating material jasmone, the natural rose complex contains only about 1% of the far less effective materials eugenol and citral. These are, in fact, not detectable by their smell.

Rose is far superior to jasmine in its narcotic effect. The chemical analysis of rose oil shows that it contains nearly 99% alcohols (in addition to the so-called 'rose alcohols', traces of linalool and farnesol are found) all of which possess a narcotic effect. In jasmine, the content of narcotic components is lower and these are, moreover, far less effective, with the exception of methyl anthranilate which is present at low levels. Hence, the rose complex exhibits an almost purely narcotic effect, barely modified by erogenous and stimulating nuances. The fact that the rose, especially the red rose, has classically been considered the flower of love by all cultures that have known it is certainly not due to its odor alone. The opulently rounded shapes of the petals of a rose in full bloom are suggestive of the mature female body and their rich red color evokes thoughts of lips and kisses. The austere form of the bud before blooming, which only subtly hints at the rounded abundance and fragrance of full maturity, and its opening to amorous life, exhuming a ravishing scent are external manifestations of the flower's life processes which man sees and senses and which stimulate his erotic fantasy. The reason, therefore, why rose ranks among the most important aphrodisiac odor types is that its narcotic effect enhances the receptivity for the erotic images which are evoked by the colors, shapes and life processes of this flower and which are reminiscent of women and of love.

The odorous components of *orange* blossoms are collected, just as those of the rose, either by steam distillation or by extraction with volatile solvents. The production of flower oils by way of *pommades*, using the enfleurage process, is no longer practised today with roses or with orange blossoms. The average composition of the oils obtained from orange blossoms is shown in Table 8.2. The erogenous components of rose and orange oils are the body odor-related materials indol, the esters of phenyl acetic acid (fecal) and decyl aldehyde (sweaty–fatty). It should be stressed that of these only indol has

Table 8.2 Average composition of the oils obtained from orange flower

Component	Neroli oil obtained by steam distillation (%)	Fleurs d'oranger absolute obtained by solvent extraction (enfleurage) (%)
Terpenes (pinene, limonene)	35	0
Linalool	30	30
Geraniol and nerol	4	4
Geranyl and neryl acetate	4	4
Linalyl acetate	7	7
Terpineol	2	2
Phenyl ethyl alcohol	1	35
Methyl anthranilate	1	9–12
Nerolidol	6	0
Indol	0.05–0.19	0.08–0.2
Decyl aldehyde	Trace	Trace
Phenyl acetic acid	Trace	Trace

a distinctly body-related odor. The esters of phenyl acetic acid are primarily floral, the fecal component is but faint, and the combination of the two components results in a sultry effect. Decyl aldehyde exhibits, especially at high dilution, a slightly sharp nuance, reminiscent of oranges, along with its fatty note. In the chapter on fantasy perfumes this complex odor effect, which results from the conjunction of erogenous and stimulating components, will be discussed in detail. The effect plays a very important role, especially in modern perfumes.

Narcotic components of orange flower oil are geraniol, nerol and their acetates, also phenyl ethyl alcohol, methyl anthranilate and linalool. Like linalyl acetate, terpineol possesses a floral odor which is more refreshing than narcotic. These two materials, rather different in odor but similar in effect, are characterized by a certain cooling effect which, from the erotic standpoint, is *calming*. We can thus amplify the range of odor effects. Next to the primary odor effects erogenous, anti-erogenous, narcotic and stimulating, we have established the two combined effects 'sultry' (erogenous + narcotic) and 'calming' (anti-erogenous + narcotic).

Neroli oil contains distinctly refreshing, anti-erogenous odor materials in the form of the terpene hydrocarbons which have been identified and isolated by distillation. It is interesting to note that the terpene hydrocarbons, often referred to simply as terpenes, are not really components of the natural flower oils. They are found exclusively in products obtained by steam distillation and their presence may be explained in one of two ways: either they are formed from certain derivatives during the steam distillation process or they get into the distillate as components of the green parts of the plants which are often

processed along with the flowers, for example in lavender oil. Flower oils obtained by extraction or enfleurage never contain terpene hydrocarbons. This lack of the most important and most widely distributed anti-erogenous components has a clear impact on their effect. This is the reason why neroli oil is far less erotic in its effect than orange flower absolute. The latter has a much more pronounced sultry component caused by the higher levels of methyl anthranilate, phenyl ethyl alcohol and indol.

The *tuberose* possesses a very intensive odor whose aphrodisiac power is strongest after sundown. It has provided the flower with an exceptional position even among tropical flowers, as witnessed by the name given to it by the Malayans, 'queen of the night'. The chemical composition of tuberose absolute has been only partially elucidated. Its odor is characterized above all by methyl salicylate with its sharp–sweet scent, methyl anthranilate and the balsamic note of methyl benzoate. The presence of eugenol, geraniol, nerol and farnesol in traces has also been chemically established. The flower is also rich in waxes whose odorous admixtures, the fatty alcohols and aldehydes with 7–10 carbon atoms as well as esters of lauric and pelargonic acid, are probably responsible for the fatty erogenous body-odor (perspiration) related note exhibited by the flower and its extraction products.

With respect to its erotic effect, the tuberose complex is related to that of jasmine. It also has an intensive aphrodisiac effect which is the result of the fact that an erogenous odor – fecal in the case of jasmine, sweaty in tuberose – has a particularly powerful effect if it is accompanied by narcotic odorants that make the senses receptive and by stimulating components that stir them. The odor materials that exercise these functions in the jasmine complex have already been discussed. In tuberose, methyl anthranilate, geraniol, farnesol and the exceptionally effective methyl benzoate make up the narcotic component, and methyl salicylate, which is experienced as hard, in higher concentrations even as sharp, makes up the stimulating component. Tuberose therefore possesses, like jasmine, a sultry effect that is at the same time arousing and stimulating.

The flowers of *cassie* (*Acacia farnesiana*) possess an odor that is somewhat reminiscent of violets but is also pungent and a little herbaceous, and about whose chemical composition little is known. Thus far, only the presence of methyl salicylate (about 10%), geraniol, farnesol and eugenol has been established. Even these limited findings explain the strong stimulating effect of this flower odor, evident on olfactory examination. It may be attributed to eugenol and more particularly to methyl salicylate, the effect of which was encountered in tuberose. An excessive hardness of the odor is avoided thanks to the tempering effect of the alcohols geraniol and farnesol which have been found to be present; their narcotic effect is probably backed up by irone and anisic alcohol. Nevertheless, the stimulating characteristics dominate and this is felt more clearly because of the absence, to judge by the odor, of erogenous components.

The narcotic effect of *hyacinth* odor is well known. It is so powerful that the flower, like lily of the valley, cyclamen, tuberose and others, is generally banned from bedrooms. The narcotic odor readily causes headaches or nausea. Popular lore interprets this phenomenon in wildly romantic ways. To explain it, it can be assumed that such heavy narcotic odor effects are due to the penetration of the odor materials into the nervous system via a dual route. In addition to the direct but narrow route by way of the olfactory organ into the neurons of the brain, the odorants, released by the plant in relatively high concentrations, are inhaled, enter the blood stream through the lungs and from there reach the central nervous system. This second, additional effect, exercised by fairly high doses of odorants over extended periods, causes the familiar unpleasant symptoms. In the case of hyacinth, the materials participating in this narcotic effect are benzyl alcohol, cinnamic alcohol, esters of these two alcohols, *N*-methyl methyl anthranilate, phenyl ethyl alcohol and methyl eugenol. In addition to these materials, which have been chemically identified, the hyacinth complex undoubtedly contains additional narcotic components that vary with the variety of the flowers and that have been characterized by odor analysis only. Chemical analysis has also established the presence of the spicy materials eugenol, cinnamic aldehyde and benzaldehyde as well as dimethyl hydroquinone with its hard odor. These materials make up a strongly stimulating odor component. Materials responsible for the erogenous note in the hyacinth complex have not yet been chemically characterized. Olfactory analysis leaves no doubt regarding the presence of such materials, with fatty–sweaty and fecal notes respectively, which dominate in varying degrees depending on the hyacinth variety.

While the essential oil of *lavender* is obtained by steam distillation of the entire plant in flower, lavender essence absolute is obtained from the flowers only by extraction with petroleum ether, followed by solution in alcohol of the resinoid obtained to remove waxes and resins. Table 8.3 gives the chemical

Table 8.3 Composition of lavender oil and lavender absolute

Component	Essential oil obtained by steam distillation (%)	Absolute obtained by solvent extraction (%)
Linalyl acetate (linalyl butyrate, geranyl acetate)	30–35	35–55
Linalool (geraniol, nerol)	35–50	35–50
Coumarin	0.5–0.8	3.5
Umbelliferone methyl ether	0	5
Terpenes (pinene), cineol	6	0
Ethyl amyl ketone	Trace	Trace
Capronic acid, geranyl capronate	Trace	Trace
Bornyl acetate, acetic acid	Trace	Trace

composition of this absolute and also, for comparison, that of the essential oil of lavender, both of French origin. The scent of the lavender flowers is characterized above all by linalool and its esters, especially the acetate. Linalool possesses, in addition to its soft floral odor with its attendant gently narcotic effect, a somewhat refreshing aspect that becomes apparent only on comparison with other narcotic odorants.

The secondary effects which accompany the dominant primary effects of individual odor materials will be discussed in detail later (Chapter 18). It should be noted here that the odorants grouped together in each category of effects are never completely identical in their effect. Within each category, pronounced differences between the effects of the individual odorants may be observed. Apart from differences in the intensity of effect, this phenomenon is due to the fact that no odor material, not even a chemically pure one, possesses a completely unitary odor. The odor effect is always a sum total of and a compromise between the different effects that are actually present. For example, in the chemical group of alcohols to which linalool belongs the effect of the alcohols is generally narcotic, with a few exceptions. There is, however, a range of shadings determined by auxiliary anti-erogenous or erogenous effects, respectively. Starting with dimethyl benzyl carbinol and terpineol, a secondary anti-erogenous effect, sufficiently distinct to result in a calming overall effect, is found in both. Proceeding from these two, in order of decreasing anti-erogenous and increasing erogenous secondary effects, the following series is obtained: santalol, linalool, D-citronellol, geraniol, dimethyl octanol, rhodinol, farnesol, L-citronellol, nerol, anisic alcohol, benzyl alcohol, phenyl ethyl alcohol, styrolyl alcohol (methyl phenyl carbinol) and cinnamic alcohol. The series terminates with hydrocinnamic alcohol (phenyl propyl alcohol) which should more properly be counted among the odorants with sultry effect. Thus it is seen that linalool, although primarily narcotic, posseses a distinct calming auxiliary effect which can boost the definitely calming effect of linalyl acetate. The couple linalool–linalyl acetate not only provides the principal fragrance note of lavender flower but also defines its odor effect. The calming effect characteristic of lavender flowers is further enhanced by a secondary contrast constituted by acetic acid and its bornyl ester, both anti-erogenous, on the one hand and capronic acid and its geranyl ester, both erogenous, on the other. The narcotic odorants geraniol, geranyl acetate, linalyl butyrate, nerol and ethyl amyl ketone, together the source of the truly floral note, come into play to different degrees in the various lavender varieties. The combination of this floral complex with the terpenes and cineol, both of which are anti-erogenous in effect, boosts the calming effect of the essential oil of lavender. In lavender flower absolute, the floral note is accentuated by the contrasting stimulating odorants coumarin and umbelliferone methyl ether. In summary, both natural lavender products exert a calming action; the essential oil is more refreshing, while the absolute, and of course also the resinoid, is more narcotic in its effect.

In the flower essences discussed so far, the observation of the erogenous effects of certain components was made possible, or facilitated, by the fact that their composition has largely been chemically elucidated. In violet, carnation, jonquil, narcis and mimosa the major odor components have not yet been identified. The following discussions of the odor effects of these flowers are therefore based only on olfactory analysis of the absolutes obtained from them.

Violets, graceful in shape, unobtrusive in color, 'flowering in obscurity' are a symbol of modesty and delicacy – attributes that, being the counterpart to wooing masculinity, incite male ardor the more since they are paired with a sweet, entrancing odor suggestive of a latent sensuality that awaits arousal. The level of odorous materials in violet flowers is extremely low, which leads, among other difficulties, to considerable expense associated with a chemical exploration of the flower oil. To identify the odorous principle of the flower, research has used a detour: it centered on the odor materials from orris root which, when dried, exhibits an odor reminiscent of violets. In this way, irone was identified, a ketone with an intensive odor similar to violets which is present in orris root. At the time, attempts to synthesize irone were unsuccessful. They led, however, to the preparation of a ketone isomerous with irone, i.e. ionone, which also possesses a strong violet-like scent. Apart from the similarity in odor of irone and ionone with the violet flower, the two share its tendency to cause rapid fatigue of the olfactory nerves; this gives support to the suspicion that the two may actually be present in the natural flower extract. The odor of violets is generally narcotic, not just with respect to the olfactory nerves. This effect is given a slight erotic or rather sultry touch by the presence of a delicate fatty note that may be due to odoriferous fatty alcohols or aldehydes.

Carnation has a scent that is both spicy and balsamic whose origin has not yet been chemically elucidated but whose character suggests the presence of eugenol, isoeugenol, vanillin and cinnamic alcohol. Just these four materials would offer an explanation of the exceptionally strong and striking odor of carnation as being the result of a contrast that enhances the activity of both components involved: eugenol and vanillin are the stimulating, and cinnamic alcohol with isoeugenol the narcotic element of the carnation complex. Olfactory analysis does not suggest the presence of erogenous, body-odor related materials. It should be noted that odor analysis should generally be conducted on the living flower. The extracts should come into play only for the sake of checking or, in some cases, supplementing the odor analysis of the flower. This precept is especially relevant to carnation. Here, the difference in scent between the flowers and the extracts prepared from them is usually particularly pronounced.

Jonquil (*Narcissus jonquilla*) has a very powerful odor, similar to narcissus (*Narcissus poeticus*) that certainly does not belong to the most pleasant but perhaps to the most interesting of flower scents. The characteristic element of

this odor is a powerful, even penetrating, fecal and urinous erogenous note, probably caused by derivatives of *para*-cresyl (methyl ether, acetate, phenylacetate) and indol. The narcotic odor component suggests the presence of methyl benzoate, methyl cinnamate, methyl anthranilate, benzyl acetate and linalool.

Among the flower odors used in perfumery, the scent of *narcissus* is characterized by its very pronounced sultry effect, untouched by stimulating or anti-erogenous components. This effect is mirrored in the interesting origin of the name of this flower. The handsome youth Narcissus (Greek: *narzissos*) who falls in love with his mirror image, dies of unfulfilled desire and is transformed by the gods into the flower that bears his name, is a figure of Greek–Roman mythology that has been handed down to us by Pausanias (*Periégesis*) and Ovid (*Metamorphoses*). However, the derivation from the Greek word 'narkan', meaning to be paralyzed, dazed, is found as early as Plinius the elder's natural history (*Naturalis historia*, liber XXI, cap. 75). Plinius explains the connection by his observation that the odor of narcissus can cause severe headaches. Plutarch (*Symposion 3*, 1) gives the same explanation. In fact, the ancient Greeks probably adopted the Persian name 'nargia' for this flower when they imported it from its native Persia. Subsequently, the link with the Greek 'narcan' naturally offered itself. The words 'narcosis' and 'narcotic', still in use today, are, incidentally, derived from the same Greek root and retain its original meaning.

Analytical investigation of the extract of *mimosa* has, so far, not yielded any information about its chemical composition. Olfactory analysis suggests the presence of such narcotic materials as irone (ionone), geraniol and farnesol as well as stimulating components such as methyl acetophenone and methoxy acetophenone. These contrasting effects, accompanied not by an erogenous but by a delicate calming note, result in an odor that is more herbaceous than floral. It is neither unpleasant nor uninteresting but as a component of other floral or fantasy compositions it adds little to the whole.

The flower odors discussed up to this point are at the perfumer's disposal in their natural form. The odor complexes obtained from the flowers by enfleurage, extraction or steam distillation can be used as building blocks for compositions in the form of concretes, absolutes or essential oils. It has been mentioned that olfactory analyses should be conducted on living flowers and not on products derived from them, since the differences between the flower and the odor concentrate are often considerable. It can generally be said that in no case is the natural flower essence by itself able faithfully to reproduce the scent of the flower. In many cases the differences between the odor impression generated by the flower and by its essence are so pronounced that the perfumer attempting to compose a complex that reproduces the scent of a flower in a true-to-nature fashion is forced to add various odor materials. Such materials may be replacements for natural components that were completely or partially lost in the process of preparing the flower essence, as in the case of

phenyl ethyl alcohol in rose oil or indol in jasmine essence absolue de chassis. In other cases chemically unstable components, such as aldehydes, are changed under the influence of light, air and water; new compounds are thus formed and existing ones are broken down.

An additional difficulty in composing flower complexes lies in the fact that what is expected is less an absolutely true-to-nature odor than the reproduction of the olfactory image which we have of the flower. In most cases our mental image of the odor of a flower does not completely correspond to reality and this leads to a certain, often considerable, difference between the true and the imagined odor impression. Such an imagined odor impression may come about if, sniffing the scent of the flower, we also experience the delicate 'green' odor of the leaves or stems, or, far more commonly, if our mental image of the flower odor is a composite of characteristics found in nature in different varieties of a species, at different times of day or during different stages of maturity of the flower.The reproduction of natural flower scents is, therefore, not a simple matter even if the perfumer has a natural flower essence available as a basis for the work. It is a far greater challenge if the perfumer is called on to reproduce faithfully the odor of a flower whose natural essence is not available in any form. Here, the perfumer must rely upon a good nose and knowledge of perfumery materials.

There are quite a number of flower odors that elicit very strong and pleasant odor sensations, and are therefore interesting for perfumery, whose causative agents have not yet been isolated from the flower by any technical means. What essences have been prepared do not resemble the natural odor sufficiently closely to be considered reproductions. These flowers include bouvardia, broom, clover blossom, cyclamen, gardenia, hawthorn, heliotrope, honeysuckle, lilac, lily, lily of the valley, lime blossom, orchid and sweet pea (these are the ones most familiar to perfumers). It is not considered appropriate at this point to offer the results of olfactory analyses in the form of formulations for artificial flower essences nor even to list the components required for creating the various complexes. Instead a critical review of the erotic effects of the most important flower odors that are available to the perfumer only in artificial form will be provided, and, where possible, the chemicals suspected to be responsible for these effects will be indicated.

The *bouvardia* flower (*Bouvardia jasminflora*) has a powerful, very pleasant scent characterized by distinct jasmine aspects enhanced by narcotic rose and violet notes, and made wonderfully soft by a delicate sweet–fruity note. The products named 'Bouvardia' offered by a number of fragrance houses strongly deviate, for the most part, from the flower odor and are in essence fantasy compositions. Even if some of them are, thanks to an effective combination of jasmine, rose and violet complexes, reminiscent of the flower, no artificial product can match its honey–sweet intoxicating nuance that is probably due to farnesol.

Farnesol, a major component of many flower odors and essential oils (it has

been identified in cassie absolute, rose oil, ambrette seed oil, cananga oil, ylang-ylang oil and others), is one of the most widely occurring odorants in nature and among the most interesting. This sesquiterpene alcohol with its sweet floral scent has very low volatility. On the smelling strip it outlasts all other perfume materials. As a component of perfume compositions it is unobtrusive, exquisitly rounded and has a fixative action. In living flowers, however, it also possesses a radiant and intoxicating effect unsurpassed by any other odor material. The honey–sweet, entrancing odor exuded by flowering linden trees or acacias (*Robina pseudoacacia*) with an intensity that can turn them into characteristic landmarks of their locations in certain seasons is largely due, in all probability, to farnesol. It is curious that this material which, in isolated form, possesses a very delicate, even weak odor which always remains unobtrusive (even in combination with other materials as in essential oils or artificial compositions), exhibits unsurpassed power and richness in the living flower. The explanation is perhaps that because of its low volatility, noted also on the smelling blotter, farnesol reaches our olfactory organ in extremely low amounts and hence can exert only feeble stimulation unless it is directly emitted, together with water vapor, by the living flower. This mechanism makes far greater concentrations in the air possible. This fact is probably one of the principal grounds for the observation that the radiantly intoxicating odor of living flowers can never be matched with materials isolated from these flowers nor by synthetic complexes. It stands to reason, therefore, that natural flower odors in which farnesol plays a major role eclipse all of their synthetic reproductions. Linden blossom and acacia are two of many examples.

An excellent replacement for farnesol in perfumery is hydroxy citronellal, a material which so far has not been found anywhere in nature. This aldehyde not only possesses an odor similar to that of the sesquiterpene alcohol but also has excellent smoothing and fixative properties. It also ranks among the most tenacious perfumery materials. In comparison to farnesol, hydroxy citronellal has the advantage, apart from its far lower price, of greater volatility. It can make itself felt in all stages of evaporation, as opposed to farnesol which exerts its effect exclusively in the dry-out phase, hence it is actually preferred in many compositions. On the other hand, the odor of hydroxy citronellal does not come close to providing the entrancing sweet richness which farnesol gives, especially in living flowers.

In the ravishing scent of *cyclamen* farnesol probably plays an even greater part than in bouvardia. Elze (1928) has demonstrated the presence of farnesol, along with nerol, in an extract from cyclamen. Additional information regarding the composition of the extract is not so far available by chemical analysis. Efforts to arrive at a match of this splendid odor by way of olfactory analysis have been more intensive since this would constitute a very valuable building block for fragrances. Unfortunately, a truly satisfactory solution of the problem of composing a good synthetic cyclamen extract is, as yet, not in sight. Because the flower is also called alpine violet, many perfumers have attempted

to produce its odor using violet odorants such as irone, ionone and methyl ionone. These attempts have invariably led to failure. Hydroxy citronellal reproduces, better even than farnesol, the flower's characteristic rich sweet floral note but gives no hint of the radiating narcotic effect which the flower also exhibits. The use of cyclamen aldehyde (isopropyl α-methyl dihydro cinnamic aldehyde) results in a highly performant watery–cool green nuance, a nuance also present in the flower but in a far sweeter and richer form. This sweet, but not at all sultry, nuance cannot be satisfactorily achieved with nerol nor with any other odorant or odorant combination known to date. The effect of the cyclamen scent certainly depends primarily, in fact nearly exclusively, on narcotic materials, modified at most by traces of stimulating and calming components.

In the odor of *linden blossom*, whose composition completely eludes analysis, farnesol probably plays an even more prominent role than in cyclamen. The odor of effect of linden blossom is distinctly sultry. Olfactory analysis suggests the presence of phenyl acetic acid with its erogenous effect or, more likely yet, of its esters, which are sultry in effect, along with indol. The narcotic range of odorants is probably represented by farnesol, nerol, heliotropin and phenyl ethyl alcohol.

The white *lily* (*Lilium candidum*) also possesses a purely sultry scent. Judging by odor, its narcotic components, apart from farnesol, are probably primarily esters of cinnamic acid. The erogenous note suggests the presence of indol and perhaps also of dihydro cinnamic aldehyde or alcohol. The fact that this flower has become the symbol of innocence is probably due primarily to its white color and perhaps also to the austere forms of the plant and the flower. Still, it seems strange that this flower with its radiant sultry odor was chosen in preference to other flowers with a more reticent, or at least less erogenous, scent. Such almost odorless flowers could readily have been found in cherry and apple blossom, in snow drop (*Galanthus nivalis*), in the wood anemone (*Anemone ranunculoides*) and others. The selection, among all flowers, of the lily, with its combination of a spotlessly pure color and a distinctly sensuous scent, as a symbol of purity and innocence has a deeper psychological reason. In an erotic content purity, innocence and virginity are valued and are attractive only if they hint, at the same time, at the presence of dormant sensuality and are not the result of inner frigidity, absence of feeling or soullessness. The white color of the flowers symbolizes the virginity of their body; their scent makes us think of their soul. For this reason also the white rose, somewhat sultry in odor, often occurs along with the lily as a symbol of innocence and virtuous virginity.

Farnesol probably also plays a key role in *lily of the valley*, whose scent is among the most wonderful in nature. Indol, embedded in a jasmine complex, lends this flower scent an erogenous touch which, however, is almost totally masked by an unusually powerful narcotic note, probably caused by rose components along with farnesol. In addition to this floral element, which may

perhaps also include traces of violet aromatics, there is a balsamic nuance that suggests the presence of anisic alcohol and cinnamic alcohol. A stimulating factor, based probably on benzaldehyde, cinnamic aldehyde, anisic aldehyde and eugenol, offers a beautiful contrast with the above-mentioned rose–jasmine complex. All of these observations are based on olfactory analyses of the flowers. Chemical analyses have, so far, not yielded any positive results; at any rate, none have been published.

The odor of *lilac* (*Syringa vulgaris* and *Syringa persica*) enjoys, like that of lily of the valley, widespread popularity and hence also an important place in perfumery. An extract from lilac flowers (Dhumez) exhibited not even a faint similarity with the living flowers and gave no indication of their chemical composition. The white and the colored varieties of lilac represent, as even a superficial olfactory examination will reveal, entirely different odor types differing also –this is of particular interest to us – in the nature of their erotic effects. In addition, different olfactory subgroups can readily be distinguished within each of the two groups. Even the blossoms of any given bush show considerable variation not only in the intensity of their odor but also in its composition depending on the weather (humid or dry), time of day (duration and intensity of exposure to sunlight) and stage of development. Since the white and colored lilac varieties represent odor and odor-effect types that are nearly opposite in many respects a decision for one or the other and a corresponding labeling of the perfumed finished product is strongly to be recommended whenever a true-to-nature lilac fragrance is composed. The odor variations within the two types facilitate odor analysis since from case to case different elements of the fragrance dominate. Moreover, they give the perfumer a certain freedom, permitting an individual interpretation of the 'ideal' lilac odor or the expression of a certain mood without abandoning the naturalness of the composition.

White lilac possesses a distinctly sultry odor, the erogenous element of which is undoubtedly represented by indol. This indol note becomes especially conspicuous, even unpleasantly so, especially to the critical nose of the perfumer or chemist, in dry or wilting flowers. In fresh flowers, the narcotic note is more dominant. It suggests the presence of heliotropin, phenyl ethyl alcohol and farnesol. At night, especially after hot days, a delicate carnation note, best approximated using isoeugenol, and the sultry odor of dihydro cinnamic alcohol may be discerned.

The scent of *colored lilac*, in all shades between blue and lilac, possesses a far less distinct erogenous nuance. This becomes especially clear on direct comparison with the white blossoms. To match it indol should be used only in minute amounts. This can best be done in the form of jasmine complexes whose other components are also quite appropriate here. The characteristic odor of colored lilac is best sampled early in the morning or after a fall of rain. At such times it exhibits a wonderfully cool, dewy note whose reproduction demands great skill. The calming aromatics dimethyl benzyl carbinol,

terpineol and phenyl ethyl alcohol render good service here. Among these, terpineol has become the classical lilac aromatic *par excellence*. In early lilac compositions it was usually present at levels exceeding 50% because of its low odor efficacy. In modern lilac compounds far less terpineol is usually employed. On dry days, especially if they are warm, colored lilac has a distinct narcotic odor component, probably resulting from the presence of rose alcohols (geraniol, phenyl ethyl alcohol, nerol), cinnamic alcohol and traces of farnesol. Dry or wilting flowers exhibit a somewhat hard odor reminiscent of dimethyl hydroquinone.

Even these limited details concerning the results of odor analyses of the two kinds of lilac show that they are quite different in their effect: the odor of white lilac can be called sultry, that of colored lilac calming.

Extraction of *broom* blossoms with petroleum ether yields a product which does not fully reproduce the odor of the flower but suggests by its honey-like sweetness the presence of farnesol and phenyl acetic acid and its esters. It has, however, not been possible so far to identify a single component of this extract by chemical analysis. In the living flower the honey note that characterizes the extract is far less pronounced. It is overshadowed by a scent that suggests the presence of the methyl and ethyl ethers of *para*-cresol and that creates, together with a distinct rose complex, an unusually sultry effect. This is somewhat tempered by a refreshing component best reproduced by petitgrain oil. A conspicuous aspect of the scent of broom flowers is an oddly soft, somewhat balsamic, note that is probably caused by the presence of an important and interesting material, *amyl salicylate*. This ester in its pure form – the perfumer should insist on such a grade – possesses a mildly balsamic odor with a narcotic effect, as does the olfactorily very similar isobutyl salicylate. Amyl salicylate as a component of flower and fantasy compositions is surprisingly versatile and produces quite different effects in various complexes. In carnation compositions, for example, this ester plays the role of a green odor and hence has, in a way, a calming effect. Added to ambrette or ketone musk in small amounts, its narcotic effect results in bringing out the heavy, almost animal note of these aroma chemicals. In contrast, complexes of amyl salicylate with stimulating oak moss extracts produce a sharp, somewhat animalic effect that plays an important role in certain fougère and hay compositions, and that acts, depending on the other components present, sometimes as rather narcotic, sometimes as clearly stimulating. For all its ability to sometimes cause calming or sultry effects, amyl salicylate should certainly be classified as a narcotic material.

At this point benzyl salicylate should also be mentioned. Its odor is of the same type as that of the amyl or isobutyl ester but is far weaker. It is, therefore, often employed, in not too large amounts, as a 'neutral', softening component.

Judging by odor, amyl salicylate should play a decisive role in the odor complex of *clover blossom* (*Trifolium incarnatum*, trefle). This similarity of odor is the reason for its common name 'treflol'. The narcotic principle of the clover

odor, characterized primarily by amyl salicylate, probably also contains smaller amounts of rose alcohols and farnesol. Erogenous aromatics such as phenyl acetic acid and its esters, recognizable by their honey note, as well as traces of *para*-cresyl derivatives and perhaps also of indol result, in conjunction with the narcotic components, in a distinctly sultry odor. In the fresh flower this is somewhat modified by stimulating odorants such as anisic aldehyde, coumarin or dimethyl hydroquinone, and considerably tempered by a calming nuance that is produced effectively by bergamot oil. The odor of 'sweet' hay is characterized by dry, withered clover blossoms. Here, the less volatile components of the complex dominate: the erogenous honey note of phenyl acetic acid and the stimulating components coumarin and dimethyl hydroquinone.

Amyl or isobutyl salicylate probably also play an important role in the odor, totally uncharted in its composition, of many European species of *orchids*; not so much as a dominant component but by blending with other, more highly profiled and powerful odorants into a harmonious accord. The often very powerful, nearly aggressive odor of orchids is characterized above all by a pungent sweetness that is occasionally very sharp. In some types of the flower it has a distinct vanilla character strongly suggestive of the presence of vanillin. True vanilla (*Vanilla planifolia*), whose fruit is the vanilla pod, is an orchid variety. The odor of vanillin, extremely important both as a fragrance and as a flavor material, certainly should not, as is often done, be characterized as balsamic but instead as spicy. This is indicated not only by a certain hardness, even sharpness, of truly pure vanillin but also by the practice of using it as a condiment. The reason for the diverse opinions regarding the odor character of vanillin is that this material in its pure form possesses only a weak odor but it becomes unusually performant on adding even traces of other materials, accentuating not so much the odor as the effect of the additions or involuntary impurities. Since in nature vanillin very often occurs together with narcotic esters and alcohols, for example in benzoe resin, styrax, balsam peru and balsam tolu, its odor, nearly always clearly discernable, becomes associated with the narcotic or sultry effect of these resins. In truth, vanillin should be regarded as a stimulating material, as is proved beyond any doubt by its behavior in complexes of different kinds. In the odor complex of orchid flowers the stimulating effect of vanillin is boosted by eugenol; a less common component with a similiar effect is anisic aldehyde. In orchid, the stimulating element is less conspicuous than an unusually sultry complex which it accentuates through a contrast effect. This sultry complex is formed on the one hand by the narcotic materials heliotropin, anisic alcohol, phenyl ethyl alcohol and probably also farnesol, and on the other hand by traces of erogenous materials such as indol, *para*-cresyl derivatives and, more rarely, fatty aldehydes. As mentioned above, amyl salicylate plays a very important role here, not only because of its narcotic effect but also because of its wonderful ability to bring all of the contrasts in the orchid complex into harmony. It is this ester above all that accounts for the resultant sultry effect of this flower's scent.

The stimulating effect of vanillin, aided probably by benzaldehyde, anisic aldehyde and coumarin, is noticeable also in the scent of the *heliotrope* flower. It is likely, although this is as yet unconfirmed by scientific research, that the odorous principle of this flower is heliotropin. The narcotic effect of this material is accentuated in the odor of the flower by the contrast provided by small amounts of the above-mentioned stimulating materials.

The flowers of *honeysuckle* (chèvrefeuille) emit an exceptionally powerful odor whose total effect is sultry and whose chemical composition is entirely unknown. Olfactory analysis suggests the presence of the erogenous aromatics indol, phenyl acetic acid, *para*-cresyl derivatives and traces of dihydro cinnamic aldehyde. The narcotic component, formed probably by cinnamates, rose aromatics, methyl anthranilate and benzyl esters, is even more distinct. Esters of phenyl acetic acid certainly participate in the resultant sultry effect. A stimulant nuance, reminiscent of the pungent odor of nutmeg, serves, by a contrast effect, yet again to underline the sultriness of this flower odor. The fact that the splendid, characteristic and exceedingly sultry scent of honeysuckle is relatively rarely used in perfumery must be attributed to the circumstance that the perfumer has neither a natural extract available for use nor a synthetic replica that comes even close to the scent of the flower.

Sweet pea (pois de senteur) is another flower whose odor can be analysed only by the nose since scientific exploration of the composition of this flower scent has, so far, not yielded any information whatsoever. A whole medley of flowers appears to be contained in the scent of sweet pea; different authors describe it as being reminiscent of orange blossom, jasmine, rose, tuberose and hyacinth. In fact this flower, cultivated in a great variety of colors, emits a very powerful odor whose primarily sultry effect is boosted by a contrasting stimulating complex and is pleasingly offset by a calming note. The sultry factor, whose honey-like character betrays the presence of esters of phenyl acetic acid, is formed by the narcotic odorants methyl anthranilate, farnesol, rose alcohols, linalool and heliotropin together with the erogenous indol. The stimulating component is reminiscent of benzylidene acetone with added traces of vanillin and methyl salicylate. The calming nuance appears to be due to linalyl acetate.

Wallflower (giroflée) also belongs to those flowers from which no extract has so far been obtained that comes close to doing justice to the scent of the living flower. It has a scent that is not generally popular but is certainly interesting. Kummert (1911) analyzed a petrol ether extract of wallflower blossoms after removing the flower wax and found evidence for the presence of irone, nerol, geraniol, methyl anthranilate, indol, anisic aldehyde and benzyl alcohol as well as traces of phenols (possibly eugenol and *para*-cresol), lactones, salicylic acid, anthranilic acid and acetic acid. In olfactory analysis of the flower a scent component reminiscent of carnation, suggestive of eugenol and perhaps iso-eugenol, is most noticeable. This stimulating component is enhanced by anisic aldehyde. It contrasts with a strong, sultry complex the composition of

which was established by the analysis referred to above. The nose confirms the results of this analysis and perhaps supplements it in the sense of asserting that amyl or benzyl salicylate must be present as well. Linalool appears to be present largely in the form of its acetate whose calming effect can be clearly discerned. In summary, the odor of wallflower can be characterized as being sultry and at the same time somewhat stimulating.

An extract has been prepared from the flowers of *mignonette* but its chemical composition has so far not been elucidated. In any case the extract does not capture the natural odor of the flower sufficiently closely to make it useful for perfumery. Smelling the flower, one first notices a fresh green note that is accompanied by a somewhat fatty (erogenous) note and can be quite well represented by decine carbonic acid methyl ester. In addition, a violet-type note is found that does, however, exhibit not so much the narcotic effect of irone or ionone as a stimulating effect of the methyl ionone kind. A nuance reminiscent of decylic aldehyde also acts as stimulating but at the same time erogenous (fatty–sweaty). A narcotic effect is also evident in the flower odor. This may be caused by linalool, geraniol and benzyl salicylate but is not so much sultry as calming, suggesting the presence of linalyl acetate. The mignonette scent, therefore, combines opposing effects which in this case appear to counteract each other for the result is a fine, very delicate but not very characteristic odor that might be considered stimulating. Earlier generations loved mignonette and the perfumes named after the flower for just this non-assertive, discreet quality. Modern perfumery neglects it almost entirely because of its lack of character.

The flowers of *acacia* (*Robinia pseudoacacia*) possess a sultry odor caused primarily, as even superficial examination shows, by methyl anthranilate and heliotropin. The presence of these two materials in an extract of this flower was confirmed by Elze (1910) who also identified indol, nerol, linalool, benzyl alcohol and terpineol. The sultry effect of this flower scent, tempered somewhat by calming terpineol, is explicable just from these scientifically established components even though they certainly do not offer a complete picture of the composition of the odor. The acacia complex is of little interest in perfumery since its effect can usually be achieved simply by a combination of jasmine, orange flower and heliotropin.

Although very pleasing and distinctly stimulating, the odor of *hawthorn* (aubepine) is also rarely imitated because it can be substituted simply, at least as a component of other compositions, by anisic aldehyde. The striking odor similarity of this aldehyde with the flower odor is the reason for the aldehyde's common name 'aubepine'.

An investigation of the flower extract of *gardenia* led to the identification of styrolyl acetate (methyl phenyl carbinyl acetate), methyl anthranilate, terpineol, linalool, linalyl acetate and ample quantities of benzyl acetate as well as traces of benzoic acid esters. The most characteristic element in the gardenia complex is styrolyl acetate, an ester with both an anti-erogenous and a stimu-

lating effect that is among the most difficult of perfumery materials to blend. In the scent of the living flower this blending problem is solved by a jasmine complex whose constituents, with the exception of indol, have been found to be present in gardenia. This jasmine complex effectively tempers the hardness of styrolyl acetate; the effects of these two components directly contrast with one another. The aggressive odor of styrolyl acetate is further tempered and smoothed by the esters of benzoic acid with their balsamic odor and their narcotic effect, by the rose alcohols and their esters – whose presence, however, has been established by olfactory analysis only – and by the calming effect of terpineol and of linalyl acetate, present in the jasmine complex. In spite of the quantitative preponderance of components with other effects, the odor of gardenia is dominated by the fresh scent of styrolyl acetate. Natural extracts of gardenia are not available. In the artificial compositions which attempt to be true to the natural model, the strong yet not overly assertive, pleasantly rounded scent of the flower has never been achieved. The flower oils or perfumes commercially available under the designation 'Gardenia' are fantasy creations which usually share with the natural flower only its characteristic component styrolyl acetate.

We have characterized the odor effect of styrolyl acetate, typical of gardenia, as refreshing (anti-erogenous) and also stimulating; this combination can also simply be designated as 'fresh'. This term is justified by the fact that a number of natural odors in which anti-erogenous and stimulating components are combined (citronella oil Ceylon, lemon grass oil and thyme oil are examples) are spontaneously called fresh-smelling. More important in perfumery is the fact that in the empirical arrangement of odor effects (Figure 11.2) the term 'fresh' for the anti-erogenous and stimulating effect offers a good verbal contrast with 'sultry' (erogenous and narcotic).

The somewhat exotic odor of *magnolia*, whose chemical composition is as yet totally unknown, is also at the perfumer's disposal only in the form of artificial bases that must in large part be considered to be purely fantasy products. Nature is inimitable in the way in which a fresh note reminiscent of citral contrasts with, but also emphasizes and lends character to, an essentially narcotic complex that can be adequately represented by ylang-ylang oil. A delicately sultry note that might be composed of jonquil and orange flower complexes modifies the scent of magnolia so that the total effect of the natural odor is delicately narcotic.

It is strange that most authors ignore *freesia* (*Freesia refracta*) which belongs to the iridaceae species. Even though a complex that resembles the natural flower would be excellently suited for toilet water or skin-cream fragrances, the only products to be found in practice are fantasy compositions with little resemblance to the natural model. Olfactory analyses of this wonderfully delicate and yet radiant flower odor suggest above all the presence of linalyl acetate whose calming action also constitutes the main effect of the natural scent. Linalool and its propionate or butyrate, nerol and

farnesol, accompanied by a note akin to a jasmine–orange flower–ylang-ylang complex add a delicate fruity touch; to achieve this, the perfumer can use minute amounts of 'strawberry aldehyde' (ethyl methyl phenyl glycidate, also called aldehyde C16) and 'peach aldehyde' (aldehyde C14, undecalactone). The freesia complex deserves far more attention in perfumery than chemists and perfumers have generally given it.

The natural odor of *poppy* is very weak, unpleasantly bitter and of no interest to perfumery. The compositions available under this designation are all fantasy creations with odor types including clover blossom, orchid and carnation that are almost always distinctly sultry in effect.

A brief summary of the various erotic effects of flower odors will serve to give a better general view. First, however, an introductory remark. The components found in the natural flower complexes by chemical analysis or suggested by olfactory examination in no case possess homogeneous, one-directional effects. Most flower complexes are characterized by multi-faceted odor effects that often directly contrast with each other and thereby attenuate and temper or, in other cases, accentuate each other. In the classification of flower odors according to their erotic effects which follows, each odor is classified either by the main effect that is the resultant of the diverse single effects or by a combination of the two main effects that remain simultaneously discernible.

The flowers or flower extracts discussed above exhibit the following effects:

narcotic: rose oil, rose absolute, neroli oil, cyclamen, violet, magnolia
stimulating: cassie, mimosa, mignonette
calming: lavender, colored lilac, freesia
fresh: gardenia
sultry: acacia, bouvardia, white lilac, honeysuckle, broom, jonquil, linden blossom, white lily, narcisse, orange flower absolute, clover, sweet pea
sultry and stimulating: jasmine, tuberose, lily of the valley, wallflower
narcotic and stimulating: carnation, hyacinth

In view of the fact that sultry and calming effects possess a narcotic component it turns out that of the 30 flower complexes described here only four do not elicit a narcotic effect. Even in these four – gardenia, mimosa, cassie and mignonette – narcotic components were detected either chemically or by olfactory examination but were overshadowed by other, more dominant effects to the extent that they were not considered in the characterization of the flower odors involved.

If only the four primary effects are considered, including them also where they occur as components of the combination effects sultry, calming and fresh, it is found that they can be divided in the following manner over the flower complexes considered: 26 complexes exhibit a narcotic component or effect, 17 an erogenous component or effect, nine a stimulating component or effect and only three complexes an anti-erogenous component or effect. This relationship clearly demonstrates the importance of the individual erotic effects within the

flower complexes: the narcotic effect and hence also narcotic odorants play by far the most important role and anti-erogenous components have only a marginal role. The finding that not a single flower odor is predominantly erogenous is readily explained by the consideration that only odorants with animal odor character, i.e. reminiscent in odor of human personal odor or its components, have this effect exclusively, and no flower odor used in perfumery can be called purely animal. The determination and analysis of the odor effects of flowers or of the odor concentrates obtained from them serves also to explain the erotic effects of their individual chemically defined components.

It is not appropriate at this point, however, to classify the individual odor materials, because so far consideration of flower odors has only covered the erotic effects of a small selection of natural and of a relatively minor part of the synthetic perfumery materials. A survey of the erotic effects of the individual perfumery materials – natural and synthetic, composite and chemically pure – will be provided later (Chapter 18). Knowing the erotic effects of the individual flower complexes and of the odorants responsible for these effects facilitates their use as perfume components. In their creative endeavors, perfumers need no longer depend only on imagination and taste but can consciously achieve certain effects using the results of systematic investigation.

9 The erotic effect of perfumes

The natural and the artificial flower oils, extracts and bases are among the most important raw materials of perfumery. They become more valuable the more closely they match the odor of the living flower. It would, however, be a grave mistake to regard them as finished products in the sense that their alcoholic solutions could be regarded as perfumes or toilet waters, or that they could be used as such for scenting cosmetic products. Perfumery and cosmetics are, without doubt, servants of Eros and the creations of these arts are valued according to the extent that they are erotically effective. The erotic effects expected of cosmetic products can be of several kinds. Only stimulating effects, for example, are demanded of many body-care products. Here, an appropriate fragrance can and should support, as much as possible, the effect of the cosmetic or its manner of application. From alcoholic fragrances (perfumes, colognes, eaux de toilette) we always demand the greatest possible erotic effect. This is achieved by using, depending on the odor type desired, refreshing, stimulating and narcotic perfume materials to support the effect of one or more erogenous components.

The *refreshing* (anti-erogenous) components of a perfume usually constitute the top note of the composition and hence a kind of olfactory introduction. They serve to awaken the dormant, fatigued or distracted senses and to make them as receptive as possible for the main odor experience. The *narcotic* odor materials should dull consciousness, bedazzle sober reason, remove inhibitions of all kinds and thus clear the way for feelings and fantasies. The *erogenous* odors exploit the thus attained heightened readiness for feelings and fantasies in such a way that even distant similarities to body odors will be registered and will trigger sexual ideas in the imagination. *Stimulating* components then serve to animate the spirit, which is now prepared for erotic activity, and to make it receptive to additional sensual impressions.

If a certain flower odor is used as the basis for a full-fledged perfume, therefore, it must be modified or complemented in such a way that all of these odor effects are achieved. Elements that are lacking or too faint must be built up by adding appropriate perfume materials or complexes, taking care not to modify the desired odor type too much.

The preferred *erogenous* additives for floral perfumes are jasmine or orange blossom absolute (the effective agent in both is indol), also civet and fatty alcohols and fatty aldehydes selected to harmonize well with the floral type at issue.

To bolster the *narcotic* effect, hydroxycitronellal is almost universally applicable in floral perfumes. In addition, rose odorants, ylang-ylang oil, orris

P. Jellinek, *Psychological Basis of Perfumery*
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root absolute, esters of benzyl alcohol, linalool, cinnamic alcohol and ionone are popular supplements. Alpha-amyl cinnamic aldehyde ('jasmine aldehyde'), a material that has not been found in nature, can also be used as a narcotic component in many flower types. In certain complexes methyl anthranilate, heliotropin, amyl salicylate, isoeugenol and, sparingly used, dimethyl benzyl carbinol can also serve very well.

Cassie absolute is excellent in many cases for achieving or boosting a *stimulating* effect. Cyclamen aldehyde, methyl ionone and anisic aldehyde are even more broadly applicable. Phenyl acetic aldehyde, cinnamic aldehyde, benzaldehyde and dihydro jasmone (isojasmone) are particularly effective stimulants. Because of their characteristic odor, however, they are appropriate only in certain complexes and even then must always be used with care. When vanillin and eugenol are used, it must be taken into account that the stimulating effect of these odorants is coupled in nearly all complexes with the generation of a balsamic odor.

In flower perfumes that should remain as close as possible to their natural model, the *refreshing* (anti-erogenous) note is most difficult to achieve. For reasons of odor harmony, the addition of purely anti-erogenous components to flower complexes is not to be advised. There are, however, some perfume materials which possess calming or fresh effects and hence an anti-erogenous element, and that can be blended well with particular flower odors. Foremost among these are the 'leafy' or 'green' odors. Violet leaf absolute and, similar in odor, methyl heptine and octine carbonate have a fresh effect, while phenylacetaldehyde dimethyl acetal, more reminiscent of rose and lilac leaves, has a calming effect. Additional calming materials that are readily usable in various flower compositions are dimethyl benzyl carbinol, linalyl acetate, linalyl formate and geranyl formate. Bergamot oil, also calming in effect, is almost universally applicable in flower perfumes and plays a similar but even greater role in fantasy perfumes. Terpineol is also calming but its effect is very faint.

It should be emphasized once again that the erogenous, narcotic, stimulating or refreshing additives, which a natural or synthetic flower oil requires in order to become a 'perfume', must usually be used at very low levels since they always cause the odor of the complex to deviate from that of the living flower.

Modern taste prefers perfumes with an outspoken character, i.e. with clearly discernable erogenous, narcotic, stimulating or refreshing effects over gentle, not very exciting fragrances. Since such effects can be achieved only with additions of odorants that are clearly noticeable and that always transgress the bounds of naturally appearing flower complexes, flower perfumes have ceased to meet the public's expectations and have gradually been replaced by perfumes that possess, more or less clearly, a fantasy character. The development in this direction was favored or even forced by the demand for the greatest possible lasting power, i.e. tenaciousness, in perfumes of all types. This

demand can be met only through the use of components of low volatility, the fixatives, which in nearly all cases are 'heavy' and not 'floral' in scent.

By combining several flower complexes in the 'flower bouquets', such as Essbouquet, Frangipani, Mille Fleurs or Quelques Fleurs, compositions could be created in which a heightened erogenous effectiveness was achieved through the juxtaposition of complementary odor effects. Since such a 'flower bouquet' was no longer tied to a natural model, refreshing and fixing odorants that were not natural components of flower complexes could also be employed. Thus the point was reached where nothing stood in the way of the creation of a *complete erogenous complex*, which, as has been discussed, consists of refreshing, erogenous, narcotic and stimulating components, rendered as long-lasting as possible by suitable fixation. In creating flower bouquets, the perfumer's model was, in a way, an arrangement of different flowers. In an analogous fashion, a number of other fantasy perfumes were inspired by other natural fragrances. In some cases, this natural fragrance not only gave the composition its name but also formed its olfactory basis. The lacking refreshing, stimulating, erogenous and narcotic components, needed to achieve the highest possible effectiveness, were added by selecting from available odorants those that best fitted the theme.

An example of such a fantasy perfume, in which a natural odor comprises the central theme, is New Mown Hay (Foin coupé). The heart of this complex is coumarin or extracts of tonka bean, the odorous principle of which is again coumarin. The stimulating effect of this lactone, sometimes supported by anisic aldehyde or dimethyl hydroquinone, represents the sweet, somewhat hard note of hay odor. The other major component of natural hay odor possesses a bitter herbaceous character. This can be achieved by using patchouli oil, vetiver oil and extracts of oak moss, and results in a further boosting of the stimulating effect. An erogenous note is usually achieved by the use of fleurs d'oranger absolute, ambrette seed oil and infusions of civet and musk. A strong narcotic element is particularly important in the hay odor. It can be achieved by the use of rose odorants (rose oil, geranium oils, etc.), ylang-ylang oil, clary sage oil, orris products and esters of salicylic acid. A fresh touch is usually obtained by the use of citrus oils, lavender oil or petitgrain oil. In all, the primary effect of hay perfumes is stimulating; this is counterbalanced and softened by narcotic components. Erogenous and refreshing notes play less important roles here.

In the *leather* perfumes, represented by the fantasy types Cuir de Russie and Peau d'Espagne, a strong erogenous complex dominates. This is because the most potent body-like perfume materials, castoreum, musk tonquin, ambergris, civet, ambrette seed oil (Ambrettolide, Exaltolide) as well as styrax and balsam tolu are all highly suited for combinations with birch tar oil, which is the basis of leather fragrances. The sharp phenolic odor of birch tar oil, in itself stimulating, forms, when combined with erogenous odor materials of animal or vegetable origin, a complex with a distinctly animal and hence powerfully

erotic odor. In the odor of Cuir de Russie type perfumes, this complex dominates. Narcotic nuances are usually added by the use of rose odorants and synthetic musks, and refreshing nuances obtained by additions of bergamot, neroli or petitgrain oil. Coumarin and vanillin enhance the stimulating effect of birch tar oil. Peau d'Espagne type perfumes are marked by an animal erotic element only slightly modified by small amounts of birch tar oil. This perfume is strongly boosted by indol-containing flower complexes, especially jasmine and orange blossom absolutes; these also add a floral to the animal note. The floral element is further emphasized by generous additions of narcotic flower complexes such as rose, orris and others. Additional narcotic components are often found, e.g. synthetic musks and esters of benzoic and salicylic acids. For a stimulating effect, spice oils (clove, cinnamon, mace, etc.) as well as patchouli oil, vetiver oil and coumarin are favorite additives. An Eau de Cologne complex or single components thereof are usually used to provide the refreshing touch.

Additional examples of fantasy perfumes based on a natural odor theme are the Verbena, Ylang, Sandalwood, Patchouli and Oak Moss perfumes, popular once but nearly forgotten today. The fantasy perfumes Ambergris, Musk and Opoponax continue to retain a certain popularity, especially in the Orient and in southern hemisphere countries. Prior to discussing these, consideration will be given to a group of three closely related aroma chemicals that play a key role in them: the 'synthetic musks'. The synthetic musk odorants play an inconspicuous yet extremely important role not only in the leather perfumes discussed above but in nearly all modern fantasy perfumes. A close look will therefore be taken at the erotic effect of the three that are most widely used.

The synthetic musks have no chemical relationship whatever with the odorous principles of musky animal or plant extracts. They owe their name to an odor nuance which they share with the natural products. The odor of tonquin musk was characterized earlier (page 40) by noting that it is composed of three elements which were designated as pungent–ammonia, bitter–animalic and sweet–nutty. The odor of the synthetic musks most closely approximates the latter nuance which, in natural musk, is reminiscent of the regional odors of the scalp and the skin. This resemblance, however, is not sufficiently close to permit us to designate the synthetic musks themselves as body-like and erogenous. They are, rather, primarily characterized by a narcotic effect, accompanied, more or less distinctly in each type, by an erogenous and a stimulating nuance.

Musk xylol is the faintest smelling of the three. The narcotic element is relatively weak and the erogenous and stimulating notes are quite clear. Musk xylol therefore most closely approximates musk tonquin in odor character. In *musk ketone*, the sweet–nutty note is gently narcotic, the erogenous and stimulating auxiliary nuances remain in the background. The odor of musk ketone can, therefore, be described as 'soft'. The sweet–nutty component of *musk ambrette* is reminiscent of the odorous principle of the 'plant musk'

ambrette seed oil (p. 41) which has been identified as ambrettolid. Musk ambrette shares with Ambrettolide the stimulating more than the erogenous effect. In addition, musk ambrette exhibits a powerful, somewhat balsamic, narcotic note, much superior in strength to that in the two other synthetic musks and capable of making itself clearly felt in compositions.

The synthetic musks share an exceptional tenacity of odor, suggestive of powers of fixation which they do not actually possess. Their usefulness for perfumery stems, especially in the case of musk ambrette and musk ketone, largely from the fact that they are among the rare narcotic perfumery materials that are neither floral nor distinctly balsamic. While the synthetic musk aromatics must be used with great caution in floral perfumes and also serve only as modifying or smoothing agents in most modern fantasy perfumes, they must be considered part of the base of the three 'Oriental' fantasy types that will now be discussed. These owe their names to natural odor materials but have little to do with them in terms of odor.

The *ambergris perfumes* have very little in common with the very delicate bitter–sweet animalic odor of matured amber tinctures. They are usually built on a very sultry base whose erogenous elements are natural ambergris, tonkquin musk, ambrette seed oil (Ambrettolide or Exaltolid), terpeneless cypress oil and labdanum extracts, while the most common narcotic components are musk ambrette and musk ketone, East Indian sandalwood oil, oil of clary sage, orris products and rose odorants. Stimulating effects are achieved by the use of vanillin, coumarin, patchouli oil, vetiver oil, oak moss extracts and small amounts of spice oils. Possible refreshing components, whose role in the ambergris complex is very minor, are the terpene-rich cypress oil and the resin oils, even higher in terpene content, of labdanum, cistus, olibanum, opoponax and others. Quality ambergris perfumes, therefore, do not share the natural product's odor type but do share its distinctly erogenous effect. The same is true for the synthetic ambergris products that are commercially available. These may also be regarded as strongly erogenous fantasy complexes in which a close resemblance to the odor of ambergris or its infusion is perhaps attempted, but never achieved, and which are nearly or entirely lacking in narcotic and refreshing components. Solutions of top quality artificial ambergris compositions can therefore never be regarded as true perfumes unless they are complemented by additions of narcotic and refreshing perfume materials.

The *musk perfumes* can also be regarded as attempts to reproduce the erogenous note of tonquin musk infusions in the form of stylized perfume creations. To achieve this erogenous note infusions of tonquin musk, castoreum, civet and ambergris are used as well as ambrette seed oil or Ambrettolide (Exaltolide). Musk ketone and xylol, rose oil, orris oil and East Indian sandalwood oil are used as narcotic additives. Stimulating effects are achieved using clove oil, more rarely cinnamon oil, and vanillin. Lavender oil and bergamot oil are used for a refreshing touch.

Amber and musk perfumes share with their natural namesakes a certain similarity in odor, thanks to the large proportion of the infusions of the natural materials contained in them; they certainly attempt to achieve an erogenous effect akin to that of the natural materials. None of this is true in the case of the *Opoponax* types known today. These have nothing in common with the odor nor with the effect of the natural resin. In fact, the resin is rarely used in the perfume compositions that bear its name, since its somewhat dry scent, which in mature tinctures recalls the bouquet of certain southern European wines, would add little to the compositions even where it would not upset their balance. The basic complex of the Opoponax perfumes is made up of narcotic and stimulating components. Accompanied by a distinct refreshing and a little emphasized erogenous component, they are responsible for its characteristic 'piquant' overall effect. The narcotic materials used here are musk ambrette and musk ketone at relatively high levels, and also East Indian sandalwood oil, benzoe resin, balsam Peru, heliotropin and rose odorants. A major role in the odor complex is played by certain resins and balsams whose erogenous body-like nuances, together with their balsamic base note, result in distinctly sultry effects. Such resins and balsams are tolu, labdanum, styrax and olibanum (incense). Orris root concrete, often used here, also has a slight erogenous effect due to its fatty note, reminiscent of sweat, which accompanies the narcotic scent of irone and makes it sultry. The stimulating effects in the Opoponax complex are usually achieved using vanillin, coumarin, vetiver oil, patchouli oil and spice oils such as pepper oil, coriander oil, clove oil, tarragon oil and others. The oils of bergamot and of lemon are the major refreshing components.

It is possible that an early, long since forgotten, Opoponax perfume may have been based on the resin of that name or may have tried to emulate its scent. In the Opoponax types of today, however, a reminder of the natural product is found in the name only. Similar situations are found with other fantasy perfumes known under such names as Fougère (fern), Poppy, Cherry Blossom, Apple Blossom, etc. Maybe here, too, a delicate flower or plant scent may have been the initial inspiration for the creation of a perfume that in the course of time, in response to the changing demands of fashion, deviated from its natural model to such an extent that the types known today must be regarded as creations of pure fantasy. Alternatively, and with at least equal plausibility, it can be postulated that certain plants and flowers have stimulated perfumers' creative imagination by their characteristic form, their striking color or by the charm of their native habitat. Blood-red poppies whose form, austere in the bud and opulent in full bloom, is apt to generate erotic fantasies could lend their name only to erogenous, sultry perfumes. The white or delicately pink apple or cherry blossoms could inspire the compositions of similarly delicate, spring-like fragrances that contain, perhaps, aroma nuances that are formed only later, in the fruits.

The perfumer finds a particularly wide scope for the imagination when

composing a Fougère type fragrance, since none of the more than 4000 known fern species possesses a scent that could serve as the basis for a perfume. Why has this flowerless plant, of all plants, inspired the creation of a whole range of fantasy types, out of which the rather precisely defined type which is known today has only gradually emerged? Perhaps the reason lies in the somewhat mystical atmosphere in which the ancient ferns are steeped, with their bizarre shapes and growing in the shade of old forests. Growth and decay of plants can here be seen and also smelt side-by-side. The acrid–fresh scent of emerging leaves and young, sap-rich woods is blended with the sweet–putrid odor of rotting leaves and decaying trunks. This olfactory form, interesting because of the contrasts it contains, can be considered to be the main theme of Fougère compositions. The refreshing scent of young leaves and herbs is represented by lavender oil, one of the key components of the complex. The lavender may be modified by linalool and linalyl acetate, natural components of the oil, or by the use of bergamot oil, which contains the same two aromatics and is particularly refreshing in effect. The putrid–musty component is represented by the herbaceous patchouli oil and the more woody-smelling oak moss extracts. These materials also provide a stimulating effect which may be enhanced by sweet–herbaceous coumarin and by vetiver with its dry woody note. Narcotic components which fit well into the Fougère complex are clary sage oil, East Indian sandalwood oil, amyl salicylate and the resins labdanum and tolu, which are also somewhat erogenous. Musk and ambergris infusions, as well as ambrette seed oil, are used as plainly erogenous components.

It should be noted at this point that mention of the use of the absolutes of jasmine and rose has generally been avoided, since these, and perhaps also the absolutes of orange blossom and tuberose, are almost universally used in perfumes and always provide that erogenous and narcotic, i.e. sultry, base note that is found in all modern perfumes and is characteristic especially of the creations of French perfumers. Moreover, to mention, in the discussions of the characteristics of complexes, all of the perfume materials that could be employed to achieve special nuances, rounding or fixing effects would be going too far. It would be counterproductive since an overly large array of materials would obscure the truly characteristic aspects of each type. Only the greatest possible parsimony in the number of components can provide a clear picture of the specific effects of each; this is true also in practical creative exercises.

With the Fougère complex it is still possible to find a relationship between its name and its odor character, although it will never be known whether the explanation proposed above was really what the creator of the first perfume named Fougère had in mind. With pure fantasy perfumes, however, there is no relationship whatever between their odor and their name. A discussion of the various sources of inspiration for the creation of a pure fantasy perfume or of the process of naming perfumes is beyond the scope of this discourse. Moreover, the answers to such questions could only be surmised since no perfumer is in the habit of commenting on the mode of creation or the

character of fantasy creations. In fact, in most cases this could not be done even if the perfumer wanted to. The extensive discussions that follow of the two most renowned fantasy complexes are meant only to provide additional guidance in the analysis of the erotic effects of single odor components.

Chypre is the French name for the isle of Cyprus. Crusaders are said to have brought an 'Eau de Chypre' from here to Europe as early as the twelfth century (Piesse, 1917). Lazare (1925) reports that a mixture of labdanum, styrax and calamus was used in fourteenth century Europe as an incense and went by the name Chypre. In 1777, Dejean published two recipes for Chypre. One of these contained oak moss powder (decolorized by washing), musk, ambergris and civet; the other oak moss, orange blossom, benzoe, styrax, civet, bitter almonds, cardamom, rose leaves, clove stems, sandalwood and camphor. The island of Cyprus is, in fact, one of the prime native habitats of cistus, a genus of the rock rose family (Cistinae). The resin of this bush, named labdanum or ladanum, stuck to the wool of grazing sheep and was collected by combing by the shepherds. The so-called labdanum resin that was thus obtained was used, because of its powerful balsamic odor, in the preparation of incense and later also for perfumes. It certainly is not unusual for an article of trade to be named after its country of origin. It is, therefore, quite likely that the designation 'Chypre' was first used for certain fragrant resin mixes based on labdanum resin and in this way made its way into perfumery.

As far as the historic development of the Chypre type can be traced, it appears at first to have been purely balsamic. The recipes from the eighteenth century are based on oak moss, combined either with animal odor materials exclusively or with flower odors, resins, spices, sandalwood and civet. Formulations from the nineteenth century contain flower odors, animal extracts, resins and balsams, but no labdanum, oak moss or spicy components. As with most perfumes of the period, Chypre became a delicate floral scent, made a little special by a gently balsamic note and a slight erogenous touch. The modern Chypre complex is based on the accord bergamot (refreshing)–oak moss (stimulating)–jasmine (erogenous)–rose (narcotic). In most Chypre perfumes the refreshing effect is achieved entirely by bergamot oil which plays a very important role in the composition. In some formulations from the hand of the most renowned authors, bergamot oil makes up 15–22% of the total composition. To boost the stimulating effect of oak moss extracts, patchouli oil, vetiver oil, methyl ionone, coumarin and vanillin are used. The erogenous note is enhanced by tonquin musk, castoreum and musk odorants of vegetable origin, the narcotic effect by East Indian sandalwood oil, oil of clary sage, hydroxy citronellal, orris products and synthetic musks.

If the historic development of the Chypre complex is reviewed with respect to its erotic effect, an interesting picture emerges. In the next chapter conclusions will be drawn from this development that have great importance to the perfumer. The most ancient Chypre type is distinctly sultry, that is balsamic and also erogenous, due to the body odor-like aspects of labdanum

and of added animal extracts. Later additions of oak moss did not change this effect, they rather boosted it since these blends were used exclusively for burning as incense. The process of burning in which, aside from new empyreumatic odor materials, carbon monoxide and carbon dioxide are formed has a narcotic effect in itself, an effect strongly enhanced by the odorous materials used in incense. The first Chypre compositions that were no longer used for burning but directly as perfumes were based almost exclusively on narcotic, floral effects. These were later joined by erogenous components, gradually also by refreshing ones and eventually by a stimulating note that received increasing emphasis over the course of time. This stimulating note, achieved in the classic Coty Chypre largely by oak moss, was eventually considerably boosted by certain strongly stimulating spice oils such as cinnamon oil, clove oil, tarragon oil, coriander oil, cardamom oil, sassafras oil, angelica root oil, sweet basil oil and thyme oil, in effect creating a new fragrance type that is most beautifully represented by Guerlain's splendid 'Mitsouko'.

The origins of the second classic fantasy type, *Eau de Cologne*, are much more recent than those of Chypre. In contrast to Chypre, it has remained essentially unchanged in odor type and effect up to the present time. 'Kölnisches Wasser' was produced and sold on a fairly large scale as early as 1709 by its inventor Johann Maria Farina, an Italian who had emigrated to Cologne and established an enterprise there at Gegenüber dem Jülichsplatz (opposite Jülich Square). According to an alternative explanation Eau de Cologne was invented by Paul de Feminis in his native city of Milano and was manufactured by him in Cologne starting in 1690, and by his nephew Jean Antoine Farina since 1706 in Paris. In any case, this toilet water, which achieved rapid success and has remained the most widely used type even to the present day, first became generally known at the beginning of the eighteenth century. Since this time, its method of manufacture has changed but not its odor type, although the world-wide success of this fragrance has led to the creation of numerous imitations and variations.

The effect of Eau de Cologne is primarily refreshing owing, apart from the far from negligible refreshing effect of alcohol, primarily to the citrus terpenes contained in its fragrance composition. (The use of terpeneless Eau de Cologne compositions is therefore absurd, even more so since these are employed only for lotions with low alcoholic content. This means doing without the two main refreshing components of Eau de Cologne, alcohol and terpenes, to the greatest possible extent.) Next to the refreshing effect, Eau de Cologne also possesses a marked stimulating effect which it owes largely to the odorous principles of lemon oil (citral) and orange oil (decylic aldehyde). Apart from these two essential oils, important components of the Eau de Cologne complex are neroli oil, bergamot oil and lavender oil. These three oils contain linalyl acetate (calming) and linalool (narcotic) as their main components. Bergamot serves to smoothe the distinctly acid–fruity odors of orange and lemon oil so that the sweet flowery scent of neroli oil becomes more noticeable and with it

the effects of its narcotic (linalool, nerol, nerolidol, phenyl ethyl alcohol, geraniol, methyl anthranilate) and erogenous components (indol, phenyl acetic acid). Just as bergamot oil serves to smoothe the odor of the citrus oils rich in terpenes, so lavender oil has the function of toning down the dry–herbaceous, camphory odor of rosemary oil, forming with it a floral–herbaceous complex that enables neroli oil to stand out better. The oils of rose and jasmine, whose effects have been amply discussed above, are minor components of Eau de Cologne compositions. Petitgrain, which is much used, is closely related to neroli oil both in chemical composition and in its odor. It differs from neroli by the complete absence of indol; it contains only traces of methyl anthranilate, fewer alcohols but considerably more esters, especially linalyl acetate (up to 70%), and it has a higher terpene content than neroli oil. Thus, petitgrain possesses no erogenous components and is nearly exclusively refreshing in effect.

The toilet waters sold under the designation 'Eau de Cologne Russe' are combinations of Eau de Cologne complexes with narcotic, erogenous or sultry fantasy components, hence the refreshing, stimulating effect of Eau de Cologne is far less dominant in these perfumes. Eau de Cologne Russe is the best-known representative of a range of toilet waters that may be grouped under the designation 'fantasy Eaux de Cologne'. Among these, Juchten-Eau de Cologne (leather Eau de Cologne) and Eau de Cologne Chypre are particularly popular. In recent decades the designation 'Eau de Cologne' has been used in the place of 'lotion' or 'toilet water', especially in southern European countries. This practice, confusing to the perfumer, probably comes from the fact that the lotions and toilet waters of all fragrance types, which are much lower in perfume materials than the corresponding extrait perfume, are far more refreshing largely because of their alcohol content. These diluted perfumes are used much like Eau de Cologne.

Lavender water, comparable in many respects to Eau de Cologne, has known considerable ups and downs in popularity while the success of Eau de Cologne has survived all whims of fashion. Finding an explanation for this difference presents an interesting challenge. Lavender water has been commercially manufactured and been in general use at least as long as Eau de Cologne, and certainly matched it in popularity and distribution until the end of the nineteenth century. The unobtrusive, calming odor of the lavender waters of the day were entirely in accord with the prevailing refined taste. Around the turn of the century, the public began to find the old lavender type boring and old-fashioned, and it lost much of its popularity. Only after the introduction of several changes did the 'modified' lavender compositions regain the popularity that they still possess today. Next to Eau de Cologne, lavender water certainly is the most widely used toilet water.

Originally, lavender water was prepared by simple distillation of aged alcoholic infusions of fresh lavender flowers. Later it consisted of an alcoholic solution of aged lavender oil to which oil of bergamot had usually been added.

The lavender waters prepared in this fashion had a purely calming effect. In response to the demands of modern taste, English perfumers later added civet and musk as erogenous components, and orris root infusions, clary sage oil and rose oil as narcotic materials. In France the 'Lavande ambrée' type, a variant made sultry by the addition of artificial ambergris products, was more popular. The lavender waters that are successful today are distinguished from their forerunners primarily by an emphasis on the stimulating note. This is achieved through additions of coumarin, patchouli oil, vetiver oil and certain spice oils. The increasing use of lavender absolute (see p. 57), with its natural content of coumarin and acetic acid, further supports this emphasis. The development of the lavender water type shows, albeit not as clearly as that of Chypre, that modern taste prefers stimulating effects above all, in combination with erogenous notes, while earlier generations were content first with balsamic – later with sweet and floral, i.e. with narcotic perfumes.

10 Technical progress and fashion in perfumery

An attempt to discover the psychological and physiological factors underlying the modern concept of esthetics in perfumery is not only of theoretical interest but offers insights of great practical use to the perfumer in his work. All cultures at all times have used the narcotic effect of burning, usually fragrant fumigants to induce or reinforce a mood conducive to mystical thoughts. Archeological finds of incense burners document the exercise of this practice in Egypt, Babylonia, Asia Minor and in southern Europe. A granite plate inserted into the breast of a sphinx shows King Thothmes (*c.* 1600 BC) bringing a burnt offering. The religious ceremonies of the Jews also used burnt offerings as testified by the prophet Isaiah (Isaiah 1, 13; 6, 6) who lived in the eighth century BC. The oracles of the Delphic god were delivered by the priestess Phytia in a trance of narcotic vapors. Incense, one of the most widely known resins for burnt offerings, was used by Egyptians, Babylonians, Greeks and Romans, the latter starting only in the second century BC (Ashley, 1909). The introduction of incense into Catholic liturgy occurred in the fourth century. The practice of ceremonial burnt offerings has been preserved up to the present also in the Chinese and Indian religions. As these examples show, fragrant resins were initially used solely for ceremonial, i.e. mystical, purposes. In most ancient cultures the priest was also the healer. He used fragrant plant materials and smoking also for sanitary purposes. This prepared the way for the profane use of these materials, probably initially for healing and disinfecting, later also simply for their pleasing scent. The religious fanaticism widespread in Europe during the Middle Ages led to a flowering of the mystic bent that has always been latent in man. Doubtless, the perfumes popular during the Middle Ages were the sultry, narcotic 'perfumes of Arabia' – for reasons to be discussed later these probably were not erogenous – which were initially brought to Europe as booty by the victorious crusaders. They were most appropriate to the taste of the time, characterized as it was by mysticism.

The modern age which set in early in the sixteenth century was accompanied by a rebirth of sensuality. Renaissance man began to turn his glance, which had long been turned inwards, towards the outer world, liberated himself from the medieval otherwordly, life-disdaining outlook and enjoyed the pleasures of life with all the senses of his body, which he learned to groom, decorate and perfume again. One of the consequences of this mental reversal, expressed by the abandonment of the darkness of mystic thought, was a growing rejection of heavily narcotic 'dark' odors and of the burning process with its almost hypnotic effect. People started to perfume their garments and their bodies with

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more gentle and brighter odors, such as those offered by flowers and the strongly scented citrus fruits.

Satisfying the new taste that had come with the changed outlook on life was facilitated by the remarkable progress occurring at the time in the fields of science and technology. The technique of distillation, developed to a fairly high level by the alchemists, made possible the production not only of rose and orange blossom waters but also the manufacture of alcohol of higher concentration than could previously be obtained by fermentation only. This alcohol could be employed to extract the odorous principles from fragrant natural materials and to preserve them, in a true-to-life and fresh state, in the form of tinctures and infusions that could be blended and used in a simple fashion.

Thus the foundation had been layed for perfumery in the more narrow sense. The possibility had been created for preparing solutions of odorous materials that were sufficiently concentrated to serve as scenting agents. By maceration with alcohol, extracts were obtained from fresh and dried flowers, fragrant plants and various materials of animal and vegetable origin. These could either be used as essences after simple filtration or they could be used after distillation. Compositions were made either of the plant and animal materials as such or of their extracts. These could be combined with distillates. Often this was followed by another distillation, or by the addition of fresh materials. All of these processes could be varied or repeated at will. The original lavender water, for example, was a straight distillate. Eau de Cologne in its earliest form was a mixture of essences, distillates and perhaps oils obtained from the peels of citrus fruits by pressing.

The familiarity with alcohol and its solvent powers for odorous materials also paved the way for the preparation of true flower perfumes. Based on the knowledge that flower scents are absorbed by fatty materials, two methods came to be known for the preparation of scented fats and oils. In the process of 'maceration' or 'enfleurage à chaud', fresh flowers were treated with heated oils or melted fats; their fragrant components were thus *dissolved* in the fat. The advantage of this method was the near completeness of extraction; its disadvantage was the decomposition of the more heat-sensitive components of the flower scent. In some flowers, moreover, the life processes, including the production of odorous materials, continue for some time after picking. Contact with the hot fats and oils in maceration immediately suppressed these processes.

On close contact with cold fat, the odor materials diffused by the flower are *absorbed* by the fat. The advantages and drawbacks of this technique, called 'enfleurage à froid' or simply 'enfleurage', are the reverse of those of maceration. The end products of both processes were oils (huiles antiques) and fats (pommades) infused with the fragrance of the flowers. These were important and valuable materials for cosmetics but less suitable for direct use as perfumes since they contained at most only 1% of pure fragrance materials. These materials, vaporizing rapidly, were influenced in their effect and eventually

drowned out by the odor of the fats themselves. Moreover, the relatively large amounts of fat made these substances unpleasant on the skin and on the garments worn.

When alcohol became available, it offered a way of extracting the odorous materials from the fat. The recovered fat could be used again and, a far more important advantage, a fragrance solution (lavage) was obtained that was entirely volatile and that could be applied to the skin or to garments without undesirable side-effects. Since the alcohol was far more volatile than the odor materials dissolved in it, these could be concentrated at will by distilling off the alcohol. They could even be obtained in pure form, free from alcohol.

Fashions reflect the advances of science and technology and are directly shaped by them. This phenomenon may be observed quite generally and is certainly true in perfumery. Streamlined designs are found today in vacuum cleaners, typewriters and other everyday and luxury articles; the invention of synthetic fibers, plastics and cellophane has had revolutionary effects in many areas; health and sickness yesterday depended on vitamins, today on hormones, tomorrow perhaps on viruses of all kinds. In the same way, fashions in perfumery have strongly depended on the advances in fragrance technology. The feasibility of producing concentrated flower scents resulted in a near-total dominance of flower perfumes. All odor materials that had been used earlier were now used as modifiers or fixatives for floral fragrances and were judged in terms of their suitability for this purpose.

In the first half of the nineteenth century, the synthesis of nitrobenzene ('oil of mirbane') and of benzaldehyde provided proof that perfume materials could be produced not only by nature but also by the chemist. The syntheses of vanillin (1874), coumarin (1875) and ionone (1893) were followed by the discovery of a large array of aroma chemicals that were isolated from the natural complexes in which they occurred, their chemical structure identified and in some cases synthesized.

Realism in the visual arts came into being in the Hellenistic period of classical antiquity as a reaction against a style that lost vitality and dynamism. It reappeared in the waning days of the Middle Ages. The quest for 'naturalistic' expression can be successful only if the artist has the appropriate working materials available, in perfumery as in other arts. Naturalism in perfumery became possible only when technicians provided the perfumers with natural flower oils and chemists furnished them with certain aroma chemicals that were needed to achieve, by skillful blending, a faithful rendering of flower scents. Thus, the application of scientific and technical achievements resulted in the establishment of 'naturalism' as the style that dominated fashions in perfumery. This orientation reached its zenith in the first decade of the twentieth century. It produced an array of masterworks in the form of excellently wrought artificial flower oils and floral perfumes. At the same time, it resulted in a decline in perfumery in the strict sense since it exhausted itself in

the imitation of natural scents and lost its true purpose, i.e. to create fragrant aphrodisiacs.

The deceptively close matching of a flower scent by the masterful blending of natural and synthetic perfume materials must certainly be recognized as an admirable achievement. However, the belief that such a creation would be successful as a perfume was destined to be disappointed in nearly all instances, for it was born out of a lack of understanding of the expectations which the public, albeit usually unconsciously, holds of the effect of a perfume. No woman is actually interested in smelling deceptively like violets, roses, lilac or lilies of the valley. If she is fond of these scents, she enjoys them in her soap and in other toiletries. However, when using a perfume, her only aim is, as it is with her clothing or hair, to enhance her beauty and her loveliness (in the literal sense of that word) in her own eyes and in the eyes of those around her, especially the members of the other sex. Preference patterns in fragrance may change with the fashions but among the benefits that the public expects from perfumes the strongest possible stimulation of the imagination in the erotic sense will always rank first.

It should be emphasized, however, that erotic effects cannot be achieved solely by using erogenous perfume materials; narcotic, stimulating and refreshing components must also be present. The degree to which each of these effects is stressed may vary with the prevailing fashion. In the nineteenth century, for example, perfumes in which the narcotic flower scents predominated were the fashion. This predilection might be explained by the fact that, masking an inner lack of sexual freedom, the quest for control of the all-too-strong sexual urges had been turned into a moral prescription. Hence perfume, as a discreet aphrodisiac, had to serve primarily to weaken the inculcated moral restraints by its narcotic components and their intoxicating effects. The predominance of the narcotic effect can be deduced from the recipes for the fashionable perfumes of the day; the perfumes themselves are probably no longer retrievable. In their names – Mille Fleurs, Jockey Club, Fines Herbes, Peau d'Espagne, Foin coupé, Bruyère, Floraison, Frangipani, etc. – all erotic allusions are carefully avoided.

This era, in which perfumers had proved, both by the composition and by the discreet names of their perfumes, to have properly understood the spirit of the times, was followed by the intermezzo of decline mentioned above. One of the causes of this decline consisted, as has been noted, in the failure of most perfumers to understand the objectives which their creations had to serve. Proud of their skills in imitating nature, they lost sight of the public's unarticulated but justified desire for aphrodisiacs. Yet another factor was involved in the public's loss of interest in perfumes. This was the tremendous development in body care which became apparent around the second decade of the twentieth century, although its roots had been laid earlier, and which manifested itself in an often truly excessive cult of hygiene and sports. Sports above all, hitherto a nearly exclusively male domain but now also turning

women into enthusiastic disciples and zealous apostles, gave rise to momentous changes in the outlook and mores of the adolescents and adults of the day. This is not the place for an enumeration and critical evaluation of the causes and consequences of this development. Suffice it to note that both the young and the adult generation sacrificed their freedom in a reactionary fashion to the cult of the body and the joys of untamed nature in an era in which science and technology made triumphant strides and in which organizations and industrialization threatened to stifle individualism. Nevertheless, Eros was not asleep during this period, he had simply changed his tactics. The women of this generation also did not want to do without the arts that served their beauty. The cosmetician was far more alert to this than the perfumer, and much more skillful at adapting cosmetic creations to the new expectations. Gradually, however, perfumers also awoke tc an understanding of the new patterns of taste that have come to dominate perfumery right up to the present day.

11 The modern perfume

In order to understand the direction in which modern taste in perfumery has developed and starting from the near-irrefutable premise that perfume must be regarded as an aphrodisiac, it is important to learn above all to comprehend the relationship between the sexes in our time to the extent that this is not fixed by immutable laws of nature but determined by the patterns of social life and prevailing attitudes. The equality of women in all areas of public and social life was prepared for by the feminine emancipation movement, it was suddenly and dramatically boosted by the shortage of male labor during World War I (1914–1918) and it has since been almost totally achieved. It has led to a great communality of interests, both intellectual and material, between the sexes. This fact, reflected also in mixed or at least equivalent education, resulted in an ever-increasing closeness, a partnership in both work and leisure. The closer non-sexual relations among men and women naturally led to changes also in the relationship between the sexes. The enticement of the other sex, rooted in mystery, fantasy and illusion was largely lost. It was replaced by the attraction of the natural strengths and weaknesses, usually felt to be equally lovable, which men and women could now better and more freely observe in one another. Erotic relationships lost much of their exaggerated romanticism and became more healthy and natural. The same attribute which earlier generations had dared allude to only as 'mysterious charm' and 'enchantment' was now called, honestly and in a matter-of-fact way, 'sex appeal'. This contrast characterizes the difference in effect of yesterday's and today's perfumes. The nineteenth century valued in perfumes above all the 'mysterious enchantment', an undefinable narcotic effect. Today's public expects, first and foremost, sex appeal, i.e. an erogenous and stimulating effect. Based on the arguments just presented, these translations of the public's expectations into perfumery terms speak for themselves. Expressions such as 'spirited', 'sexy' and 'full of personality' are often applied to successful modern perfumes, and reflect an accurate, if imprecisely expressed, understanding of their key characteristics.

During the misguided naturalistic era, a few masterworks were created whose world-wide renown survived the period of decline and showed perfumers the way from the outmoded esthetics of an earlier age towards a modern style. The three perfumes of this group that were perhaps the most characteristic and the most successful will be analyzed here, looking at the individual effects of their main components in order to find a common pattern in their interactions that may serve to explain their popularity.

As the most noble representative of an old and distinguished perfume family, the 'Chypre' created at the beginning of this century by the genius

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perfumer François Coty is a classic of our times. Coty, whose real name was Francesco Giuseppe Sportuno, was born in 1874 in Ajaccio on the island of Corsica. Like his great compatriot Napoleon Bonaparte he made France his home. There he laid the foundations of his world fame, starting from the most humble beginnings. Chypre de Coty is probably his most successful creation. The peculiar charm of this perfume (compare also p. 80) is rooted first and foremost in its jasmine–oak moss complex. The erogenous and, even stronger, stimulating effect of this accord owes much to the remarkable power of ambergris and tonquin musk to boost the stimulating effect of oak moss in complexes without losing their own erogenous character.

From now on the term 'exalting' will be used to denote the complex effect, i.e. the simultaneous and long-lasting action, of erogenous and stimulating perfume components. This effect plays a key role in modern perfumes. It is not exhibited, in a pure manner, by any natural odor complex and can be produced only in artificial blends. Having recognized this effect, all of the known odor effects can be represented in the Odor Effects Diagram (Figure 11.1), a representation that has been validated by practical experience. The diagram shows the polarity of effects: the opposing corners and sides of the square represent contrasting odor effects. It demonstrates which groups of perfume materials or complexes can serve to boost, smoothe or attenuate any given odor effect. Herein lies its practical value. The perfumer can use it both in the creation and in the analysis of perfumes rather than having to rely on experience and the powers of imagination. Thus the perfumer's work is greatly facilitated.

The Odor Effects Diagram also provides a framework for describing more precisely the odor effects of all natural and artificial odor complexes. In the

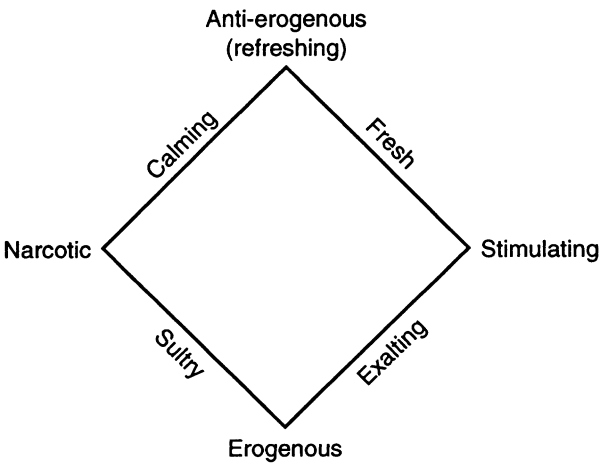


Figure 11.1 The Odor Effects Diagram.

arguments to follow, it will be extensively used in this way. For a better understanding of these arguments, it should be pointed out once more that odors or *odor sensations* must be strictly distinguished from *odor effects*. The differentiation of cause and effect, long since a matter of course in other fields, has been largely neglected in perfumery. The perfumer has always been able to give more or less apt names to odor sensations such as floral, balsamic, spicy, woody, etc. With more complex compositions such characterizations are rarely appropriate, except with natural complexes or widely familiar fantasy types. In such complexes, terms such as rosy, violet-like, Fougère-like, Eau de Cologne-like, etc. are used. Descriptors of this type are, however, unequivocal only in a rough sense, for the odor of complexes is never monolithic and homogeneous – if it were, olfactory analysis would be impossible – only its effect can be so.

Since perfumers were conscious of and could name only the odors and not the effects, these effects, to the extent that they thought or talked about them at all, were simply identified with the odor sensations. Impossibilities and contradictions resulting from this practice were ignored. They were not noted at all or not considered worth thinking about, explaining or overcoming in some way. Odors were called rosy, green, sultry, bitter, exciting, woody or calming in the same breath, and no thought was given to distinguishing between causes and effects, between odor sensations and odor effects. On reflection, anyone would admit that an odor can be described as rosy, green, bitter or woody but that terms such as exciting, calming or exhilarating are descriptions not of odors but of effects that may be induced by different senses, including olfaction. Conversely, odors may calm, excite or exhilarate but they cannot exert rosy, green, bitter or woody effects on us. *Odor impressions are sensory experiences,* and to describe them we use words associated with sensory perceptions, words pertaining also to the senses of vision, taste or touch. Thus, odor descriptions such as green or bright refer to visual impressions; sweet, sour or bitter to the sense of taste. The sense of touch and temperature provides terms such as cool, sharp and soft. Odor descriptions such as fatty, woody, fecal, rosy, etc. refer to a combination of sense impressions, i.e. to sensory perceptions. The term *odor effects* refers to our physical and psychic reactions to odor sensations. Reactions of the same kind can also be caused by sensations of touch, vision, hearing or taste. In experiencing odor sensations, it is possible therefore to infer what effects they will elicit but it is not possible, from the mere observation of an effect, to deduce by what sensory modality it was triggered.

Since perfumers are not yet sufficiently familiar with the description and categorization of perfume materials and complexes (compositions, perfumes) in terms of their effects, the most common odor descriptors have been inserted in the Odor Effects Diagram shown in Figure 11.2. Of course it is not possible to claim either absolute exactitude in the placement of each descriptor within the diagram or completeness in their enumeration since personal views play

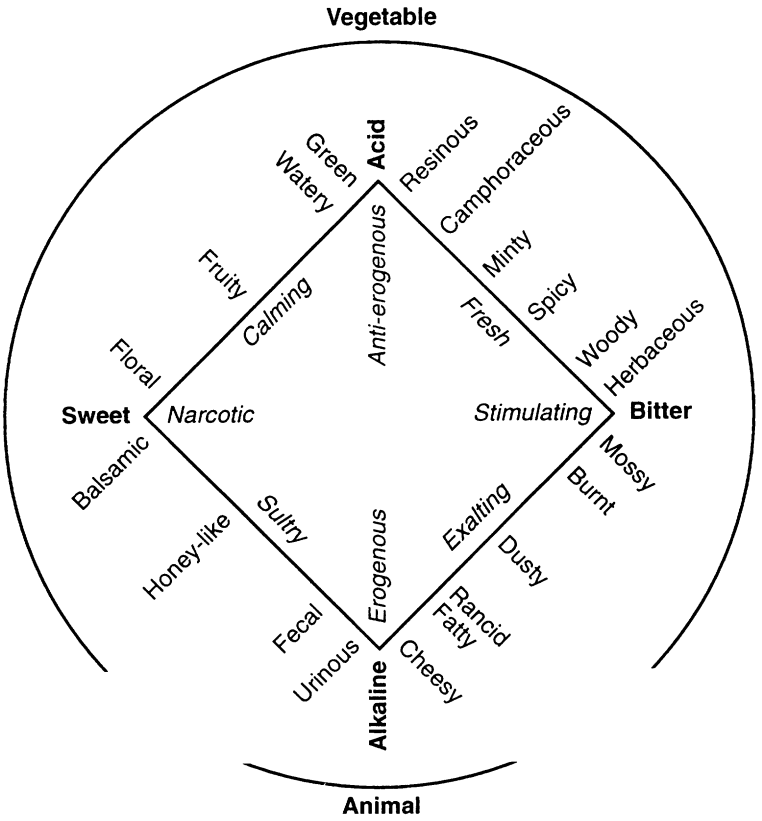


Figure 11.2 Odor effects and odor notes.

a decisive role here. The author has used his own experience in translating the designations of the erotic odor effects, unfamiliar to the perfumer, into familiar odor descriptors. The positions of these descriptors in the diagram indicate, as clearly as is possible, their specific effects.

To illustrate the descriptors included in the diagram, a typical example of each is given below. In addition, alternatives are provided for some of the descriptors.

acid	lemon oil
resinous	pine needle oil
camphoraceous	borneol
minty	peppermint oil
spicy	safrol
woody	vetiver oil

herbaceous	sage oil
bitter	isobutyl quinolin
mossy	oak moss extracts
burnt (phenolic)	birch tar oil
dusty (suffocating, powdery)	Iraldein delta (H&R)
rancid (sweaty)	octyl aldehyde
fatty (waxy)	nonyl alcohol
cheesy (putrid)	ginger grass oil
alkaline (ammonia-like)	musk tonquin
urinous	*para*-cresyl derivatives
fecal	indol
honey-like	phenyl acetic acid and its esters
balsamic	balsam Peru
sweet	rose oil
floral	hydroxy citronellal
fruity	geranyl formate
watery	dimethyl benzyl carbinol
green	phenyl acetaldehyde dimethyl acetal

Returning to Coty's Chypre, it was stated earlier that this perfume is based on a complex with an exalting effect formed by the extracts of oak moss with their stimulating effect and the erogenous infusions of ambergris and tonquin musk. This exalting effect is boosted by additional stimulating components including patchouli oil, vetiver oil and traces of spice oils. Jasmine absolute also plays a very important role here. The effect of this absolute, the most important of all in modern perfumery (Chapter 8), will be briefly reviewed here using the Odor Effects Diagram. Indol (erogenous) forms an exalting complex with jasmone (stimulating) and at the same time a sultry complex with the narcotic materials benzyl acetate, methyl anthranilate, linalool and benzyl alcohol. The effects of both complexes are somewhat attenuated by linalyl acetate (calming). Jasmine absolute is therefore as well suited for boosting exalting and sultry effects as it is for complementing them.

A dominating component of Coty's Chypre in a quantitative sense, important also in its contribution to the perfume's overall effect, is *oil of bergamot*. This oil, obtained from the peel of the bergamot fruit (*Citrus bergamia risso*) by pressing, plays a very important role in modern perfumery generally. It contains 35–40% linalyl acetate and about 30% terpene hydrocarbons, which render it primarily refreshing in effect. This effect is attenuated by narcotic alcohols, present in the oil at levels of up to 30%, largely in the form of linalool. As a result, the overall effect of oil of bergamot is distinctly calming. As the Odor Effects Diagram shows, the overall effects of the jasmine and bergamot complexes are in exact opposition to each other. Thus, these two components, perhaps the most widely used and important ones of all in modern perfumery, exhibit contrasting effects in the erotic sense. With this observation, attention

is drawn to a very interesting factor, of fundamental importance to the effect of individual materials or complexes within the context of compositions: *contrasts of effects*. The modern perfumer uses such contrasts frequently and to great advantage. The application of this effect differentiates the modern technique of composition from the techniques of earlier days and also from the way in which nature constructs its odor complexes. Natural odor complexes, predominantly vegetable in origin, are the end products of biochemical reactions occurring in various parts of living plants. In these processes the plant's 'laboratory' probably starts from a single material, tannin, and operates by specific methods characteristic of the plant species and of the part of the plant involved in odorant synthesis (root, leaf, flower). External (climatic) conditions affect the production of individual components in a quantitative but not in a qualitative sense.

'Natura non fecit saltus': nature makes no leaps. This precept holds for nature's production of odorous materials. Therefore, natural odor complexes always contain, in addition to the principal components that characterize them, substances that are intermediates in the synthesis or decomposition of the odorous principles, similar to them in odor and deviating only in tonality. The effect of these materials is a smoothing of the main odor; this phenomenon will be discussed more fully later (Chapter 12). These organic smoothening agents may represent higher or lower oxidation states of the main substance or homologs of it. Very often they consist of free components which by their interaction form the main material and whose presence is due to the fact that this reaction did not proceed to completion or is reversible as is usually the case, for example, with esterifications and saponifications. The thus obtained organic and almost ideal rounding of natural odor complexes is fully realized only in the fragrant plant itself. The perfume materials isolated from the plant – essential oils, extracts, isolated aroma chemicals – that the perfumer has available have always suffered deterioration to a certain extent because of the process of isolation that, in relation to the delicacy of the materials, always represents a rough operation. In perfume materials whose isolation involves heating (steam distillation, maceration), alcohols and acids are often esterified, esters are saponified, aldehydes form polymers or acetals, etc. In the case of cold extractions, the most volatile components are always lost as the solvent is distilled off.

The perfumer of former days was guided, by and large, by natural models, combining these to 'bouquets' only to ensure that they were all different from one another. To achieve harmonious overall effects in the compositions, the perfumer also sought to smoothe their individual components as perfectly as possible. The preferred smoothing agents were materials related in odor to the given components or bland odorants. The use of stimulating ('hard') perfume materials, whose smoothening usually presents considerable difficulties, was avoided as much as possible and natural complexes, being harmoniously rounded in themselves, were always preferred to single and especially to

synthetic aroma chemicals. This method of creation resulted in perfumes which to present tastes are monotonous, insipid and unacceptable. In contrast to the approach in which harmony is achieved by the use of olfactory notes that smoothly blend into one another, avoiding all leaps, the modern style aims at effects arising from the use of materials or complexes of very pronounced character whose odors are complemented by means of contrasting components and whose erotic effect is enhanced and boosted by this contrast.

The earlier and the modern perfumery approaches will now be considered with the aid of the Odor Effects Diagram. In the old days the accent was on narcotic perfume materials. Their effect is not merely psychological, involving the heightening of receptivity to erotic feelings (see p. 51), but consists also of a desensitization of the sense of smell. This purely physiological effect serves to blur any unevenness which the complex may contain and to promote an impression of smoothness. Narcotic perfume materials are, therefore, the best smoothing agents.

In modern perfumes the accent is on stimulating components. In line with their opposite position in the Odor Effects Diagram (Figure 11.1), stimulating odor materials are capable of activating and sensitizing the olfactory nerves. They make smoothing particularly difficult. The modern technique of composition does not seek to achieve a harmonious effect primarily through smoothing of the stimulating components by the use of materials with kindred odors but aims primarily at the avoidance of monotony of one-sided odors by using materials with *contrasting odors* as a kind of 'olfactory complement'. The contrasting complexes achieved in this way are then smoothed just enough to lend a harmonious, well-blended character to the composition as a whole. The titillating 'piquant' effect of the stimulating materials is preserved as much as possible and not smothered by excessive use of contrasting, i.e. narcotic, components.

This description demonstrates that a clear distinction must be made in the creation of compositions, between *contrasting effects* and *contrasting odors*. Contrasting effects in the erotic sense may be recognized by their opposite position in the Odor Effects Diagram. In contrast to the odor effects, which are limited to four main and four composite ones, the odor types (single aroma chemicals plus complexes) are practically unlimited in number even though they may be grouped into categories such as spicy, floral, balsamic, etc. Here there is no such thing as a clear, truly polar opposition and an odor contrast is nothing but the least possible similarity between odors. The Odor Effects Diagram can be an aid in finding perfume materials with contrasting effects. The contrast to a given odor, in terms of effect, is to be found in the group of effects designated by the opposing corner or side of the diagram. To find contrasting odors in terms of odor quality, personal judgement, observations and experience are the only guide.

Although there are many cases in which perfume materials that contrast in odor are also opposed in their erotic effect, this juxtaposition is by no means

the rule. Citral, vanillin and vetiver oil, for instance, have the same erotic effect, namely stimulating. They are, however, contrasting in odor: citral smells acidic, vanillin sweet and vetiver dry–woody. Conversely, geraniol, phenyl acetaldehyde and *para*-cresyl acetate may all be called floral odors but their erotic effects – narcotic, stimulating and erogenous, respectively – are different or contrasting. The modern perfume unites in its composition anti-erogenous, stimulating, erogenous and narcotic effects. Naturally, this results in all kinds of contrast effects. As was already observed in the analysis of the effects of natural flower complexes, contrasting effects may lead in some cases to mutual reinforcement, in others to attenuation.

The modern perfume is characterized and distinguished from earlier styles not by contrasting effects but by contrasting odors. The modern perfumer seeks to make his compositions striking not by using finely tuned harmonious accords but by contrasts. Once again, the construction of Coty's Chypre offers a good example. The major components making up this perfume are complexes that contrast with one another in various combinations. In the past century, prevailing taste would certainly have preferred perfumes based on its individual components – e.g. Ambre, Mousse, Eau de Cologne and perhaps a Bouquet combining jasmine and rose – over such a complex perfume which is rich in contrasts.

The functions of the major components of Coty's Chypre are represented in Figure 11.3 in the framework of the Odor Effects Diagram; the main components have been set in bold type. The diagram shows that the contrast jasmine–oak moss, which may be considered the most outstanding feature of Coty's Chypre, is a contrast not of effects but of odors. In jasmone, the jasmine complex contains a component that is, like oak moss, stimulating. The effects of these two complexes, therefore, blend smoothly while their odors present a distinct contrast.

The most modern Chypre type is represented by 'Mitsouko' (Guerlain), a most interesting perfume, well deserving of its great success, which many perfumers have attempted to imitate, never arriving at a perfect match but creating some inventive variations in the process. In this perfume the stimulating component of the exalting effect is even more strongly stressed by the use of spice oils and methyl ionone. To avoid an aggressive, one-sided odor effect, the level of bergamot oil is increased several-fold compared to Chypre. Alongside the contrast of effects formed by the calming (bergamot) and exalting components, which results in an attenuation of both effects, a complex contrast of odors is found in Mitsouko that makes the materials involved stand out even more strongly. The combination jasmine–oak moss, effective in itself because of its inner contrast, contrasts with bergamot not only in effect but also in odor. This double contrast is the main theme of the perfume. It also occurs in Chypre but in Mitsouko it is accompanied by a secondary, special contrast. This is formed by the various spice oils and methyl ionone – a classic example of a complex of materials similar in effect but contrasting in odor – which in

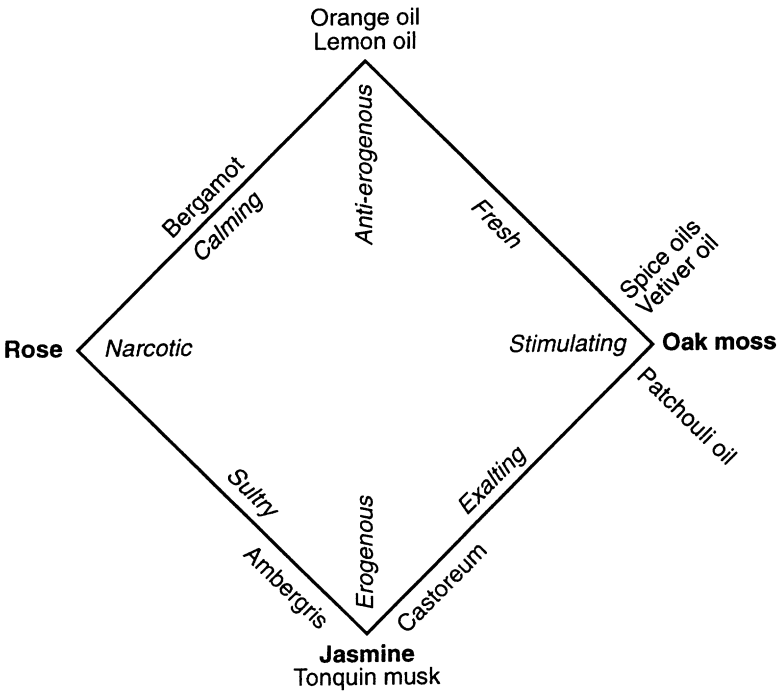


Figure 11.3 Chypre (Coty).

turn contrast, both in effect and in odor, with the perfume's rose note. With these two complex contrasts, both the typical spicy–floral odor of Mitsouko and its effect are roughly outlined. This perfume has been discussed in some detail because it represents the closing mark of the development of a classic perfume, Chypre, that took place over the course of several centuries.

Another creation by Coty that became a milestone of modern perfumery is 'l'Origan'. This perfume exhibits a dominant exalting effect, the most conspicuous component of which is methyl ionone; the stimulating material which here celebrates its first great triumph in perfumery. The exalting effect is boosted by eugenol (in the carnation complex) which contrasts with methyl ionone in terms of odor quality. Jasmine and an ambergris complex not only provide the erogenous (sultry) element but also serve as a transition to a narcotic note formed by ylang-ylang oil, rose and heliotropin. Bergamot oil furnishes an anti-erogenous nuance (as part of its calming effect) that is not overly stressed in l'Origan.

The most conspicuous and interesting component of l'Origan is without doubt *methyl ionone*. The importance of this material is such that it merits a closer look. In the synthetic preparation of this homolog of ionone (by the

condensation of citral with methyl ethyl ketone) a mixture of four isomers, which differ greatly in odor, is formed. The relative proportions of the isomers depend on the conditions of reaction and purification and is the factor that determines the quality of commercial grades. Köster has isolated the isomeric methyl ionones and prepared them in pure form. *Alpha-methyl ionone* (Iraldein Alpha 100%) is marked by a delicate floral odor, narcotic in effect, that particularly predisposes this material for use in flower complexes. *Beta-methyl ionone* (Iraldein Beta 100%) is somewhat reminiscent of beta ionone, possesses a rather faint, stimulating odor and is the least interesting of the four isomers. *Gamma-methyl ionone* (Iraldein Gamma 100%) is the isomer that is the best known and most highly valued today. Its proportion in the mixture determines the mixture's value. Accompanied by varying lesser proportions of the other isomers this material is commercialized under designations such as Iralia, Iraldein Gamma H&R and Raldein and is one of the pre-eminent raw materials of modern perfumery. It owes this privileged position to its odor which combines floral–sweet aspects with a somewhat woody–leathery note reminiscent of tan bark, an odor contrasting within itself and distinctly stimulating in effect. With its intensive and long-lasting scent this material adapts itself both to floral and to woody odors, a rare quality among stimulating odorants, and can reinforce both, at the same time accentuating them through contrast effects. In addition, it gives rise to very interesting contrast effects when used together with the higher fatty aldehydes and is for this reason a nearly irreplaceable component of all perfumes with an aldehydic character.

Among all ionone derivatives, *delta-methyl ionone* (Iraldein Delta 100%) is the one that most closely approaches irone in odor. In addition to its violet-like note, it has a characteristic dusty–suffocating nuance, often called 'powdery', that also occurs in the dry–down note of some other perfume materials, notably in patchouli oil and oak moss extracts, and is much appreciated in modern perfumes and is strongly stimulating in effect. This fascinating material certainly deserves more attention than most perfumers generally give it.

In l'Origan, the violet note of methyl ionone is backed up by orris products and ionone, the woody nuance by vetiver oil. *Vetivert oil*, the sesquiterpene alcohol isolated from it and the esters thereof, especially the acetate, are favorite and versatile components of modern perfumes and therefore merit a closer look. The roots of vetiver grass, called 'khus-khus' in India, on steam distillation yield a brown, highly viscous oil with a powerful and long-lasting herbaceous–woody odor. The quality of vetiver oil depends on the growing site of the plant. Its value depends on the care with which distillation is conducted, and increases with aging. Fresh or carelessly distilled oils have an unpleasantly acrid off-note, probably caused by terpene hydrocarbons. Distillates prepared with care in suitable apparatus are far milder in odor and on sufficient aging – top grade vetiver oils are aged for several years before being

sold – turn into an oil whose mild woody odor is somewhat reminiscent of sandalwood oil. Vetivert oil owes its important role in modern perfumery to its peculiarly bitter–dry, strongly stimulating odor, its exceptional fixative properties and to the interesting effects that it gives when combined with methyl ionone and with the higher fatty aldehydes.

In the frequent cases where the strongly herbaceous nuance of vetiver oil is undesirable, it is replaced by one of its components, the sesquiterpene alcohol *vetiverol*, that is similar in effect to the essential oil but far milder and more delicate in odor. Often vetiverol is preferred to vetiver oil solely because the perfumer has access only to an inferior grade of the latter.

Vetiveryl acetate (vetivenyl acetate) is similar in odor to vetiverol but a little more fresh. It is used primarily in compositions in which a sultry note is to be counteracted or completely avoided. Of all vetiver products, perhaps of all perfume materials, vetiveryl acetate is the one that gives the finest effects with the higher fatty aldehydes, acting both as an odor contrast and as a fixative.

Until a few decades ago perfumers hardly dared use the *fatty aldehydes* with 8–14 carbon atoms. These exceptionally powerful and performant materials, which leave a strong mark on any composition even if used in minute quantities, are, save lauric aldehyde, the only aroma chemicals whose effect may be called exalting. Octyl (C8) and nonyl (C9) aldehydes, methyl nonyl acetaldehyde (C12) and myristic aldehyde (C14) are primarily erogenous owing to the prominence of their sweaty note but they also possess a stimulating nuance. Nonylenic aldehyde (C9), methyl hexyl acetaldehyde (C9), undecylic (C11), undecylenic (C11) and tridecylic (C13) aldehydes are primarily stimulating, with a less pronounced erogenous (fatty) note. Lauric aldehyde (C12) is an exception. With its floral, narcotic and also somewhat fatty erogenous odor effect it must be counted among the sultry materials. The aldehydes with 8, 9 and 10 carbon atoms have been identified in natural complexes such as orange oil and rose oil. Traces of myristic aldehyde are probably present in orris butter. The other aldehydes have not been found in nature up to the present time.

With their striking, powerful and long-lasting odors, the aldehydes certainly merit the perfumer's attention. The reason why they have received it only in modern perfumery is twofold. The exalting element was not even desired in earlier periods, and perfumers did not learn until a few decades ago to achieve harmonious effects in compositions by combining the aldehydes with contrasting materials such as methyl ionone and the vetiver products. The first successful perfume in which aldehydes formed the heart of the composition was Rêve d'Or by Piver. (The same perfumer had earlier used them as modifiers in Floramye.) This perfume is also based on a complex with an exalting effect, formed by methyl nonyl acetaldehyde (erogenous and somewhat stimulating), vetiver products (stimulating) and jasmine, civet and musk (erogenous). The contrasting complex of methyl nonyl acetaldehyde and isoeugenol gives this perfume its specific character. The pronounced exalting

effect of Rêve d'Or is tempered by narcotic rose materials, hydroxy citronellal and synthetic musk, and by the refreshing effect of the oils of bergamot and orange.

The splendid perfume Quelques Fleurs (Houbigant), basically conceived in the old tradition of bouquets, probably owes the success which it has retained up to the present day to the stimulating effect of aldehydes (C12). The emphasis on lily of the valley, itself somewhat stimulating but piquantly boosted in this effect by the aldehydes, has been emulated in a number of related perfumes such as Printemps de Paris.

The interesting effects that can be achieved by combining different fatty aldehydes characterize a wide range of modern perfumes collectively known as the 'aldehydic perfumes'. One of the earliest and most successful of these is Crêpe de Chine (Millot), characterized by the interesting contrast of fatty aldehydes with strolyl acetate, which forms the basis also of nearly all modern Gardenia perfumes. Floral–aldehydic perfumes – characterized almost without exception by the complicity of methyl ionone – are Chanel's No. 5 and 1944 as well as Dandy, Arpège, Au Matin, Gemey, Joy and Le Debut noir, to mention only a few of the better-known creations of the type. The contrast effect formed by the fatty aldehydes with woody materials, especially the vetiver products but also sandalwood oil, santalol, santalyl acetate, cedarwood oil and cedryl acetate (patchouli oil and oak moss extract may also be used at low levels) are the basis of well-known fashion perfumes such as l'Aimant, Bois dormant, Azurea, Ivoire and others.

The above remarks make it clear that the great majority of successful fashion perfumes are characterized by the exalting effect. This is perhaps less surprising than the observation, apparent on closer scrutiny of the modern creations, that they are all derived from a small number of truly original basic types. They represent variations of these, more or less closely related to the archetypes. The fact that nearly each perfumer has created a Chypre and that a considerable number of perfume houses has launched perfumes under this name may be explained by the old tradition associated with this popular name. Mitsouko was the first perfume not to use the name, yet it preserved the type created by Coty albeit in a modernized and more distinctive fashion. A number of perfumes clearly inspired by Mitsouko were to follow. The most famous among these is Mylord (d'Orsay). The l'Origan type is represented by Mon Type, Richesse and Tosca as well as by other less well-known creations. Guerlain's l'Heure bleue is akin to this type as well.

The classic Fougère type, originated with Houbigant's Fougère Royal, was gradually modified in ways which moved its characteristic lavender note increasingly into the background to make way for the dry, stimulating complex formed by oak moss, vetiver products, patchouli oil and coumarin (often seconded by methyl ionone). In some instances, the hard odor of these stimulants was tempered by sandalwood oil which, although also stimulating in effect, possesses a soft–woody odor. Erogenous materials, such as the

absolutes of jasmine and fleurs d'oranger, animal extracts and labdanum (the latter usually in the form of artificial ambergris complexes), provide, in conjunction with the stimulating materials, an exalting effect. Well-known perfumes of this type, also called 'woody' or, occasionally, 'tobacco' type perfumes, are Emeraude, Tabac blond, Maja, Tabu, Trophée, Essence rare, Scandale and others.

The modern perfumer's awareness that fragrant aphrodisiacs are being created is also demonstrated by the many instances in which attempts are made to steer the imagination into erotic directions by the naming of the creations. Names suggestive of lovelife are, among many others, Amour-Amour, l'Aimant, N'aimez que moi, Rêve d'Amour, Dans la Nuit, Extase, Scandale and My Sin. As mentioned before, nearly all successful modern perfumes possess a common characteristic in their exalting effect but vary in the degree to which the stimulating or the erogenous elements dominate. A look at the Odor Effects Diagram explains why, in exalting complexes, materials with a refreshing (anti-erogenous) effect will bring out the stimulating aspect by a shift of the overall effect's focal point, while narcotic materials tend to stress the erogenous component.

12 Perfume creation and odor sensation

The observations recorded in the last paragraph of the preceding chapter and related remarks in earlier parts of this book pertaining to the critical–analytical discussion of the odor effects of single perfume components (single materials or complexes) point to the need for a more extensive treatment of a psychological phenomenon that is of fundamental and outstanding importance for the perfumer's work. To put it more precisely, an aquaintance with this psychological phenomenon becomes meaningful to the perfumer who is no longer content with a purely *intuitive* working style but wants to tackle the solution of problems in a *deliberate* way, making use of available physiological and psychological experience. To do this we must turn to the field of Gestalt psychology.

Recent psychological research has shown that each sense perception and each act of mental grasping is at first an indeterminate *perception of a total impression* that, for the purpose of clarification and comprehension, is subsequently analyzed and structured but is stored in the memory as a totality (Koehler, 1925, 1929, 1933; Sander, 1930). Impressions are registered in a way exemplified by the reading of words (or even brief sentences) that appear to be familiar: we do not spell them, we immediately perceive a 'word image' without consciously registering the images of the individual letters. Thus, writing or printing errors are easily overlooked. Similarly, we first see a person, a face, a house or a tree and only afterwards, if we have sufficient time and interest, see the details that make up the total impression. Our experience consists of a steadily expanding collection of such complex impressions in which we unconsciously prefer a certain order and a systematic structure, e.g. symmetry, straight angles, circles or spheres, over irregularity. If we are exposed – with the aid of a tachistoscope – very briefly, for fractions of a second, to the image of figures, e.g. geometric ones, that have some irregularities, the eye perceives the correct, irregular picture but the mind registers a corresponding regular image; we see the irregularities but do not register them, do not become conscious of them and store a regular figure in our memory. The correctness of these observations is confirmed by the *expressions* of little-controlled or subconscious generation of shapes. Such forms of expression can be observed in the near-universal regularity of form characteristic of primitive art, of the first drawings of children and the doodlings produced unthinkingly on scraps of blotting paper or in phone booths. The observations of the Gestalt psychologists and the conclusions which they drew from them may readily be applied also to perfumery.

The *impression* made by a perfume composition on a lay person who is only

P. Jellinek, *Psychological Basis of Perfumery*
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briefly exposed to it will be stronger and longer lasting, the more it is a single whole. Very brief exposure will always result in an initial impression of regularity but this may change on continued exposure, leading either to an unpleasant disappointment or to a feeling of something striking and titillating. In perfumery this regularity, called 'harmony' in a more general context, is referred to by the technical terms 'rounding' or 'smoothing'. Each momentary odor is perceived as unitary and rounded. Only with prolonged exposure and the opportunity for more precise observation comes the possibility of smelling individual components and perhaps deviations from harmony, i.e. flaws in rounding.

The practical effects of this state of affairs are familiar to every perfumer. The perfume of a person who passes us quickly (who has not had such olfactory experiences, for instance in a dancing hall!) may be registered as more or less pleasing but always as unitary and well-rounded. Faced with the task of analyzing a composition, usually in order to match it, it is always necessary to smell the smelling blotter for some time and to explore the odor more deeply before being able to distinguish individual components. Analyzing at a quick sniff is not possible!

Each perfumer knows the components of his or her own creations. To the perfumer these are always not so much a unitary whole as the sum total of individual notes that are known and of which the perfumer constantly remains aware. Their structure and the way in which their effect comes about is known hence the perfumer does not experience this effect by pure feeling. Comprehension may be satisfying, but only a feeling can be sensually pleasurable. With our 'cool' reason we can never quite 'warm up' to something in the way we can with our feelings. It is telling that adjectives such as 'frosty', 'hot' or 'glowing' are applied to feelings only. Therefore stirrings of the soul of the kind triggered by the witnessing of natural scenes or events, or the confrontation with great works of art can be expected only if they appeal to our feelings, but not if they address our reason only. These psychological reflections explain the widely known, if not always admitted, fact that critical perfumers usually like the creations of others better than their own, whose composition they know. An experience familiar to most perfumers shows that this is not the result of true differences in quality: if you come across one of your own creations by chance, you like it particularly well as long as you do not recognize it as your own brainchild.

The first impression, which is, as we have seen, unitary, is experienced in a purely sensual fashion. It has a far stronger impact on the feelings than the subsequent rational apprehension which starts, especially with the expert, with critical, analytical observations. When the veil of mystery and the charm of the unexpected is lost, so is most of the emotional impact. There is another phenomenon familiar to every perfumer. The first impression gained from a good, original composition is unitary and novel. On closer examination of the odor some individual components are gradually discovered, others re-

main, at first, unrecognized. The young, inexperienced perfumer tends to see in these unrecognized components the secret of the success that is therefore destined to elude him. The experienced expert now makes an increased effort and continues making observations until the unknown components have been analyzed. Usually, they turn out to be odor complexes of well-known materials. When creating new perfumes, the perfumer can make good use of these experiences. Having been explained by Gestalt psychology, they can be stored in memory in an orderly fashion, to be at hand when needed.

Of utmost importance in the creation of a perfume is the insight that its unitary impression, transitory though it may be to the expert, determines the way the perfume strikes the layman for a long time, perhaps for always. It is this impression which elicits the desired effect. Just as sometimes we find a face beautiful or striking only to realize, on looking at the details, that the nose is not very noble, the eyes inexpressive or other features not really beautiful, so also can a perfume at times appear splendid as a whole even if the critical nose of the analyst discovers shortcomings on thorough examination. Not only are objectionable or unpleasant odorants considered to be flaws but even materials that stick out from the complex or are recognizable and therefore disenchanting. A miracle is no longer compelling if the forces that bring it about are known exactly.

Acquaintance with the function of parts of a machine or of individual chemical agents in a reaction, the tricks of jugglers or the technique of artists enables their processes and accomplishments to be understood. The sense of understanding can give rise to satisfaction and pride but it weakens the immediate emotional impact that comes from inexplicable, wonderful sensual experience. The scent of jasmine makes a far deeper impression on the layman than on the perfumer who recognizes indol and benzyl acetate as functional components. The expert smelling a rose, lilac or narcissus may well discover 'just' geraniol, perhaps 'too much' heliotropin, anisic aldehyde or dimethyl hydroquinone or may find the characteristic note of *para*-cresyl derivatives 'offensively strong'. The perfumer will avoid these 'flaws' in compositions and therefore be unable to succeed in a truly faithful reproduction of a flower scent.

When creating original fantasy perfumes, it is also necessary to overcome the inhibitions that stem from the quest for that regularity which is represented in perfumery by natural and widely known 'standard' fantasy types. Such inhibitions may express themselves in a fear of producing poorly rounded effects and lead to exaggerated timidity when working with highly characteristic, striking perfume materials. They endanger originality and, with it, one of the fundamental conditions for success. The strength of this urge towards regularity, of the attraction of well-known, well-established avenues and their restrictive effects on the imagination, can be observed in the fate common to newly discovered perfumery materials. All progressive perfumers are highly interested in new materials. With their help, they hope to be able to find new approaches and to fashion novel creations. If, however, they have such a new

material with a truly unique odor in their hands, the first thought and tendency of their evaluation is to ask themselves in what 'type' this new material could be used to advantage. In other words, the objective of the first reflections or experiments is to find out how the novelty could be used to achieve familiar effects or, at best, to improve, enhance or 'modernize' these effects or perhaps just make them less expensive. The result of such an attitude is often the rejection of the new material if it is not sufficiently adaptable, strong or cheap, or it is condemned to an obscure fate in the perfumer's formulation as a 'modifier' that must, if possible, be unnoticeable. Having thus accommodated the new material, the perfumer is proud of his innovation.

Within the community of perfumers, those who show practical interest in a novel material only if given a complete set of instructions for use are anything but a minority. (Self-knowledge may be the first step on the road to improvement.) These instructions must include a detailed description of the odor character, its strength, fixative powers, harmonizing effectiveness, etc. Hints should be given regarding the perfume types in which the material can be used and the recommended levels of use. Formulations that provide practical examples of the application of the new material are also popular and are often demanded.

The aroma chemicals industry has come to live with this weakness of most perfumers and provides its new materials with the desired directions and with suggestive names (Jasmine aldehyde, Cyclamal, Gardeniol, etc.). In many cases, moreover, the newly discovered material is commercialized not in its neat form but 'dressed-up', with the purpose not only of making it more difficult for competitors to analytically identify and imitate it but also in order to shield the customer, the perfumer, from too strong an impression of strangeness in the new material. The manufacturers of aroma chemicals have too often experienced the reserve and reluctance with which even trailblazing innovations such as hydroxy citronellal or alpha-amyl cinnamic aldehyde were initially received by perfumers. They have remembered this experience well and have learned more from it than the perfumers. The perfumers able to overcome the urge towards regularity and to find the fortitude for true innovation have always been but a few lonely pioneers.

Since the public experiences a perfume as a unified whole, its novelty depends entirely on its complex odor and not on the odor of individual components. Novel perfumery materials can provide useful impulses here and, as characteristic notes of innovative perfume types, lead to success. However, the view that nothing truly novel can be created by the use of familiar materials alone is no more justified for the perfumer than the opinion of a musician that the discovery of new tones or new laws of harmony are indispensable for the composing of new melodies or harmonies. What is true for the odor of a perfume also holds for its erotic effect. Here too the refreshing (anti-erogenous), stimulating, erogenous or narcotic effect does not arise from the individual components; what is experienced is a totality that results from these

individual components, the effect of a complex. In reflecting on this, it is extremely important to keep the following facts in mind. Just as no odor can be cancelled by another for what is formed is always a resultant odor, so also can no erotic effect be eliminated by another; here, too, the effect is a resultant.

Odor complexes may form a harmonious whole because of similarities between their components; they may, however, also be formed by contrasting odors. Complexes based on similarity always have a somewhat monotonous and poorly lasting effect; complexes based on contrasts, where the characteristic aspects of one component are made to stand out by the contrast provided by the other, are more interesting, more striking and more lasting in their effect. Here again, a parallel may be drawn between odors and their effects in the erotic sense. The complexes based on similarity (think of the Odor Effects Diagram) are represented by the effects 'calming' (narcotic + refreshing), 'fresh' (refreshing + stimulating), 'exalting' (stimulating + erogenous) and 'sultry' (erogenous + narcotic). All other combinations of two or more effects may be regarded as contrasting. Each technically accomplished flower or fantasy perfume will show that such contrasting effects do not cancel but complement each other, thereby either attenuating or accentuating each other. As discussed earlier, all types of erotic effects must be present in these perfumes to optimize the total effect. Just as all attributes, forces or movements can become effective only if their opposites are also present and make themselves felt, so also with odors and their effects. The way they are experienced is not absolute but determined by contrasts.

There is a possible objection here. Chlorine, for example, triggers a specific sensation no matter whether some other odor was smelled previously or is smelled alongside or after it. The odor of chlorine is therefore something absolute after all and the same holds for vanillin, ionone, rose, in short for any perfumery material or odorous substance. The flaw in this argument is that air, the odor-neutral medium, is implicitly involved in every case. Living creatures endowed with an olfactory sense and living in a chlorine atmosphere would certainly experience chlorine as odorless or neutral and assign a definite odor to the mixture of gases that we call air. The assumption that more chemically reactive substances are more likely to elicit odor sensations than inert ones seems to be confirmed by the odorlessness of the rare gases (helium, etc.) but is contradicted by, for example, strongly oxidizing oxygen or strongly reducing carbon monoxide.

We experience gases or substances in vapor form (we can only smell these) as 'odorless' if their odor is the same as that of the air to which we are accustomed. On the other hand, we experience an odor as strong the more it deviates from that of air or, more precisely, the more it deviates from the odors to which we have become accustomed. What we experience as odorless is not 'pure' air but the atmosphere to which we are accustomed and to whose odor we have become insensible. The country dweller does not experience the odor of forests or meadows as aromatic nor does the city dweller find city air stifling. It is

possible to become accustomed to the odor of glue factories or tanning plants just as much as to that of a perfumery laboratory where a casual visitor soon loses all powers of odor discrimination while the perfumer analyzes delicate odor blends. For this reason, a perfume will be less fatiguing and desensitizing the more it is based on vivid odor contrasts, and its erotic effect is more intensive and long-lasting, the more pronounced are the opposing effects which it incorporates.

If the perfumer makes use of the intensifying and vitalizing effect of contrasts, it is nearly always done with the intention of accentuating a certain odor or erotic effect. The contrasting component employed to make the desired effect stand out must remain in the background in such cases. It must be just sufficiently strong, in a qualitative and in a quantitative sense, to serve as a contrast without making its own odor or erotic effect too apparent. For example, in rose compositions small amounts of patchouli oil may do excellent service as a contrasting agent. The pungent herbaceous odor of this oil contrasts with the sweet floral scent of rose, and the stimulating effect of patchouli oil presents a direct contrast to the narcotic rose odorants. The addition of patchouli oil must, however, never go so far that its odor dominates or the rose complex, modified by it, will become stimulating in effect.

In creating compositions the perfumer must be clear about which odor theme and which erotic motive should be developed to the highest possible effectiveness. Only then can contrasting odors and effects be employed to the precise extent necessary to avoid monotony in the perfume, to enhance the effect of the central theme and to achieve striking, piquant and novel effects.

13 Perfume and personality

Concerning the 'character and nature of the accord', Winter (1933) stated:

> 'The perfect harmony of the basic odor notes with respect to their total effect, which is determined by the context, must exist in all parts of the perfume and between all essential parts. It must therefore be achieved in the complex perfume (the mixture of the odor materials without the carrier), but also between the perfume and the carrier which determines the form of the final product (alcoholic perfume, soap, powder, etc.) to such an extent that a harmonic effect in *the whole* is achieved.'

Thus, briefly stated, Winter emphasizes that the odor accord (the complex of perfumery materials) must give a harmonic total effect in conjunction with the carrier of the odor (alcohol, soap, powder, etc.). From this there follows the necessity, when developing an alcoholic perfume or a cosmetic product, to create first a perfect 'primary' accord and then, between this and the carrier, a 'secondary' accord if a 'harmonic effect in the whole' is to be achieved. Winter defines these accords in the following way:

> 'the *primary* or *basic accord* is the one which we may aim to achieve to perfection when blending the pure individual perfume materials in the form of artificial flower oils or essential oils. The *secondary accord* refers only to finished fragranced products such as alcoholic perfumes, toilet soaps, powders, brillantines, skin creams, etc.'

Starting from this classification and from Winter's definitions, it appears to this author that the introduction of a third component, a *tertiary accord*, is necessary. This consists of the fragrance of the perfume, powder, cream, etc. on the one hand and the *person of the user* on the other. This component, although it is not under the perfumer's control, must be taken into account as an important factor in the total effect of a perfume or cosmetic product. The intensity of the personal odor is inversely related to the degree of bodily cleanliness, hence it certainly played a far greater role in earlier days than it does today, now that the universal use of soap and bathing has reduced it to a minimum. Nevertheless, its presence makes itself felt in pleasing or displeasing ways, albeit largely in the context of the fragrance of skin- or hair-care products such as soap, creams, powder or brillantine.

It is strange that every woman of educated taste knows exactly what colors are becoming to her and uses this knowledge in her selection of clothing, lipstick and powder but a pronounced taste in the selection of perfumes or fragranced cosmetics is far more rarely encountered. Rare is the woman who, if in doubt, would hesitate to ask her friends or the salesperson in the fashion boutique or perfumery store for advice regarding the color of her attire and make-up. If she does so, she can expect that the advice given will be useful.

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Knowledgeability in this area is a matter of course for trained or experienced sales personnel in the clothing and cosmetics trade. Perfumes are selected in quite different ways to colors. First alcoholic perfumes will be discussed, rather than cosmetics.

Typically, perfumes are bought as gifts. When buying a gift, it is a common matter to take the personality of the recipient into account in order to find something suitable. With books, one thinks of the recipient's range of interests, with cigarettes or alcohol, of preference, etc. However, when perfumes are bought as a gift – every perfumery sales consultant will confirm this – the personality of the recipient, usually female, plays little part and is hardly ever mentioned. The first question usually is about the *dernier cri*, about what is 'in' at the moment. If a suitable selection is presented, the final decision depends, apart from price, on the personal taste of the buyer who is usually guided by purely superficial criteria. The name of a well-known manufacturer, Paris as the true or alleged place of origin, a perfume name that is interesting, pleasing to the ear and preferably French, a beautifully shaped, tastefully labeled and carefully packaged flacon indicative of the preciousness of its contents: these are the most powerful persuaders for purchase. A smelling test is possible only in the rarest of cases. Very few buyers insist on it or even ask for it. At most, this happens if the perfume is bought for one's own personal use. Considering this fact one is forced to ask whether each fragrance truly goes with every person, i.e. whether the tertiary accord (perfume + individuality) is always and necessarily harmonious. The intuitive answer to this question is certainly negative, both because of personal observations and experiences, and because of what has been stated about the different types of personal odors (Chapter 4).

Before attempting to deal with this problem from the point of view of the perfumer, a few remarks about the far more popular and older psychological point of view are certainly called for. An interesting treatment of this question is given by the German author and pamphleteer Oscar Panizza (n.d.) and was published nearly 50 years ago (*c.* 1900) under the pen name Hans Kistenmaeker in *Zürcher Diskussionen*:

> The fact that women perfume themselves and thereby impress men is one of the profound proofs of the human soul's susceptibility to deception. The first woman who used a perfume in the far-fetched hope that her male counterpart would imagine that this fragrance were part of her, emanated from her body or was the noble expression of her soul, made a bolder conjecture regarding the constitution of the male soul than Kant ever did in his *Critique of Pure Reason.* And she succeeded. We really think that the scent, the fragrance of a woman is something peculiar to her and part of her identity. We really say: she smells good. And what odors does this creature, so astute about psychology, select?
>
> In order to disentangle the confused web of psychological considerations regarding woman's motives for using perfume and for reaching for one scent in one case, for a different one in another, a keen psychological analysis of our notions of sexuality would be required. Each individual root of the drives that urge us on toward the

sexual act would have to be laid bare – especially those of cruelty and the joy in brute force. One would have to show especially to those medieval moralistic dreamers, who in their Christian view declared all sexual intercourse, even between husband and wife, that was not motivated purely by the wish for procreation as deadly sin, one would have to show them that on the basis of the physiological design of our blood vessels and nervous system pure lascivity is the only, and the only possible foundation for the accomplishment of the appetitus carnalis and the conjunctio membrorum.

As odorous forces, violet, rose, reseda or other flowers initially only evoking images of loveliness, delicacy, sweetness and gentleness, probably have, to begin with, no other purpose than to suggest the same characteristics in the woman wearing the perfume. But along with the odors the pictures of the flowers concerned come to mind, and with them, albeit indirectly, the entire language of flowers. We know that roses are preferably used by young girls and women for their adornment while the older woman prefers the cool and nearly odorless camelia. We are familiar also with the role which the rose plays in love poetry. Therefore, we can have no doubts about the ultimate intentions of a woman using a rose perfume. We also associate with the picture of the rose and of flowers generally the ideas of the untouched, the intact, the virginal, innocence. But behind innocence there lurks without fail the appeal to the lust for destruction and defloration, to male cruelty which is a near kin to the sex drive.

We are touched by the violet with its modesty, its quiet and self-contained obscurity. Here again there is a link, albeit a feeble one, to man's lust for destruction and uncovering. Mignonette has, along with its gentleness, a burnt, arousing character and gives its orders to our imagination, to our nerve junctions not by detours as does the rose but directly. Odors such as ylang-ylang, white rose, heliotrope and others certainly are intended to evoke images of sleep, dreams, languishing fantasies, those half-awake states of mind in which lascivious thoughts florish. We see beds, soft pillows, snug blankets, dark shadows in the curtains, muted red night-lights – and the rest is clear. Each woman, therefore, who confronts us wearing such perfumes, unleashes a whole flock of images all moving in the same direction. Opoponax and all emanations that are mixed with musk or patchouli then have intentions that aim, almost exclusively, directly at the blood vessels. They do not bother long about associations but physically change their victim.'

In the *Hamburgische Korrespondenz* of September 13, 1912, a well-known French perfume manufacturer claimed to be able to deduce the innermost being of a woman from her handkerchief, provided it was perfumed:

'The woman who prefers the refreshing scent of Jockey Club over all other perfumes is a gay, easy-going person, who sees everything from the bright side. She is sensible and pleasing in character so that Jockey Club is always a sign of a good partner for a man. Rose essence is the favorite scent of the elegant woman of the world. The odor of rose always calls up a mood of luxury and prodigality. Lucky the man who offers his affections to a lady who has selected lavender for her toilet table: she is modest and faithful, quiet and kind-hearted. But woe unto him whose path of life is crossed by a woman who indulges in strong, Indian perfumes. These are demonic, wild and passionate creatures who do not shrink back even from crime...'

The desire to recognize a person's innermost being from his or her preferences for certain colors, flowers, perfumes, etc. may be justified in many cases. However, with perfume, often adopted by a woman because she knows it to be the favored scent of the man whom she wants to please, and therefore it does not have to correspond to her personal taste at all, to make such far-reaching conclusions about her character or temperament are, to put it mildly, risky. This remark touches on a facet of the relationship between the sexes that is too important, particularly for the specific subject of perfume, not to be treated at more length. It may be stated thus: *in the context of sexual relations, the changeable manifestations of the one sex are guided by the wishes and the taste of the other.*

Where nature equips the individual sexes of animal species in special ways, conspicuously different from the other sex, this happens only after the onset of maturity, be it permanently or transitorily, and for the sole reason of exerting a special effect on the sex partner. Such secondary sexual characteristics that manifest themselves primarily in the breeding period may be, for example, a 'wedding attire' in the male or a special scent emanation in the female. No matter how far the outward forms of life have evolved away from nature as a result of cultural developments, they are nevertheless shaped, to a very high degree, by the natural drives. Even the dictates of fashion (apart from certain usually short-lived excesses) are, to the extent that they concern one of the sexes, promulgated, maintained and disbanded or changed by the other.

It is important to emphasize and note once again that it is characteristic of fashion to be shaped, at least in its basic traits, or to be decisively influenced by the other sex so that it mirrors that sex's desires and tastes. Repeated changes in external manifestations of fashion, following each other in fairly rapid succession, such as are found in our times in female hair fashions, head-dress and the cut of garments, would, according to this view, not be due to women's fickle whims but to their attempt to accommodate the polygamous nature of the male by continuously showing herself to him as different. A superficial look at our fashions suggests that only woman is responsive to the partner's wishes, since male fashion for the past 150 years has produced no beauty of form or color. However, this is not at all the case. The paucity of color and the stiffness and gracelessness of line in today's male day and evening wear, as well as the lack of imagination, individuality and elaboration of male hair fashions, result from the not sterile but rarely eugenic force of negation. The appearance of the higher strata of the male population at the time of rococo was marked by splendid colors, adornment of dress with embroidery and lace, the use of velvet and silk and by short pants (culottes). At the time of the French Revolution, revolutionary spirit, romantic love of nature and an exaggerated adoration of reason resulted in a reaction which manifested itself in a conscious and complete reversal of the dress code. At the same time, the wig was abandoned, making a place for hair worn in its natural state, cut more or less short. Male

dress has stayed with the basic forms created at that time up to the present day. This appears to indicate that either woman was content with this fashion, showing a conservative bent lasting over centuries, or that the male did not respond to her wishes. The reasons prevailing here are, in fact, far more complicated. The revolutionary reaction, which, for many causes, came to pass at the waning of the rococo period, decisively rejected not only the fashion of the preceding period but also its mores and its way of life, and made the opposites into its new ideals. The public flirting and the underlying loose, hedonistic way of life, which was manifested in, for example, the pastoral plays of the rococo period, were rejected as being lascivious. Modesty, now woman's highest virtue, was allowed to admire in man only his superior mind and the boldness of his ideals. A self-presentation that by color, form or scent might give rise to the suspicion that one was trying to impress the other sex was considered immodest in woman and unmanly in man. Conspicuousness in any form was to be avoided, discretion was the prevailing canon. In this way the erotic drive was concealed in social life and its manifestations were suppressed as much as possible. It did, however, not lose its force. Under the often rather transparent cloak of romanticism it looked for ways out and found them in social groupings and styles of life that the solid citizen, although not considering them quite up to the level required, could tolerate as long as he could give them moral legitimacy by an appropriate label. The life of the 'bohemians' offered artistic liberties of which the citizen loved to partake, of course only for recreation or diversion. Sumptuous costume balls and festivities of all kinds, sanctioned by these same labels, served the same purpose.

Was woman first to sense that the condemnation or contempt of sensual pleasures in daily life was a lie based on conventionality and did she precede man in finding the courage to draw the consequences from this insight as she gradually began to wear more colorful dresses, made of beautiful materials, that showed off the shapeliness of her body? We shall leave this question unanswered. In any case, the fact is that man is only in our days gradually beginning to emancipate himself from the bondage of convention that prescribed his appearance. In this, even if he does not know or admit it, he responds to woman's long-held desires and preferences. Young women's love of colorful military uniforms and sumptuous theatrical costumes gave witness even in the past century to the fact that woman continued to appreciate beauty in male clothing. Man could read these signs but dared to act on them, exceptional cases apart, only in the herd, not as an individual. In the costumes of student corporations, paramilitary societies and gymnastic clubs he relished the effect of more or less colorful uniforms, banners and insignia on the romantic female heart. Such practices were especially cherished in central Europe. Since around the turn of the century, the growing interest of woman in sports has found expression in new designs of men's fashions. Since World War I, men have dared to show a little more color in their ties, shirts, vests and scarves. Nevertheless, man is still a poor second to woman with regard to his

understanding of the taste of the other sex and the courage to accommodate it openly.

These remarks may appear to have been a digression from our true theme. However, as a reminder of a historic development they were necessary to provide a better understanding of the significance of this development to the perfumer. In the rococo era the use of fragrances of all kinds was popular and widespread among both sexes. This custom also fell victim to the revolutionary period of the late eighteenth century. Bourgeois morality condemned the use of conspicuous perfumes, a discreet whiff of lavender or of flowers was just barely accepted, perhaps because it could be justified by the illusion that it came not from perfumes but from floral sachets. The only admitted and hence widely used scent was Eau de Cologne. Using it, one did not feel that one was using perfume. The expression 'using perfume' did not have a good ring at all. It suggested that a person put perfume on garments or even on the body in order to be noticed and to be more attractive. If perfume was used at all, the only excuse was that the user was very fond of this scent and wanted to have it to hand at all times. To this end, one could sprinkle a few drops on a handkerchief, hence the term 'handkerchief perfume', commonly used at the time.

The use of perfumes in the more narrow sense, i.e. a toiletry product whose sole function is to provide a long-lasting pleasing scent aura, was and has remained to this day, largely restricted to the female sex. This fact has a physiological and psychological explanation that stems from the specifically female form of love wooing which is, in this respect also, quite different from man's (Chapter 6). Nature has given the use of scents as an aphrodisiac primarily to the female sex and fashion, being marked by the desires of the other sex, also sanctions the use of perfume by woman. Thus, double proof is provided that it is man above all who loves strong fragrances. Since natural human personal odor is considered pleasing only if very faint, man is delighted if woman supplements it by a perfume, i.e. if she exudes a scent of which her personal odor is but a component, a component that may be more or less noticeable but that must in any case harmonize with the perfume employed. It is not sufficient for the harmony between a perfume and the person wearing it to be limited solely to the odor effect, i.e. to the earlier defined tertiary accord. It must prevail also in the psychic domain. A technical example from perfumery practice may serve to clarify this point.

A perfumer given the assignment to create two perfumes (not artificial flower oils) named 'Red Rose' and 'White Rose' must, seen from the technical perspective, take the scent of the corresponding living flowers as a model and base the perfumes on the thus created matches of the flower scents. The experienced perfumer, familiar with the public's taste, will develop both perfumes from the same 'neutral' rose complex. In one case, the aim will be a sultry effect, using the esters of the rose alcohols and other suitable strongly narcotic perfume materials as well as lesser amounts of erogenous components

such as jasmine, nonyl alcohol, indol, esters of phenylacetic acid, etc. In the other case, the narcotic effect will be emphasized less (using fewer rose alcohols and more esters) and a calming effect achieved by the use of anti-erogenous (refreshing) materials such as linalyl acetate and lemon oil. The sultry complex will then be used as the base for the Red Rose perfume and the calming one for the White Rose. It is not necessary here to dwell on the further technical elaboration of these two perfumes, i.e. the vitalization by contrast effects with patchouli oil, green notes, β-ionone, etc. The important point of this example is that the assignment is, in fact, not about capturing the scents of red and white roses in the truest possible way – they are, incidentally, far from clearly defined – but about creating two compositions that correspond to the public's notions about the scent of these flowers. These notions are, in fact, rarely based on true and pure odor memories; nearly always they are fantasy images arising not only from the flowers' true odor but influenced also by their color and by all of the mental associations triggered by it. The red rose is the color of blood and of glowing, passionate love and thus evokes images to which a sultry scent is most fitting. The white rose is the color of purity and innocence. Its image is soothing to the imagination rather than agitating and this effect must also be expressed by the perfume bearing its name.

As stated before, the personal odor of cultured men and women is so slight that the objective, to bring the perfume into harmony with the wearer's personality, comes down primarily to taking psychic factors into account.

14 Odor Effects Diagram and personal perfume type

Leaving aside the male sex for the moment, we shall now attempt to determine which perfumes are best suited to the different types of women.

The observations that follow can in no way claim to be considered the clear results of exact experiments or, so to speak, laws of nature. This is impossible, first of all because none of the types described actually exists in 100% pure form, as an embodiment of the ideal type. Every woman always also has certain traits belonging to other types, often even of opposing types. Another reason why the results obtained can never be exact lies in the lack of clear delineation of taste. Even in those persons said to have a 'pronounced' taste, it is always far removed from mathematical clarity. These uncertainties represented, at first, the greatest difficulty in the elaboration of the diagrams that are to follow, an elaboration based on years of observations and experiences collected by the author in a circle of friends and acquaintances spread over several European countries, and supplemented and corrected with the aid of some *ad hoc* experiments. In spite of these difficulties, certain directions and tendencies soon became apparent which were valid even where tastes were unclear and types hard to define. It became apparent at length that these difficulties could be explained in part by certain contradictions found in concrete cases; in other cases, the empirically obtained results made it possible, with the aid of the diagrams, to define readily and clearly individual factors which had been uncertain or indefinite at the outset. The meaning of these remarks will certainly become much clearer once the use of the diagrams has been explained and practical examples given.

Let us therefore proceed with a schematic presentation of the system which is again based on the Odor Effects Diagram. Placing the figures side by side will help to demonstrate how, in actual practice and accordingly also in the diagram, individual types overlap, correspond or contrast. Figure 14.1 shows the types as characterized by their hair color. In classifying women here, the considerations and limitations that were discussed earlier (p. 28) should be taken into account. In Figure 14.2 the classification of women into the 'mother' and the 'mistress' type proposed by Weininger (1903) has been taken up. In Figure 14.3 the female types with distinct 'feminine' and 'masculine' characteristics are brought into opposition. Figure 14.4 represents the contrast in behavior between the 'naive' and the 'artful' woman, experienced in love. To avoid cluttering the diagrams, only the corners of the Odor Effects Diagram are marked with single letters. The explanation of these letters and the naming of the sides are provided in Table 14.1.

From the hair-type diagram (Figure 14.1) it can be seen that the center of the

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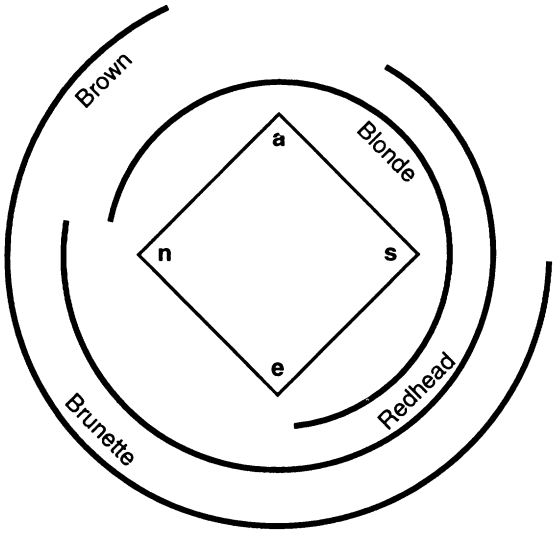


Figure 14.1 Hair type.

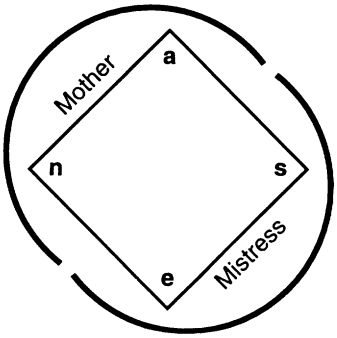


Figure 14.2 Mother–mistress.

arc representing the *blonde type* is at the a–s side of the square which corresponds to perfumes with a fresh effect. This means that perfumes with fresh effect best harmonize with blonde women. In addition, the blonde arc also encompasses the corners a (anti-erogenous) and s (stimulating) as well as large parts of the sides n–a (calming) and s–e (exalting). From this it may be concluded that perfumes with anti-erogenous and stimulating effects also fit this type very well, and that calming and exalting perfumes fit it quite well. Less suitable for blondes are purely narcotic and erogenous perfumes, and sultry

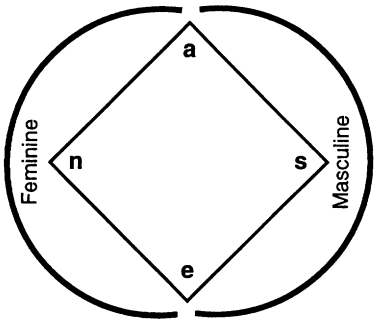


Figure 14.3 Feminine–masculine.

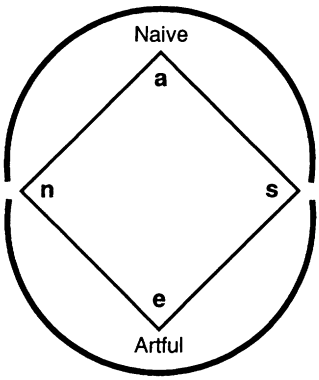


Figure 14.4 Behavior.

Table 14.1 Key to Odor Effect Diagrams, Figures 14.1–14.4

Corners		Sides	
a	anti-erogenous	a–s	fresh
s	stimulating	s–e	exalting
e	erogenous	e–n	sultry
n	narcotic	n–a	calming

perfumes are quite unsuitable: the blonde arc leaves the side e–n completely free.

In the same way, the diagram shows that exalting (e–s) perfumes go best with the *redhead* type, and sultry (n–e) perfumes with the *brunette*. Fresh (a–s) perfumes are least suited to the brunette, calming perfumes (n–a) least suited to the redhead.

The *brown-haired* type occurs widely in the western world, accounting for about 60% of all women. It can be seen as a mixture of blonde and black hair. It is therefore not represented by its own arc but distributed over the sections of the arcs that the brunette and the blonde type have in common. Thus, calming perfumes (n–a) would best harmonize with a 'neutral' brown, for darker shades of this type narcotic (n) and sultry (n–e) would be best, and for lighter shades anti-erogenous (a) and fresh (a–s) perfumes.

For women who have dyed their hair for reasons of fashion or personal taste, the natural hair color becomes irrelevant with respect to perfume selection. With platinum blonde hair shades, a fresh perfume type goes best, with Titian blonde (a reddish shade of blonde) exalting types are best, no matter whether these hair shades are natural or adopted.

On the mother–mistress diagram (Figure 14.2) it should be noted that the openly exhibited motherly characteristics of a woman are the only relevant measure. The term 'mistress' is actually to be regarded only as a negative antipole, representing, in the ideal case, a total lack of motherly features. Only when used in this way can the diagram provide concrete results. The fact that a woman wears perfume for the man, responding to his preferences, is a mark of her erotic orientation *vis-à-vis* the man and would necessarily lead to a classification as a 'mistress' type. No perfume whatever harmonizes with the woman in her role as a mother but perfumes are appropriate to the mistress who shows, to a greater or lesser degree, motherly feelings.

As the diagram shows, exalting perfumes harmonize with the woman who exhibits a minimum of motherly feelings; calming perfumes with the woman who shows her love in a distinctly motherly fashion. A less emphatically motherly woman can, if she is quiet in temperament, also use anti-erogenous or fresh perfumes. If the opposite is true, narcotic or sultry perfumes are appropriate. The mistress who does not represent the pure type can, if she is passionate, use erogenous or sultry perfumes, or, in the opposite case, stimulating and fresh perfumes.

Like hair shades, albeit less obviously, the characteristics dealt with in the mother diagram are subject to fashion. Even though the mistress who slumbers in each woman has always been far more interesting to the majority of men than her counterpart, there have been periods when motherliness was in fashion. Nevertheless, female behavior in this respect was and is less commonly determined by fashion than it is by the individual attitude of the man in whom the woman is interested.

In the feminine–masculine diagram (Figure 14.3) the distinctly feminine or androphilic type that presents itself as passive and emphasizes feelings is opposed to the masculine or gynophilic type whose demeanor is active and intellectual. We have already noted in the characterization and designation of the individual odor effects (Figure 11.1) that the narcotic odorous materials have certain female characteristics and the stimulating materials certain male characteristics. Accordingly, as shown in the feminine–masculine diagram,

narcotic perfumes are the choice of the distinctly feminine type of woman. Perfumes with sultry or calming effects are also suitable since a narcotic component is present in both. For the woman with more masculine tendencies, stimulating perfumes are best but perfumes with a stimulating action component, i.e. fresh and exalting types, are also suitable.

The behavior diagram (Figure 14.4) presents the 'naive' type of woman, also called 'natural', 'unstudied' and 'uncomplicated', and her opposite, the 'artful' woman, who is seen as 'interesting' and often also as 'dangerous'. The naive type of woman is too little challenging to have played a major role in mythology or literature. Genoveva, Gretchen in Goethe's *Faust* and Elsa in Wagner's *Lohengrin* are among the few exceptions, and it is certainly not by chance that they all belong to German literature, always inclined towards romanticism. The artful woman, on the other hand, is at the center of countless myths and has always greatly stimulated the imagination of poets. The sirens, Circe, Judith and Delila are, as artful daughters of Eve, forerunners of today's 'vamp' type. Antiquity often assigned god-like powers to such women and the Christian Middle Ages gave them diabolic magic powers. Man is usually the victim of the artful (dangerous) woman, while in the case of her naive sister the roles are reversed.

In the determination of personal perfume type, i.e. in the selection of a perfume that, by the erotic effect most distinct in it, best harmonizes with a given personality, the *personal perfume scheme*, consisting of all four diagrams, can be of great help. This scheme can, of course, be successfully employed only if the person choosing the perfume is sufficiently well acquainted with the woman for whom it is intended. It is essential to remember, moreover, that it is not necessary that the perfume harmonize with the natural physical endowments of the woman nor with her innermost psyche; only the characteristics which she displays and her social demeanor count.

Two additional diagrams are now introduced, the 'age' and the 'activities' diagrams. These may be used to supplement or correct the diagrams consulted so far in the selection of a perfume, or can be used if the combination of the original four does not point to a clear-cut perfume effect. The question of useful and unclear results will be discussed later.

Age or, more precisely, the degree of maturity of a woman can also play a role in the selection of a suitable perfume type, sometimes a decisive one. A young, not yet fully developed girl wants to and must exude a different scent than the mature woman or the woman who has passed the zenith of her sexual life. Here again, it must be emphasized that the decisive factor is not actual age but the woman's style, her way of behaving, of dressing, etc. In this, too, woman is to some extent subject to fashions. Whereas earlier generations exhibited a special interest for the young or very young woman, for the age group between 18 and about 25, leading to a tendency to prolong the impression of belonging to this age bracket, in our days the interesting type is represented by the mature woman of between 30 and 40. This is mirrored by

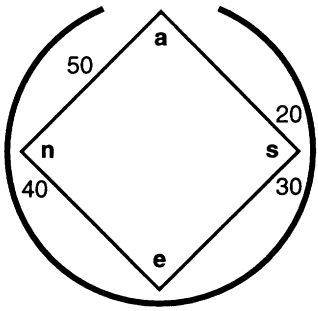


Figure 14.5 Age.

the heroines of literature, stage and film. The age diagram (Figure 14.5) reflects the awakening, maturing and waning of a woman's sex life. The diagram shows that the two end-points of the almost closed arc lie near a (anti-erogenous); these two age groups will, if they use perfume at all, prefer scents with a fresh or calming effect. The mature woman between 20 and 50 years old has the whole gamut of perfumes characterized by erogenous components at her disposal. Whether her choice should go more in the stimulating or in the narcotic direction is determined by her type as reflected in Figures 14.1–14.4.

The diagrams discussed thus far and the characteristics with which they deal are usually fixed for prolonged periods of time. Only in the types opposing each other in the feminine–masculine diagram are there often rapid alterations in the outward demonstration of traits. This is the more remarkable since the physical and psychic endowments corresponding to masculinity or femininity in behavior are the ones least subject to change. To be sure, feminine or masculine hair style trends, represented by longer or shorter hair, come and go at the same rate as characteristics of dress fashions tending in the same direction. However, modern woman, whose environment and activities often change several times in the course of a day, is skillful at adapting her clothing and also her behavior to the demands of the situation. While engaging in sports, for example, she will emphasize such male characteristics as combativeness, chivalry and good fellowship that are latent in her, while representing caring and guiding femininity when she is at home in her role of mother, wife or homemaker. Consequently she should use different perfumes on these occasions. She will normally emphasize her sex least when at work and most in her social life. The consequences to be drawn from this attitude in the selection of a perfume are illustrated in the 'activity' diagram (Figure 14.6).

The activity diagram should be considered particularly in those cases where a woman does not use just one favorite perfume but uses different ones according to her changing clothing or varying activities – a practice far more appropriate to a refined taste. In such cases, the application of the activities diagram needs no detailed comment. The focal points indicated in the diagram

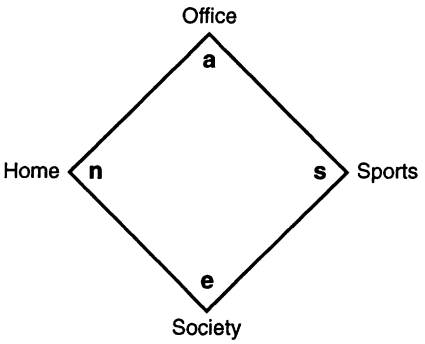


Figure 14.6 Activities.

can be shifted into whatever direction is indicated by the final outcome of the personality type diagrams. The activity diagram is of special importance in fragrances for cosmetics products, which will be discussed later.

In practice it will hardly ever be possible to consult all of the type diagrams (Figures 14.1–14.4), since it is rare for all of the characteristics to be sufficiently clearly marked in any one case. In one case, for example, it may be hard to decide whether the mother or the mistress type fits better; in another case, it may be hard to say whether a woman's behavior should be characterized as naive or artful. In such cases the diagrams concerned should simply be skipped, to avoid a shifting of the final result in an inappropriate direction. Moreover, as stated before, pure embodiments of any one type are rarely found in practice, hence in the determination of perfume types it is not the focal point, corresponding to the pure type, but the extensions of the arcs, representing compromises, which usually come into play. The direction in which one has to deviate from the center when determining perfume type may be derived from the specific diagram at issue or from some other diagram.

Before embarking on a discussion of some striking and interesting conclusions that emerge from an in-depth examination of and comparisons between diagrams, it is important to stress once again that the psychic features to be determined here in no way have to be identical with the results of psychoanalysis. In fact they cannot be, since the meaning of certain terms in depth psychology is often distinctly different from the way they are used here in the designation of types. In any case, the purpose of the type diagrams is simply to find the perfume type that harmonizes with the outward appearance and comportment of a woman. On the other hand, it certainly lies within the realm of possibilities, if a woman's favorite perfume is known, to draw some conclusions about her psyche with the aid of the type diagrams. However, a necessary precondition for this would be that the choice of perfume be determined solely by the taste of the woman in question and that no thought of

the wishes or tastes of any other person play a part in it. This condition can probably be satisfied only in theory, therefore true results are hardly to be expected. In addition, such tests would require the presence of a range of perfumes of comparable quality, representing all types of erotic effects, from which to choose. This is rarely found in practice when shopping, for example, in a perfumery shop. The assortment offered here, although rich in perfumes that are in fashion at the moment, and hence usually comparable in the type of erotic effect they represent, is poor in equally good unfashionable or outdated perfumes.

Comparing the different type diagrams, we see that the focal points of certain woman types are at the same position or close together, or that the arcs representing them largely overlap, while with other types the opposite is the case. In cases of covergence, the determination of a suitable perfume type will readily give clear-cut results; where there is opposition, it is necessary to take one or several additional diagrams into account before coming to a decision. If no clear direction regarding perfume type becomes apparent even then, the conclusion must be that no single perfume type is particularly suited to the woman concerned.

In the discussion that follows we shall, for the sake of conciseness, refer to the correspondence or opposition of typical characteristics. What is meant is solely a corresponding or opposing tendency with respect to the erotic effect of a perfume that harmonizes with these characteristics or with a woman possessing them. This is not meant to imply in a general way that these various characteristics always go together in women or, conversely, that they never go together, although practical experience often seems to lend support to such a view.

Perfume types are frequently referred to as representing a specific erotic effect. To give the reader a more concrete idea of what this means, examples of perfumes in which the various erotic notes may be especially stressed are given here:

anti-erotic (refreshing): Eau de Cologne (with the citrus note emphasized), Verbena
fresh: violet or lily of the valley perfumes with emphasized green notes, gardenia (the naturalistic, not the fantasy type)
stimulating: mignonette, mimosa, cassie
exalting: most fashion perfumes, types such as Chypre, Mitsouko, Fougère, aldehydic perfumes
erogenous: leather perfumes
sultry: ambergris and Oriental types, white lilac, narcis, jasmine
narcotic: rose, tuberose, cyclamen, heliotrope, etc., as well as most floral bouquets
calming: lavender, freesia, Eau de Cologne (with the bergamot note stressed), Fougère (with stressed lavender note), blue lilac.

Comparing the hair-color diagram (Figure 14.1) with the others, it is seen that the brown-haired and the motherly type have common focal points as do the redhead and the mistress types. In our system, therefore, brown-haired and motherly are congruent characteristics, while brown-haired and non-motherly or redhead and motherly are contrasting ones. The conjunction of contrasting characteristics provides no direction for perfume choice; this can be obtained only after consulting additional diagrams.

Mixed hair types may also contrast with the characteristics covered by the feminine–masculine or the behavior diagrams. This is the case with dark brown (n) and masculine (s), dark blonde (a) and artful (s), reddish blonde (s) and feminine (a), and reddish brown (e) and naive (a).

Contrasts can also arise if the characteristics in one diagram oppose the resultant of the conjunction of other diagrams. For example, the combination of motherly and blonde (a–n and a–s, respectively) results in a focal point at a which is opposed to the focal point (e) of the artful type. Therefore, the combination blonde–motherly contrasts with artful. By the same token, non-motherly–brunette contrasts with the naive type. In some cases, therefore, the combination of the applicable diagrams leads, in the end, to a contrast and no clear focal point can be detected. From the point of view of perfumery – this is all we are concerned with here – such types are called *inharmonious overall.* A *harmonious overall* type is one in which the combination of all applicable diagrams results in a wide arc of possible perfume types, with a focal point that is not greatly stressed. An example of this would be the combination of blonde (a–s), motherly (n–a) and feminine (n). Here the entire range of perfumes between narcotic, calming and refreshing would be appropriate.

Where all characteristics that can be determined center around a common point, emphasizing this point, this is termed a *clear-cut overall* type. An example is redhead (e–s)–non-motherly e–s–masculine (s)–artful (e). The emphasized focal point here lies at e–s. This means that exalting perfumes would excellently suit this type of woman.

In most real cases, only two or perhaps three diagrams will be used to determine a suitable perfume type, for only rarely can all of the type assignments which the diagrams demand be carried out in a clear-cut manner. In such cases, the determination of a focal point or arc of erotic effects and, with it, choice of a suitable type of perfume, will cause little trouble and could be conducted using a simple hand sketch of the Odor Effects Diagram.

If, however, useable type assignments from all diagrams are available, the resultant focal point or arc can be determined only by calculation. To do this in a simple way values are assigned to the various corners and sides of the Odor Effects Diagram in the following manner. Erogenous (+ e) and narcotic (+ n) are regarded as positive characteristics; their opposites, anti-erogenous (– e) and stimulating, which may also be called anti-narcotic (– n), as negative ones. The unit of calculation is one-half of one side of the square (see

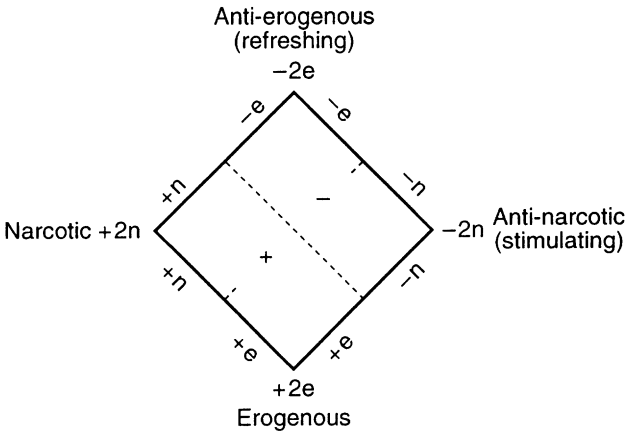


Figure 14.7 Calculation diagram.

Table 14.2. Correspondence between calculation, odor effects and type, age and occupation diagrams

Value in the calculation diagram	Characterization in the Odor Effects Diagram	Corresponding odor effects	Contains the focal points of the following type assignments
−2e	a	Naive Refreshing (anti-erogenous)	Job
−2n	s	Stimulating (anti-narcotic)	Masculine, sports
+2e	e	Erogenous	Artful, society
+2n	n	Narcotic	Feminine, home
−e, −n	a–s	Fresh	Blonde, about 20 years old
+e, −n	e–s	Exalting	Redhead, non-motherly, about 30 years old
+e, +n	e–n		Sultry, brunette, about 40 years old
−e, +n	a–n		Calming, brown, motherly, about 50 years old

Figure 14.7). In this *calculation diagram* the corners and sides of the square have the meanings given in Table 14.2.

Using the calculation diagram, some examples of the calculation of the focal points for a few fictitious women will now be examined. This involves the simple addition of the values obtained from the calculation diagram and the conversion of the sum obtained into units. The characteristics shown in Table 14.3 have already been cited as examples of *unharmonious overall* types. The sum 0 found in both cases shows that no focal point can be found for these

Table 14.3 Unharmonious overall type

Type assignment	Value from calculation diagram		Type assignment	Value from calculation diagram	
Motherly	−e	+n	Non-motherly	+e	−n
Blonde	−e	−n	Brunette	+e	+n
Artful	+2e		Naive	−2e	
Sum	0	0	Sum	0	0

Table 14.4 Harmonious overall types

Type assignment	Value from calculation diagram		Type assignment	Value from calculation diagram	
Brunette	+e	+n	Dark blonde	−2e	
Feminine		+2n	Non-motherly	+e	−n
Naive	−2e		Feminine		+2n
			Artful	+2e	
Sum	−e	+3n	Sum	+e	+n
	=(−e, +n)+2n				
Here, the focal point can lie at −e, +n (calming) or at +2n (narcotic), hence one of these two closely related perfume types should be selected.			The focal point lies at +e, +n (sultry), hence a sultry perfume will harmonize with this type of woman.		

Table 14.5 Clear-cut overall types

Type assignment	Value from calculation diagram		Type assignment	Value from calculation diagram	
Redhead	+e	−n	Dark blonde	−2e	
Non-motherly	+e	−n	otherly	−e	+n
Masculine		−2n	Feminine		+2n
Artful		+2n			
			Sum	−3e	+3n
Sum	+4e	−4n		=3(−e	+n)
	=4(+e	−n)			

conjunctions of characteristics. For these women, the choice of a perfume would have to be guided by the activities diagram and adjusted by the age diagram. Examples of *harmonious overall* types are given in Table 14.4 and examples of *clear-cut overall* types are given in Table 14.5. In both cases, the focal points found (+e, −n and −e, +n, respectively) are stressed several

times over, hence the appropriate perfume types are unequivocally indicated. With the woman described in the left-hand column, a perfume with a predominantly exalting effect will harmonize, with the one characterized in the right-hand column, a calming one will harmonize.

To achieve a satisfactory result, only the four type diagrams, namely the hair-type, mother, feminine–masculine and the behavior diagrams (Figures 14.1–14.4), should be combined or added in this way. The age and activities diagrams should be consulted only after the type diagrams have been combined. This is done in the following manner. In the case of unharmonious overall types, a combination of the age and activities diagrams will solely determine the choice of perfume type. The activities diagram is to be regarded as the fundamental one, the age diagram is used as a kind of correction. In the case of harmonious overall types the focal point resulting from combining the age and activities diagrams should be combined with the result of the type diagram determination. In the case of clear-cut overall types it is best to ignore the age diagram altogether and to combine only the activities diagram with the resultant sum of the type diagrams to arrive at a final focal point. In all of these cases it must be remembered that the activities diagram should be applied only when the woman in question uses several perfumes to go with the different dress styles she uses and the surroundings in which she finds herself in at any given moment.

The age diagram shows that the most commonly used modern perfume type, with its emphasis on the exalting note, harmonizes best with the mature woman. It also goes very well with the redhead – the current fashion trend favoring this shade is therefore not a coincidence – and the non-motherly mistress. The exalting perfume effect also corresponds to a combination of masculine (active, intellectual) and artful (the 'vamp' type). Within the context of the activities diagram, it lies between sports and society and hence with the social activities not related to jobs. The brown-haired type, a motherly, naive–feminine behavior and the activities which the home and the job have in common (the homemaker) are directly opposed to the exalting note which characterizes the modern perfume.

All of these findings, quite in accord with today's prevalent taste, are not the result of accidental coincidences. Even though we assume the validity of our diagrams to be unchanging, the types and dispositions to which they refer are not necessarily the natural expression of physical or psychic predispositions but are usually assumed and worn in response to fashion, just as perfumes are.

15 Men and fragrance

In the discourse about the harmony between perfume and personality we have, thus far, considered only woman as the user of fragrance. We will now deal with the question of whether and to what extent man can use fragrance within today's canons of taste. Taking into account the thesis that the fashions of each sex are determined by the wishes and the taste of the other sex, the question becomes, more precisely: is the use of fragrance by man in accord with modern woman's taste?

To find an answer to this far from simple question it is necessary first to think about what is meant by the expression 'using fragrance'. It should be recognized that this phrase, rather narrow in its meaning, is not at all identical will 'smelling nice', even if smelling nice comes about by the use of odorous materials that do not originate in the body. When we say of a person that he or she 'uses fragrance', we express our presumption that the person in question uses some personal product with the express intention that the fragrance of this product be perceived by other people and that they experience it as pleasant and attractive. We assume, therefore, that someone who uses fragrance does so knowing that it makes him or her attractive and stimulating to others; to be exact, to others of the opposite sex. However, an intended effect or, to put it more precisely, an obviously intended effect on the other sex is considered, in our days, to be a manifestation of unmanly vanity. A number of common sayings reflect the idea that vanity is a specifically female vice. Few people will take this seriously. Such a view probably only arose as a result of having invented for the more common male forms of vanity more noble-sounding terms such as need for recognition, ambition, self-confidence, pride, etc. and even having branded these, for the most part, as virtues. Any form of vanity is admissible in the male as long as its manifestations aim, or are seen to aim, only at the male sex.

Today it is a matter of course that the male, too, takes care of his body and it is justified that his aesthetic sensibilities require that the products that he uses for this purpose have a pleasing scent. Hence it is not considered unmanly if there is about him a scent considered to come from male toiletries such as soap or brillantine, hair lotion or mouthrinse. Modern woman is even fond of such scents that betray his good grooming. Thus, the author Vicky Baum describes in her novel *The Stage Entrance* how a young woman is fascinated by the 'pungent scent of an English soap' on a man. Therefore, the man of culture may and perhaps should exhibit a pleasant scent, but he must not smell as though he were 'using fragrance'. The odor about him must be, so to speak, a side-effect of his grooming and must never betray

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the use of a scent for the sake of attracting the other sex by the pleasing aura created.

To be able to draw a line between perfuming oneself on purpose and an accidentally remaining pleasant scent it is vital to remember that fragrances, i.e. perfumes, eaux de toilette, etc., have been designated as aphrodisiacs and that the aphrodisiac effect of perfumes cannot be achieved without erogenous components. Hence the effect of a perfume on the other sex results primarily from its erogenous components and their presence betrays to our intuition the intention of achieving this effect. Since, however, this wooing-with-fragrance is considered unmanly, the scents used by the male in whatever form must not contain any erogenous components. Since all fragrances that are true perfumes to our present taste must contain erogenous components, none of these can be used by males without causing an 'unmanly' effect. The male who likes to surround himself with pleasing scents will therefore look for these in toilet soap, shaving products, hair grooming aids, body powders and other toiletries. Their fragrances usually contain no erogenous components, especially in the case of products specifically designed for male grooming. They are normally complexes with anti-erogenous, fresh, stimulating or calming effects. An emphatic narcotic effect is also not to be recommended in toiletries for men because, apart from the fact that purely narcotic, intoxicating odors can themselves be considered erogenous in a sense, they give, in conjunction with the weak but never totally absent erogenous personal odor, a sultry complex which does not harmonize at all with masculinity.

Time and again, perfumers have tried to create 'men's perfumes' and marketers have attempted to launch them. All these attempts have ended in failure. The approach used was to base the fragrance on certain pleasant odors that men sometimes pick up from natural sources, such as the scent of leather or tobacco. Even though this idea was certainly obvious and perhaps correct, it did not lead to success. At fault was the fact that these leather and tobacco perfumes, for example, were constructed according to the plan that had proved successful in feminine perfumes, i.e. with the same traditional fixatives, smoothing agents, etc. The base note of the compositions was enriched with jasmine and rose extracts, etc. and they were fixed using musk, civet, ambergris or castoreum. In this way, erogenous or sultry components were introduced, making the creation unfit for male use.

Knowing from experience that 'fresher' perfumes were more suitable for men, perfumers then added the well-established Eau de Cologne complex to lend a fresh touch to men's perfumes in the expectation that Juchten-Eaux de Colognes (leather colognes) or Eaux de Cologne Russe would be accepted by the general public as men's fragrances. The effect of the erogenous note present in the perfumes was in fact attenuated by the pronounced anti-erogenous note of the Eau de Cologne complex and some degree of success was actually attained: several 'perfumed' Eaux de Cologne were used by men. These compromise solutions, however, did not enjoy true, lasting success for, as we

know, neither individual odor notes nor their erotic effects can be cancelled by any other odors, they can only be complemented or, at most, attenuated.

A perfume type suitable for men cannot, therefore, be created by allowing anti-erogenous, calming, fresh or stimulating notes to predominate. It must not contain any erogenous materials whatever and must not have a pronounced narcotic effect. Perfumes composed in this way deviate fundamentally from the French tradition, still universally cherished today and nearly inviolate. According to the definition which has been adopted and discussed in this book, they cannot be called perfumes at all even though we readily accept complexes of this kind as fragrances for cosmetic products or soaps.

We will now consider, on the basis of past experience regarding the success of fragrance creations among men, what complex types may be suitable for men's fragrances. First, consider *Eau de Cologne*. The only condition here is that the Eau de Cologne complex is not made too 'perfumey' by the addition of erogenous or narcotic components such as jasmine, rose, fleurs d'oranger, clary sage, musk, etc. A second type, which for reasons already discussed is not commonly found in perfumes, is *lavender*. Oil of lavender has a calming effect, the accent in different varieties lying either on the narcotic or on the anti-erotic effect. Nearly all compositions for lavender waters also contain erogenous components serving as fixatives; these must be avoided when creating a men's fragrance. In view of the very small difference between the most popular lavender waters and Fougères it becomes apparent that the *Fougère* complex, free from erogenous components, is also well suited for men's fragrances or may serve as the base of such fragrances.

Another fragrance type which is also used only in the form of an eau de toilette is *Eau de Cologne Russe*. Far less narrowly defined than Eau de Cologne and lavender water, it may be regarded either as an Eau de Cologne with added fixative, usually consisting of sultry components, or as an attempt to freshen the toilet water of a sultry fantasy perfume by the addition of an Eau de Cologne complex and thus to make it suitable for male use. In either case, the type Eau de Cologne Russe leaves the perfumer sufficient freedom to serve as the base for a men's fragrance.

Eau de Portugal is closely related to Eau de Cologne but has always been used exclusively by men because it omits their erogenous component, neroli oil. It is very simple in structure, containing some 50–65% sweet orange oil (Portugal oil) flanked by the oils of bergamot, lemon and geranium, and fixed, usually with benzoe resin. A historically very interesting product, also deserving mention here, is *Hungary water* (Eau de la Reine de Hongrie). This product may be considered to be the forerunner of Eau de Cologne. Originally it was probably simply a distillate of an alcoholic extract of rosemary. Later, it was elaborated by the inclusion of other plant extracts.

A men's fragrance enjoying great popularity, especially in Latin America, is *Florida water*. Originally prepared with extracts from broom (*Genista florida*) blossoms, its modern form basically consists of a combination of Eau de

Cologne and lavender, calming in effect with the addition of stimulating spice oils as a contrasting note.

Another fragrance type much in demand among consumers, although not as a perfume in the sense in which we have defined that term, is *Eau de Quinine*. This is a rosy complex freshened by anti-erogenous and stimulating components, free from erogenous materials and primarily calming in effect.

It is a general principle that only those natural and fantasy complexes that do not represent nor are based on flower odors are suitable for men's fragrances for it goes without saying that the mental images invoked by a flower scent cannot harmonize with a masculine appearance. The only exception, lavender, is explained by the unique position of lavender absolute among the flower extracts: it is the only one with a calming effect and may be regarded here as the exception that proves the rule.

In the familiar perfumes, creations of the French taste and marked by this taste until today, the floral note nearly always dominates to such an extent that many of the most successful perfumes may well be considered variations on the theme jasmine–rose. We are so used to this floral base note that we are not aware of its presence unless we smell a perfume analytically. The erogenous fixatives such as musk tonquin, civet, etc., obligatory components of all well-known perfumes, are not apparent by their odor as much as by their erotic effect. A great many of the aroma chemicals with narcotic and erogenous effects owe their widespread use to the key role which floral (narcotic) and animal (erogenous) components play in today's perfumes. A few examples in point are hydroxy citronellal, benzyl acetate, ionone, phenyl ethyl alcohol and indol – materials without which modern perfumes would be almost unthinkable. If the perfumer creating a men's fragrance must do without all of these important materials – it is up to the perfumer to make some exceptions if required – it will be necessary to employ other materials that have not been used in perfumes before now, or only in small amounts. In many cases, an important role may be assigned to such materials.

These materials include the very important spice oils. In traditional perfumery the spice oils are almost always employed as modifiers; in men's fragrances they may assume far greater importance. Peppermint oils are usually considered only as flavoring agents for oral- and dental-care products. Some varieties possess delicate and interesting dry-down notes and may be used in men's fragrances to achieve unusual fresh–herbaceous effects. The fresh scent of coniferous oils certainly offers additional creative opportunities. These include Austrian pine needle oil, juniper berry oil and cyprus oil, all fine materials of distinction. The fact that the use of these materials has hitherto been largely confined to the fragrancing of bath salts, body oils and air fresheners is a result of their incompatibility with the traditional floral base of alcoholic perfumes. In addition, because of their high terpene hydrocarbon content, the coniferous oils tend to give rise to undesirable turpentine-like notes on air oxidation, hence also on dry-down on the skin. However, the

perfume materials industry will indubitably succeed, sooner or later, in correcting this flaw, be it by a partial removal of the terpene hydrocarbons of the essential oils or by the manufacture of high-grade extraction products (resinoids or absolutes). Some small-scale experiments with coniferous extracts have fully convinced the author of the great perfumery value of these products. Thus, the technical aspects of creating fragrances that harmonize with the male present difficulties but also new and interesting possibilities.

In the commercialization of fragrances created specifically for men, the first challenge will be to overcome the conservatism of the public's taste, often underestimated in perfumery, which likes novelty but only if it adheres to the familiar style. Since we are dealing here with fragrance types that are as yet unfamiliar to the consumer within the context of perfumes or toilet waters, there is the risk of disappointment and rejection arising from misguided expectations. It will therefore be necessary to make the consumer aware by all available means that these fragrances are intended to achieve new aims by novel means. If this is done by well-known firms using astute advertising, a product name that is both appropriate and striking, and bottle and outer pack design to match, a tasteful new composition will not fail to succeed even if it is novel in type.

16 Fragrance in cosmetic products

It goes without saying that an understanding of the various erotic effects of perfume materials and complexes is also important in the creation of fragrances that serve to scent cosmetic products. Fragrance often has considerable responsibility for the success or failure of a cosmetic product. In discussing fragrance in cosmetic products, it is important to distinguish between skin-care products and decorative cosmetics.

The *skin-care products*, employed for the sake of the user, may be regarded as serving hygiene at a sophisticated level. Their direct effects, be they cleansing, disinfecting, vitalizing or maintenance, are confined to the user. Their composition as well as the necessity and manner of their use are governed by physiological considerations. The perfuming of skin-care products is either one of their functional factors or serves simply to render the application of an otherwise odorless or unpleasant-smelling product base more agreeable. In all cases, care must be taken to ensure that the perfume compositions used do not contain any materials that are in any way irritating or harmful to the skin.

Decorative products are used entirely for aesthetic reasons; they are accessories of 'cosmetics of representation'. They are an important part of make-up and serve to create in the other sex an effect that is as favorable as possible. Decorative cosmetics are clearly, therefore, aphrodisiacs; this fact sets the basic direction for their fragrancing.

The intention here is not to present an extensive overview of the best and most effective ways of perfuming each individual cosmetic product. Instead the perfume material groups that act in the same sense as the products' cosmetic functions will be identified in order to achieve an enhancement of the intended overall effect by a harmonious conjunction of the physiological and odor effects. To this end the various cosmetic products will be characterized by the erotic effects on which the Odor Effects Diagram is based.

The function of the perfume materials, or rather the flavor materials, used in *oral and dental products* is to create a pleasantly refreshing and stimulating taste during the cleansing process and thereafter. Hence it is clear that refreshing, stimulating or fresh (refreshing and stimulating) perfume materials are the most suitable ones. The perfume materials and compositions commonly used and most popular for these purposes confirm this conclusion as the basic material of the great majority of perfumes for mouthrinses, toothpastes and tooth powders is peppermint oil or its odorous principle, menthol. Both of these materials have a purely refreshing (anti-erogenous) effect, as does eucalyptus oil (eucalyptol) which is also widely used.

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The spice oils thyme oil and spearmint oil, frequently used alongside the above materials, possess a fresh effect. Frequently used stimulating materials include anethol (used as such or in the form of anise oil, star anise oil or sweet fennel oil), oil of cloves (eugenol), caraway oil (carvone) and cinnamon bark oil (cinnamic aldehyde and eugenol). In America wintergreen oil (methyl salicylate) is also popular; in England, some products also contain phenol. Both of these materials are also stimulating. Used with menthol or peppermint oil, as they usually are, they provide a fresh effect. If other materials, such as rose oil, geranium oil, orris oil, ionone, vanillin, coumarin or components of the Eau de Cologne complex, are also employed, which is the case especially in French products, it is always at low levels, as modifiers that hardly affect the overall effect of the composition.

While lotions are used primarily for their odor, *hair tonics* are treatment products and usually contain medicinal additives along with fragrance. If these additives have an odor of their own, as is the case with balsam Peru, anthrasol, euresol or the petrol hair tonics, the main function of the perfume is to modify the odor of the active component in as pleasant a manner as possible. In nearly all cases refreshing materials, especially citrus oils, are best suited for this. If the physiologically active additives are almost odorless, as is the case, for example, with infusions of chinchona bark, gallnut, canthariden or stinging nettle, perfume compositions are used that traditionally consist of narcotic and refreshing components and provide a calming effect. Experience has shown that such compositions, e.g. bay rum, Eau de Quinine and birch hair tonic, are generally liked.

The guidelines for hair tonics also hold for facial tonics, including after-shave lotions. Here, special care must be taken to avoid harming the facial skin, which is tender, especially after shaving. Odor materials must be kept at low levels and materials irritating to the skin must, of course, be avoided from the start.

The *fatty skin creams* are the most important and widely used skin-care products. They may be divided into two groups according to the duration of their application.

The first group consists of those creams which remain on the skin for a short time only, i.e. the *cleansing creams* (including make-up removal creams) and the *massage creams*. Since every cleansing treatment should induce a feeling of freshness and since the objective of a massage is to refresh the skin and the body, it is obvious that fresh (refreshing + stimulating) compositions are best for perfuming cleansing creams and refreshing (anti-erogenous) perfumes are most suitable for massage creams. The experiences of cosmeticians regarding the popularity of fragrances in the various kinds of creams confirms these comments.

The second group of fatty creams consists of the so-called *night creams*. The term is indicative of the length of time of application. The products known as 'cold creams' or 'skin foods' – the latter also include creams with medicinal

additives such as vitamins or hormones – serve to keep the skin soft and supple by the absorption (never the resorption) of fatty substances. Since the body is intended to rest during the period of activity of these creams (usually overnight), no materials that are in any way exciting, i.e. stimulating or erogenous, should be used for perfuming these products. Narcotic perfumes are most apt, for the same reason. In many cases, certain components of the cream base, such as waxes, lanolin, cocoa butter and other fats or fatty oils, exhibit strong and not very pleasant odors. These are best attenuated by refreshing (anti-erogenous) odor materials, since these contrast with the fatty or sweaty base odors which are erogenous because of their resemblance to body odors. Therefore, perfume compositions with a calming effect are best for perfuming night creams whose base in actual fact always possesses an odor of its own. Liquid products are often used in place of semi-solid creams. Naturally, these oils or emulsions are fragranced in the same manner as the creams that serve the same purposes.

Bath additives, commonly used in the form of crystals, tablets or liquids, primarily serve to add to the refreshing or stimulating effect of the bath by appropriate fragrances. Fragrances providing refreshing or fresh effects are preferred here. If the bath is supposed to exert a calming action, as in the case of nervous stress or evening baths, calming perfumes are used, i.e. compositions consisting of refreshing and narcotic materials such as lavender, floral Eau de Colognes or fresh florals.

The fragrance of *talcum powders* must meet the following expectations: it must be pleasantly fresh but not too volatile; it must mask, as much as possible, any unpleasant body odors; it absolutely must not irritate the skin. These requirements prohibit the use of terpene-rich oils, for they are too volatile. Since in many oils it is the terpenes that constitute the refreshing element, the number of suitable perfume materials is reduced to a few. Their number is further reduced by the requirement of skin compatibility in a quantitative more than in a qualitative sense. The particular suitability of materials which tend to mask body odors is not a restriction for talcum powders. This favorable condition is due to the fact that body odors and odors similar to them are among the erogenous odors or, rather, they constitute them. As is clearly shown by the Odor Effects Diagram, the perfume materials with a refreshing effect directly contrast with such odors, which is why they have been designated 'anti-erogenous'. Along with some other materials, the lavender extracts (resinoid and absolute), thyme oil and its odorous principle thymol, spearmint oil and rosemary resinoid meet all of these conditions perfectly.

The cosmetics discussed up to this point belong to the group of caring products. When they are employed, only their effects become apparent to others, not the products themselves. They contrast with the beauty products, now to be considered, in the manner both of their use and of their action. This difference is also reflected in their fragrance.

The perfuming of *lipsticks* is a highly interesting topic from the psychological perspective. The perfumer with little experience in this field usually assumes, when composing a lipstick perfume, that the lips, being part of the mouth, should have a scent which is perceived as a pleasant taste sensation or which is commonly associated with such a sensation. (For instance, the odor of oil of lemon is actually only an accompaniment to lemon taste which is caused primarily by odorless citric acid.) Consequently, the popular fruit flavors are expected to be the candidates of choice. The experiments in this direction are legion: lipsticks have been launched containing strawberry, peach, lemon, orange, raspberry and cherry flavors, as well as honey, coffee and vanilla flavors. In all cases the marketers of such products sooner or later had to conclude, to their surprise, that the aromas most faithful to the natural model found little acceptance. In fact, the opposite was the case: lipsticks with less 'aromatic' and more 'perfumey' scents were preferred by the great majority of the public. Since these observations were made over and over again, the effort to provide 'tasty' fragrances in lipsticks were abandoned. Methodically working perfumers and manufacturers attempted to explore public taste by conducting tests with differently perfumed lipsticks. It turned out that rose and violet complexes, and combinations of these, were by far the most successful. Jasmine and orange blossom followed by cyclamen, lily of the valley, mimosa and lilac scents were accepted in some cases while other variants of these types were rejected.

Intrigued by the rejection of a violet perfume modified with a touch of civet that had earlier, without the civet, met with general approval, the author initiated a series of tests from which the following findings emerged. Sweet, rich floral odors and certain balsamic complexes found the highest acceptance as lipstick perfumes. They were, however, rejected to the extent that they possessed animal notes, even though these were due to only minute additions of artificial civet or indol. The animal extracts (musk tonquin, castoreum and civet were tested) were rejected as well, albeit less decisively. Proof that natural indol had the same effect as the synthetic material came from an experiment in which two identical perfumes were compared, differing only in that one contained jasmine absolute prepared by enfleurage while the other contained an absolute prepared by petrol ether extraction. The petrol ether extract, with its far lower indol content, was clearly preferred. These findings also offered an explanation of the popularity of rose and violet perfumes. Of all common flower complexes, these are the ones least fixed with animal perfume materials; the natural oils of these flowers contain no indol nor do their artificial counterparts. A critical review of the findings obtained in these tests, aided by the observations recorded in previous sections of this book, can lead to explanations for consumers' reactions to the different odor effects and to some important general conclusions.

Food flavorings used as lipstick perfumes fail because the assumption that the consumer using lipsticks thinks of her own immediate enjoyment is

incorrect. Lipstick is used not to beautify the mouth as an organ of food intake but to enhance its erotic attractiveness as an organ of kissing. Any artefact intended to induce physical approach must be erogenous and effective over some distance. Both perfume and the intensification of the natural red color of the lips meet these conditions. At the moment of kissing, a moment brought about by the joint action of natural and artificial erogenous attractants, the physical contact, now that it has been established, needs no more artificial enhancement; it needs, rather, exhilarating, narcotic sensations which enable surroundings to be forgotten and inhibitions dropped. Thus it is clear that lipsticks are most appropriately perfumed with narcotic compositions that are not reminiscent of flavorings.

The rejection of animal body-like odors for lipsticks is explained by the observation that, in the absence of an erotic function, these odors are perceived as scents of decay and putrification. As such they are repellent and inappropriate especially around the mouth. All experience indicates that, for herself, the consumer prefers on the lips, in the immediate vicinity of the taste receptors, the aromas of foods and drinks; in the selection of a lipstick perfume, however, the usually unconscious desire to exert a many-facetted and strong erotic attraction on others predominates.

The guidelines for perfuming *day creams* or *vanishing creams* are based on the fact that the exclusive use of this cosmetic product is as a base for the application of facial powder. The use of these creams serves to promote the adhesion and smooth application of powder to the skin and to prevent the clogging of pores by mineral and dye particles that are insoluble and foreign to the skin. The fact that day cream is always covered by facial powder and, to an observer, the two act as a unit must be taken into account in the fragrancing of these two beauty products. Technically speaking, the perfumes of the day cream and facial powder that are used simultaneously or by the same person must together provide an odor accord that may be achieved through harmony or contrast. In this symbiosis of two cosmetic products the cream is the more substantive partner; moreover, the fact that the perfume is emulsified in it, while with the powder it only adheres to the surface of the particles, gives it a greater capacity to hold the more volatile perfume materials. If the same composition were used to perfume the cream and the powder, this would lead, soon after application, to a 'heavier' odor in the powder. In the cream all of the perfume's components would continue to make themselves felt while the powder fragrance, because of its exposure to evaporation, would already have lost some of its more volatile components. For reasons of suitability, therefore, the use of volatile components is avoided as much as possible in powder perfumes in favor of tenacious absolutes, resinoids, essential oils of low volatility and high-boiling aroma chemicals, some of which are crystalline. In composing cream perfumes the opposite tendency is commonly found. The fixing action of the cream base makes the use of the more volatile perfume materials possible while among the above-mentioned natural and synthetic

materials of low volatility there are many that either exhibit an intensive color of their own or tend to discolor in creams. Such materials are to be avoided in creams that are, nearly without exception, white or very delicately colored.

These purely technical comments are necessary to explain why cream and powder perfumes are usually distinctly different even when they represent the same odor types and in spite of the fact that both are doubtlessly intended to serve the same function, i.e. as an aphrodisiac, in line with the function of the two products, day cream and facial powder. Apart from qualitative differences there are also quantitative ones to consider when perfuming the two product bases. In perfuming creams, one should work with the lowest possible levels of highly performant perfume materials; levels of 1% are rarely attained. This is the best way to avoid destabilization of the oil-in-water emulsion and irritation of the skin. In perfuming powders, on the other hand, there is no fundamental objection to perfume levels of 1 to 2.5%. In some cases such levels are even exceeded, which is perfectly permissible as long as the powder base is not negatively affected, i.e. does not become sticky or discolors. Because of its level, usually several times as high as in the cream, the fact that powder makes up the external layer and because of the more frequent touch-ups to the powder layer, the perfume of the powder makes itself noticed far more than that of the cream. For all these reasons the powder perfume acts as a kind of base for the total odor complex and the cream perfume participates only as a modifier.

In composing a perfume for facial powder the perfumer's task consists of creating an erogenous, sultry or exalting composition from components of the lowest possible volatility. No thought need be given here to the scent of the day cream that serves as a powder foundation. In composing cream perfumes, on the other hand, it must be remembered that a fragrance with a very distinct character or clear-cut odor type would make the cream appropriate as a foundation only to one or a limited range of powders; with powder brands that are differently perfumed, odor discords are likely to occur. Because of these technical considerations, fragrances for day creams usually consist of materials commonly used as blending and enriching agents for erogenous, sultry or exalting perfumes. Such blending agents are, for example, the absolutes of rose, jasmine and tuberose, rose oil and the individual components of the rose complex, ylang-ylang oil, neroli oil, bergamot oil, benzyl salicylate, ionone, musk ketone, linalool, vanillin, cinnamic alcohol, musk tonquin, civet and Ambrettolide (Exaltolide). The aldehydes heliotropin and hydroxy citronellal also belong to this group but should not be used in skin cream perfumes in view of their skin irritant potential.

Brillantines and *hair oils* as well as the pommades, emulsions, gels and fixatives which serve to set and hold hair styles, are, by their purpose and the way they are used, certainly decorative products. In contrast to the other products in this group they are, however, used predominantly by men. This decisively affects the fragrances used in them. What has been said earlier about

the perfuming of men's toiletries also holds here: the use of erogenous materials or perfumes with a predominantly narcotic effect should be avoided.

The natural odor of the scalp hair gives an erogenous component to the overall odor of the scalp region. In the male this is usually very faint, to be sure, but it nevertheless is noticeable. For this reason, the perfumes of cosmetics for hair grooming must always contain anti-erogenous components whose mission is to avoid, by contrasting effect, the preponderance of an erogenous note. If sufficiently effective anti-erogenous materials are used, there is no reason not to use stimulating components alongside them. A fresh effect is achieved; the exalting effect that could have come about in the absence of anti-erogenous materials because of the conjunction with the natural erogenous hair odor is avoided.

The use of purely narcotic flower scents in hair-grooming products causes the familiar, not very tasteful, sultry 'pommade odor'. Too strong an emphasis on the stimulating note in brillantine perfumes results in obtrusive exalting effects. Therefore, the best substances for the fragrancing of hair-grooming products are those with calming, anti-erogenous or fresh effects.

17 Soap perfumery

Soaps for personal use are really cosmetic care products in terms of their function and application. The following groups and subgroups may be distinguished from the cosmetic and perfumery perspective:

1. Skin and body soaps: (a) bath soaps, (b) toilet and luxury soaps, (c) medicinal soaps
2. Hair soaps (shampoos): in powder and liquid form
3. Dental soaps: in solid, cream and powder form
4. Shaving soaps: in solid, cream and powder form.

17.1 Skin and body soap perfumery

The sole purpose of *bath soaps* is to cleanse the body. The feeling of freshness associated with the idea of cleanliness can and should be promoted by an appropriate fragrance in as pleasant a manner as possible. As mentioned earlier (Chapter 2), the feeling of freshness is closely linked to the volatility of perfume materials or perfumes. The fragrance in bath soaps is therefore expected to be noticeable only during the use of the soap, not to linger for a long time. For this reason, anti-erogenous, refreshing-acting materials are amongst the main ingredients of bath-soap perfumes, and the effect of these perfumes is either purely refreshing or, if narcotic materials are also used, calming or, if stimulating materials are present, fresh. In view of the purpose of bath soaps, the use of erogenous components is to be avoided, unless these occur in small amounts as characteristic and essential components of certain complexes that are popular as bath-soap perfumes. Indol, for example, cannot be completely avoided in composing some flower complexes. In line with these considerations, odor types that are particularly suitable for bath soaps include coniferous odors and Eau de Cologne (anti-erogenous); lavender, fresh (white) rose and violet with pronounced leaf note (calming); blue lilac, mimosa and fines herbes (fresh).

The *toilet soaps* or luxury soaps, also called facial soaps, not only serve to cleanse the skin; they are also intended to leave a pleasing odor behind. They may be viewed primarily as cleansing products but, in contrast to bath soaps, they are carriers or transmitters of fragrance, rather than refreshing products. All fragrance types that are suitable for perfumes and colognes are therefore also suitable for toilet soaps. However, the restrictions regarding fragrance for men's toiletries must again be taken into consideration here. The aim for these

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products is to achieve a fragrance that lingers long after the soap has been used. This is best achieved through generous use of extraction products (resinoids).

The same functions that fragrance exercises in toilet soap are fulfilled in *medicinal soaps* by certain medicinal, usually disinfecting or dermatologically active, additives. The fragrance in these soaps is often marked by perfume materials used for their therapeutic properties, such as balsam Peru or thyme oil. In other cases, the fragrance serves only to attenuate or modify the unpleasant odor of medicinal agents such as sulfur or tar preparations. In both cases an erogenous effect is not intended. Medicinal soaps are mentioned here not only for the sake of completeness but because the author is convinced that soap is interesting to the physician not only as a carrier for disinfecting or dermatologically active agents. Because of their perfume and its various erotic effects they deserve the physician's, and especially the psychiatrist's, attention. The customary use of soap several times daily; its common use in otherwise vacant and closed rooms, inducive to mental relaxation and, with it, to an enhanced receptivity to sense impressions; people's general readiness to enjoy pleasant fragrances and finally the possibility of making these fragrances linger for extended periods – all these are factors which must favor psychic effectiveness and which should be put to use for therapeutic purposes, more effectively and more consciously than has been the case up to now.

17.2 Perfuming shampoos

Shampoos or hair soaps serve exclusively to cleanse the hair and the scalp, regardless of whether they are sold as dry powders or as liquids.

In shampoos we observe with particular frequency the phenomenon whereby a cosmetic product is perfumed, arbitrarily and for the sole reason that the public is used to it and asks for it, with a perfume that may perhaps be well-composed but whose odor type harmonizes in no way with the specific applications and the action of the product. If the important role of the odor of the hair as a component of personal odor is kept in mind, and the fact that hair not only readily absorbs odors but also diffuses them with particular intensity is considered, it becomes clear that careful attention must be given to the perfuming of shampoos. This is especially true where shampoo is the only perfumed product used in hair care. This is not usually the case with men. Their daily use of hair tonics and the application of perfumed brillantines or hair oils, usually immediately after shampooing, results in rapid and generally complete masking of the shampoo fragrance. The following comments therefore refer only to the perfuming of shampoos for feminine hair.

Formerly, the custom of applying lotions after shampooing was widespread and it is still prevalent today. Its purpose was not only to remove, by means of the weakly acid alcohol, the insoluble calcium soaps which gave the hair a dull,

lusterless appearance but also it served to achieve a pleasant odor by masking the usually not very attractive perfume of the shampoo. Today, the alkaline hair-cleansing products are increasingly being replaced by the sodium salts of sulfonated fatty alcohols, of neutral or weakly acid pH, or by various fatty acid condensation products. Consequently, after-treatments of the hair are no longer necessary. For this reason, the use of shampoo fragrances adequate in strength, good in quality and appropriate in type has become important. The selection of these fragrances must be guided by the consideration that a fragrance artificially applied to the hair must be above all erogenous, in line with the function of the hair's natural odor. The shampoo perfume should lend the hair, momentarily deprived of its natural erogenous odor by the cleansing treatment, a scent which in its effect approaches the natural odor as closely as possible. Since the characteristic erogenous components of flower complexes, indol, phenyl acetic acid and its esters as well as *para*-cresyl derivatives, are reminiscent of fecal odors which play no role whatever in the regional odor of the scalp, flower scents are not suited for shampoo perfumes. The use of civet as a fixative is to be avoided for the same reason. In addition to erogenous odorants with a fatty–sweaty odor, particularly suitable materials are those that possess the sweet–nutty note, usually characteristic of lactones, which is also the major component of hair odor. Such materials are, among others, tonquin musk, ambergris, castoreum, camomile oil, lovage oil, parsley seed oil, celery seed oil, Ambrettolide (Exaltolide), musk ambrette, ketone and xylol, nonalactone ('coconut aldehyde'), dihydro jasmone (isojasmone) and coumarin. Tonka bean extract is a very suitable replacement of coumarin in shampoo perfumes for it exhibits, along with the lactone odor, the fatty–sweaty note that is also desirable here. A combination of these two desirable notes is also found in costus root oil, carrot seed oil and ambrette seed oil. Among materials which possess the fatty–sweaty note as their only erogenous component are the higher fatty alcohols and fatty aldehydes, hydro cinnamic alcohol and aldehyde, the resinoids of labdanum, tolu, styrax and olibanum, orris concrete and sweet orange oil, especially the terpeneless form. Neither the nutty lactone odor nor the fatty–sweaty note are present in terpeneless cypress oil, patchouli oil, East Indian sandalwood oil, in oak moss extracts or in *delta*-methyl ionone. However, these materials exhibit certain odor nuances reminiscent of hair odor and hence they too are appropriate as components in shampoo perfumes.

Using these perfume materials and others with similar effects, partly erogenous, partly stimulating or with distinct erogenous or stimulating aspects, bases for shampoo perfumes may be created that optimally fit the requirements. In composing these perfumes care should be taken to ensure that the erogenous component remains sufficiently distinct, coupled perhaps with a stimulating note, resulting in an exalting effect. There is nothing to be said against the use of narcotic perfume materials or complexes in shampoo perfumes, as long as these do not drown out the effects of the erogenous and stimulating compo-

nents. Anti-erogenous materials should be used only as nuances where this appears appropriate, e.g. to achieve a contrast effect.

17.3 Fragrances for dental products

Soaps are normally used together with inorganic abrasives (usually calcium carbonate in the form of minute precipitated particles) in solid form as dental soaps, in semi-solid form in dental creams or toothpastes and in powdered form in some dental powders. Their perfuming occurs according to the same considerations that have been provided earlier in connection with dental and oral-care products (p. 131). It is only necessary to add that the presence of soap in these products leads to a noticeable and not very pleasant taste during use. This can be masked successfully by the use of stimulating spice oils such as cinnamon oil or clove bud oil.

17.4 The perfuming of shaving soaps

Shaving soaps, shaving creams and soap powders are exclusively for male use, hence their perfuming is subject to the limitations that must be observed with all male toiletries. The use of erogenous materials and a dominant role for components with a narcotic effect are to be avoided. Since the irritation of the skin occasioned by the act of shaving leads to a rejection of any kind of additional irritation, the use of stimulating odor materials as components of shaving soap perfumes should also be avoided as much as possible. For these reasons the most popular compositions for this application possess a calming effect. Lavender perfumes above all and also fresh rose compositions have effectively become standard for shaving products. In view of the continuing popularity of the lavender–rose type, fragrances of this type have nearly universally been adopted in commercial shaving soaps. This is a fact not exactly to be commended since it reflects poorly on the initiative and the imagination of the decision makers involved.

There are quite a number of additional odor materials whose use here would be appropriate not only because of their scent but also because of other properties of value such as disinfecting or therapeutic activity. Examples of such 'medicinally effective' perfume materials are sandalwood oil (santalol), thymol and balsam Peru.

18 The erotic effects of perfume materials

The arguments presented up to this point have clearly shown that an understanding of the erotic effects of perfumery materials not only provides a deeper comprehension of phenomena previously observed in practical experience or sensed intuitively, but can also be fundamental to the perfumer's technique of composition. Because of its strong appeal to feelings and the imagination, the perfumer's work must undoubtedly be regarded as an art. It is by no means the author's intention to constrain it within the rigid bounds of a science. Nor does he want to undertake the certainly fruitless attempt to reduce the technique of composition to the observation of a set of guidelines, for this would tend to paralyze the creative gifts of independent thought, personal taste and imagination. On the other hand, the arts of advanced cultures, as opposed to primitive art, do not disdain, like science and technology, building on the knowledge and skills of their great masters and deriving certain insights from their sayings and actions during their lifetime and, after their death, from their works.

In this way, progress in all fields has not been confined to the development of individuals. The recourse to tradition has made general advance possible. In this, use was made, wherever possible, of fundamental laws of some kind. The essential difference between science and technology on the one hand and art on the other lies in the nature of these laws; the laws of science and technology are discovered, those of art are found. This means that the laws that govern science and technology have been provided by nature. They have always existed and they are unchangeable even if their discovery by man is a gradual process. The free will of man is bound by these laws of nature. They can be neither ignored nor trespassed, they can only be overlooked or remain unrecognized. There are no such eternal and inviolable laws in art. It is true that certain rules are created in all arts by men who are artists, sometimes consciously but far more commonly, unconsciously. These rules, recognizable as common features of masterworks, are considered to be 'laws of art'. However, like fashions, these laws are valid only for certain cultures during certain epochs. Their validity ends the moment developments take a new direction and they are declared to be outdated, restrictive or false or even ridiculed, a not uncommon occurrence.

It goes without saying that the validity of the laws of nature also extends into the realm of art. Recognizing their consequences here and reconciling the laws of art with them or, as the case may be, finding satisfactory explanations for apparent contradictions means turning part of art into science. Such a development represents real progress and is to be welcomed. After all, it does

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not mean reducing the realm of art by assigning part of it to science. Rather, it provides artists with the opportunity to base their work, created within the framework of the laws of art, on the sure and firm foundation of scientific facts and insights.

Our presentation of the erotic effects of perfume materials is intended to add to the scientific foundation of perfumery. It represents, above all, an attempt:

1. to identify the varieties of effect on our erotic feelings that may be engendered by fragrances;
2. to explore which perfume materials elicit each of the types of effect;
3. to find explanations for these effects which must, in the final analysis, be linked to the chemical composition of the perfume materials.

A major contribution to the first objective is the Odor Effects Diagram. This constitutes, in a way, an 'organic' ordering of the different odor effects that act on our erotic sensibilities. The exploration of the question of which effects to ascribe to each perfume material is the second task which will now be addressed. It would be wrong to attribute any temporal or causal meaning to the terms 'first' and 'second'. At the outset, a large array of perfume materials with distinct characteristics was used to establish the designations of the odor effects that make up the diagram. This was achieved by selecting, for each group of materials with similar effects, the designation for their common characteristic that best fitted into the diagram and that most clearly described this characteristic from the erotic perspective. The grouping of these 'typical' materials whose effects are described in common speech and in the perfumer's vocabulary was, therefore, given priority. This done, other materials could be assigned to the diagram without too much effort on the basis of experience regarding which typical material they are commonly used to replace or to reinforce. The converse case, where experience indicated a contrasting action with respect to a typical material, could also serve as a basis for assignment. Finally, important inputs also came from observations regarding the preferential or avoided use of certain materials in cosmetics that call for a distinct, one-sided erotic effect.

As a result of these observations and experiences, a growing number of defined aroma chemicals could be classified according to their effects. An analysis of the effects was then carried out and a classification of the natural complexes made, i.e. the essential oils, absolutes, resinoids and resins. The results of years of collection of observations, steadily expanded and corrected, and of attempts at classification conducted in the manner described, are listed in the following sections. This listing cannot and should not make any claim of absolute and unchanging validity or comprehensiveness. The author has attempted to provide as complete and correct a picture as possible of the effects of the individual odorants but in doing so he has come to recognize that new experiences that contradict earlier ones regularly crop up. These diverging effects of certain materials become apparent only when the materials are used

in compositions. Frequently, especially in the analysis of contrast effects, the contradictions are resolved only after a long series of experiments consisting of the replacement or omission of single components in a composition.

If in some cases the erotic effect of a perfumery material was described differently in earlier sections of this book than it is in the listing below, the disparities are due to the fact that until now the effect of those materials has been considered mainly in the context of compositions whereas the listing below is confined to the effect of each material by itself. The essential oils obtained from resins are mentioned only if their odor differs substantially from that of the resin or if it produces a different erotic effect. If several synonyms of a material are commonly used, all are listed in order to facilitate searches.

18.1 Odor effects of perfumery materials

Anti-erogenous (refreshing)

Aroma chemicals: Borneol, bornyl acetate, camphor, cineol (=eucalyptol), fenchyl acetate, isoborneol, isobornyl acetate, the terpenes, terpinyl acetate.
Essential oils: Cedrat oil, cypress oil, dwarf pine oil, fir needle oil, juniper berry oil, lemon oil, lime oil, myrrh oil, myrtle oil, orange oil bitter, orange oil sweet, peppermint oil, petitgrain oil, pine needle oil (Tyrolean), rosemary oil, turpentine oil.

Fresh (anti-erogenous + stimulating)

Aroma chemicals: Methyl heptine carbonate, methyl octine carbonate, oenanthic ether, phenyl methyl carbinyl acetate (=styrolyl acetate).
Essential oils: Cinnamon leaf oil, citronella oil (Ceylon), ginger oil, lemongrass oil, marjoram oil, sage oil, spearmint oil, spike lavender oil, thyme oil, verbena oil.
Resinoids: Elemi, galbanum, myrrh.

Stimulating (anti-narcotic)

Aroma chemicals: Acetophenone, anethole, anisic alcohol, anisic aldehyde, anisyl acetate, benzal acetone, benzaldehyde, benzyl formate, benzylidene acetone, bourbonal, bromelia, bromostyrol, carvone, cinnamic aldehyde, citral, citronellal, citronellyl formate, coumarin, cuminic alcohol, cuminic aldehyde, cyclamen aldehyde, dihydro jasmone, dimethyl hydroquinone, eugenol, hydratropic aldehyde, isobutyl quinolin, isojasmone, jasmone, methoxy acetophenone, methyl acetophenone, methyl heptenone, methyl ionone,

methyl naphthyl ketone, methyl nonyl ketone, methyl salicylate, naphthyl methyl ketone, nerolin I, nerolin II, nerolin yara yara, orange ketone, phenyl acetaldehyde, safrol, thymol, vanillin, vetiverol, vetiveryl acetate.
Essential oils: Angelica root oil, anise oil, bitter almond oil, calamus oil, camomile oil, cardamom oil, cassia oil, cedarwood oil, celery seed oil, cinnamon oil (Ceylon), clove oil, coriander oil, cumin oil, estragon oil, hysop oil, laurel leaf oil, lovage oil, mace oil, nutmeg oil, parsley seed oil, patchouli oil, pepper oil, pimento oil, rue oil, sassafras oil, star-anise oil, sweet basil oil, sweet fennel oil, tansey oil, tarragon oil, thuja leaf oil, vetiver oil, wintergreen oil.
Absolutes: Mimosa absolute, oak moss absolute.
Resinoids: Patchouli resinoid, vanilla resinoid.

Exalting (stimulating + erogenous)

Aroma chemicals: Aldehyde C10, aldehyde C11, aldehyde C18, decylic aldehyde, methyl hexyl acetaldehyde, methyl nonyl acetaldehyde, nonalactone, nonylenic aldehyde, styrol, undecylenic aldehyde, undecylic aldehyde.
Essential oils: Alant oil, birch tar oil, carrot seed oil.
Resinoids: Olibanum resinoid, tonka resinoid.

Erogenous

Aroma chemicals: Alcohol C8, alcohol C9, alcohol C10, alcohol C11, alcohol C12, aldehyde C8, aldehyde C9, Ambrettolide, decyl alcohol, Exaltolide, indol, lauryl alcohol, nonyl alcohol, nonyl aldehyde, octyl alcohol, octyl aldehyde, *para*-cresol, *para*-cresyl methyl ether, *para*-cresyl phenyl acetate, *para*-methyl quinolin, phenyl acetic acid, scatol, tetrahydro-*para*-methyl quinolin, undecyl alcohol.
Essential oils: Ambrette seed oil, costus root oil, cypress oil (terpeneless).
Animal extracts: Ambergris, castoreum, civet, musk tonquin.

Sultry (erogenous + narcotic)

Aroma chemicals: Aldehyde C12, benzyl butyrate, citronellyl butyrate, ethyl phenyl acetate, geranyl butyrate, hydrocinnamic alcohol, hydrocinnamic aldehyde, lauric aldehyde, methyl phenyl acetate, neryl butyrate, *para*-cresyl acetate, phenyl ethyl butyrate, phenyl ethyl phenylacetate, phenyl ethyl valerianate, phenyl propionic alcohol, phenyl propionic aldehyde, rhodinyl butyrate.
Essential oils: Geranium oil (African), orris root concrete.
Absolutes: Jasmine absolute, jonquil absolute, narcis absolute, orange blossom absolute.
Resinoids: Balsam tolu, labdanum resinoid, styrax resinoid.

Narcotic

Aroma chemicals: Aldehyde C14, aldehyde C16, amyl cinnamic aldehyde, amyl salicylate, anisic alcohol, benzyl acetate, benzyl alcohol, benzyl cinnamate, benzyl isoeugenol, benzyl propionate, benzyl salicylate, cinnamic alcohol, cinnamyl acetate, cinnamyl benzoate, citronellol, citronellyl acetate, citronellyl propionate, dimethyl benzyl carbinyl acetate, dimethyl octanol, ethyl benzoate, ethyl cinnamate, eugenol methyl ether, farnesol, geraniol, geranyl acetate, geranyl propionate, heliotropin, hydroxy citronellal, ionone, irone, isobutyl salicylate, isoeugenol, isoeugenol methyl ether, linalool, linalyl propionate, methyl anthranilate, methyl benzoate, methyl cinnamate, methyl eugenol, methyl isoeugenol, methyl-*N*-methyl anthranilate, methyl phenyl carbinol, methyl phenyl ethyl glycidate, musk ambrette, musk ketone, musk xylol, nerol, nerolidol, neryl acetate, neryl formate, neryl propionate, peach aldehyde, phenyl ethyl acetate, phenyl ethyl alcohol, phenyl ethyl formate, phenyl ethyl propionate, rhodinol, rhodinyl acetate, rhodinyl formate, rosatol, santalol, strawberry aldehyde, styrolyl alcohol, trichloromethyl phenyl carbinyl acetate, undecalactone.
Essential oils: Cananga oil, clary sage oil, geranium oil bourbon, helichrysum oil, neroli oil, orris oil liquid, palmarosa oil, rose oil, ylang-ylang oil.
Absolutes: Broom absolute, carnation absolute, cassie absolute, hyacinth absolute, jasmine chassis, rose absolute, tuberose absolute, violet absolute.
Resinoids: Balsam Peru, benzoe resinoid, orris resinoid.

Calming (narcotic + anti-erogenous)

Aroma chemicals: Dimethyl benzyl carbinol, diphenyl methane, diphenyl oxide, geranyl formate, linalyl acetate, linalyl formate, phenyl acetaldehyde dimethyl acetal, santalyl acetate, terpineol.
Absolutes: Lavender absolute.
Resinoids: Ciste labdanum resinoid, olibanum resinoid.

It should be pointed out and repeated once again that this characterization of the erotic effect of perfume materials is not absolute nor definitive. Such a characterization would, in fact, scarcely be possible since there can be few if any materials whose effect is entirely clear-cut or one-dimensional. For one thing, mere concentration is a factor to be taken into account (compare p. 32), and, in addition, the materials making up each group have more or less pronounced tendencies in various directions. To give an example: indol and its methyl analog, scatol, being reminiscent of fecal odors, must certainly be regarded as erogenous materials. When greatly diluted, as they always are in perfumery practice, indol exhibits a distinctly floral, narcotic effect while scatol possesses a stimulating effect alongside its erogenous one. With some

justification indol could be characterized as sultry and scatol as exalting. The most correct, if somewhat cumbersome, designations are 'erogenous tending towards sultry' for indol and 'erogenous tending towards exalting' for scatol.

Among the erogenous aroma chemicals, Ambrettolide (Exaltolide) and the fatty aldehydes C8 and C9 exhibit exalting tendencies. Tendencies towards sultry effects are shown by the fatty alcohols with 8 to 12 carbon atoms, *para*-methyl quinolin and tetrahydro-*para*-methyl quinolin. Far more distinct are the various tendencies, sometimes directly opposed to the main effect, encountered in the complex natural perfume materials. They are explainable and even predictable, being caused by the individual components of these materials. In many cases the phenomenon makes the determination of the main, overall or resultant effect very difficult. For this reason the author has refrained from classifying bay oil since the various effects, narcotic, stimulating and anti-erogenous, are almost equally pronounced here.

Of the erogenous essential oils, costus oil, with its content of the somewhat floral isoionone, and ambrette seed oil, which contains farnesol, have a tendency towards sultry effects. Terpeneless cypress oil, on the other hand, exhibits an anti-erogenous nuance because of its content of terpinyl esters and cymol, a tendency that contrasts with its erogenous main effect.

Among the materials of animal origin, ambergris and civet exhibit a sultry tendency and castoreum and musk tonquin an exalting one. The first two materials are, therefore, usually used in floral, narcotic complexes while castoreum and musk tonquin are more commonly used together with stimulating components (herbaceous, spicy, woody, etc.).

In the group of anti-erogenous materials the terpenes and the essential oils rich in terpenes exhibit narcotic tendencies. Camphors and their derivatives, as well as camphor-containing essential oils, show stimulating tendencies.

In the group of materials with a narcotic effect, two subgroups can be made out among the defined aroma chemicals; one of these may be characterized as 'floral' in odor, the other as 'balsamic'.

The floral materials have a calming tendency. They include amyl cinnamic aldehyde, benzyl acetate, benzyl propionate, citronellol, geraniol, nerol, phenyl ethyl alcohol and rhodinol as well as their acetates and propionates, dimethyl benzyl carbinyl acetate, dimethyl octanol, farnesol, hydroxy citronellal, irone, ionone, linalool and its propionate as well as rosatol.

Among the balsamic–narcotic odor materials that tend towards a sultry effect are the esters of benzoic acid, cinnamic acid and salicylic acid (with the exception of methyl salicylate), the so-called aldehydes C14 and C16, methyl and methyl-*N*-methyl anthranilate, anisic alcohol, benzyl alcohol, methyl eugenol, heliotropin, isoeugenol and its ethers, methyl phenyl carbinol, the nitro musks, and cinnamic alcohol and its acetate.

Among the essential oils with narcotic effects, orris oil liquid, neroli oil and clary sage oil exhibit a tendency towards calming effects, the others in the

group towards sultry effects. Benzoe resin and balsam Peru possess sultry tendencies and orris resinoid calming ones.

The performance of the stimulating aroma chemicals is interesting in that they all show, in addition to their stimulating effect, other clear-cut effects which consist not only of marked tendencies in one direction or the other but frequently even show contrasting effects because of their floral or balsamic notes of narcotic effect.

Acetophenone, benzyl formate, carvol, citronellal, citral, citronellyl formate, methyl acetophenone, methyl heptenone, safrol, thymol, vetiverol and its acetate exhibit fresh tendencies. Isobutyl quinolin and methyl nonyl ketone have an exalting tendency.

Floral narcotic notes are exhibited by anisic aldehyde, anisyl acetate, benzal acetone, benzaldehyde, bromelia, bromostryol, cyclamen aldehyde, dihydro jasmone, eugenol, hydratropic aldehyde, methoxy acetophenone, methyl ionone, phenyl acetaldehyde and yara yara. On the other hand, bourbonal, coumarin, cuminic aldehyde, cuminic alcohol, dimethyl hydroquinone, methyl naphthyl ketone, methyl salicylate, vanillin and cinnamic aldehyde have, in addition to their stimulating effect, balsamic–narcotic effects. Of particular interest are the side-effects occurring in the different isomers of methyl ionone. They determine the characteristic note of these materials and their possible applications. *Alpha-* and *gamma*-methyl ionone have a floral–narcotic note, the *beta* isomer a fresh tendency and *delta*-methyl ionone an exalting one.

Among the essential oils with a stimulating effect, which include most of the spice oils, several exhibit exalting tendencies. These include camomile oil, lovage oil, patchouli oil, oil of rue and vetiver oil. Many others, including angelica root oil, calamus oil, cardamom oil, cascarilla oil, estragon oil, hysop oil, laurel leaf oil, mace oil, parsley seed oil, tansey oil, sassafras oil, celery seed oil and thuja leaf oil, have a fresh tendency.

Anise oil, sweet basil oil, cassia oil, cedarwood oil, cumin oil, fennel oil, pimento oil, star anise oil, wintergreen oil and cinnamon oil possess a balsamic–narcotic note that contrasts with the stimulating main note. Bitter almond oil, coriander oil and clove oil exhibit a floral–narcotic note. Mimosa absolute has a floral–narcotic effect that is almost as strong as its stimulating effect. It is a typical example of a natural contrast.

Oak moss extracts, which belong to the most frequently used components of modern fantasy perfumes, are available in different qualities as a result of the use of different extraction solvents. These qualities differ in color, odor and also in erotic effect. The grades which are green to brownish green in color because of their content of chlorophyll, possess a calming note alongside the stimulating base note. The decolorized grades, yellowish or brownish in color, have an exalting secondary tendency.

A more detailed determination of the individual fresh, exalting, sultry or calming perfume materials will not be given here.

19 Chemical structure and odor effect

After having empirically determined the erotic effects of individual perfume materials, we shall now attempt to find relationships between these effects and the chemical structure of the materials. The observations will be confined to chemically defined single aroma chemicals, for the effect of the natural (and of course also of the artificial) complexes is only the total of the effects of their individual components. Once these are known, their contributions to the effects of complexes in which they occur can be understood.

Perfume materials may be grouped either by their odor type or by their erotic effect. On comparing the results of the two groupings it becomes apparent that the odor type of a substance is primarily determined by its radical, i.e. the portion of the molecule that is shared by a compound and all of its derivatives. The erotic effect of substances, on the other hand, usually depends on their functional group, i.e. whether they are alcohol, aldehyde, ketone, etc. Thus, a certain family resemblance of odor may be observed among all the perfume materials derived from geraniol, from *para*-cresol or from phenyl acetic acid; the geranyl derivatives all exhibit a distinct rose note, the derivatives of *para*-cresol are reminiscent of narcis (as is phenol itself) and the esters of phenyl acetic acid are reminiscent of the scent of honey. By and large, however, the alcohols, the aldehydes or the ketones have common erotic effects. For this reason, it is sensible here to categorize the perfume materials by their behavior in chemical reactions, i.e. by their functional groups.

The *terpene hydrocarbons* and the *camphors* have, without exception, an anti-erogenous effect. The same holds for the acetates of the camphors used in perfumery, bornyl and isobornyl acetate. Other, less commonly used esters such as the butyrates and formates show different tendencies within the same main effect.

Among the *terpene alcohols*, menthol is purely anti-erogenous while terpineol also exhibits a floral–narcotic component resulting in a calming overall effect. The acetates of both of these alcohols are anti-erogenous. The other esters of terpineol have different effects which are determined by the specific effects of the acid moiety.

Among the *terpene ketones*, cineol (eucalyptol) is again anti-erogenous. Carvone has, along with its anti-erogenous component, an even stronger stimulating one.

In summary, it may be stated that the terpenes and camphors as well as their derivatives primarily possess an anti-erogenous effect which may be found in pure form or combined with narcotic or stimulating effects.

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The *sesquiterpene alcohols*, with the exception of vetiverol which is stimulating, possess a narcotic effect and are thus in line with the majority of all *alcohols*. Extremely important members of this group are the so-called 'straight chain terpene alcohols' (a frequently used but misleading expression since the cyclic structure is a characteristic feature of the terpenes) citronellol, geraniol, linalool and nerol. Dihydro cinnamic alcohol (phenyl propyl alcohol) exhibits, along with the narcotic effects which it shares with the other alcohols, an erogenous effect that results in a sultry overall effect. Dimethyl benzyl carbinol also has an anti-erogenous component and its effect is, overall, calming. Exceptions are cuminic alcohol, which is primarily stimulating, and the fatty alcohols which are all erogenous. However, in these alcohols narcotic side effects or tendencies can also be made out clearly. The erogenous effect characteristic of all higher fatty alcohols is a result of the odor similarity of all derivatives of the higher fatty acids with the sweaty component of personal odor. This also gives rise to the erogenous effect that is exhibited, singly or along with other effects, by all of the higher fatty aldehydes.

Generally, *aldehydes* are stimulating. The only exceptions are *alpha*-amyl cinnamic aldehyde, heliotropin and hydroxy citronellal, which are narcotic. With the *ketones* as well, stimulating effects are the rule. Only the two violet ketones, ionone and irone, are exceptions, having a narcotic effect.

The *esters*, reaction products of alcohols and acids, play a very important role in perfumery, both as components of natural complexes and as single aroma chemicals. The high-molecular acids such as benzoic, salicylic and cinnamic acid, as well as the low-molecular methyl and ethyl alcohols, all of which are nearly odorless, give rise after esterification to materials which are often quite powerful and effective in odor. The odor type as well as, albeit to a lesser degree, the erotic effect of esters is determined primarily by their larger molecular weight moieties but the smaller alcohol or acid parts also exert an influence.

The effects of individual acid moieties on the erotic effect of esters is as follows:

Formates: Free formic acid is hardly ever used in perfumery nor in cosmetics. It has a stinging–acid odor, stimulating in its effect, which makes itself felt in two esters that are employed in perfumery. In benzyl formate the narcotic effect of benzyl alcohol, weak in itself, recedes completely into the background. The stimulating effect of citronellyl formate finds its most likely explanation in the great instability of this ester. Under the influence of light and of the moisture which is always present in air it is partially saponified, releasing some free formic acid.

In geraniol and linalool the tendency towards a calming effect, which is already present in the alcohols, is fortified in their formates; thus the main effect of geranyl and linalyl formate may be characterized as calming.

The distinct narcotic effect of phenyl ethyl alcohol, nerol and cinnamic alcohol is barely affected by their esterification with formic acid.

Acetates: Free acetic acid is to be found at low levels in a few essential oils and in lavender absolute. In perfumery its use is confined to compositions for smelling salts, cosmetics and certain toilet waters ('toilet vinegars'). Its odor is distinctly anti-erogenous. Accordingly, the esters of acetic acid, the acetates, generally have fresher effects than the corresponding alcohols. The narcotic effect of these alcohols, however, usually asserts itself. Only in the case of linalool and of santalol, both of which tend towards calming effects, are the acetates clearly calming. Cresol is erogenous with a sultry tendency, and its acetate is sultry.

The totally different shifts observed with the actetates of carbinols are quite remarkable. While styrolyl alcohol (methyl phenyl carbinol) exhibits a narcotic effect with a sultry tendency, its acetate, styrolyl acetate, is fresh. Dimethyl benzyl carbinol is calming but its acetate is narcotic with a sultry tendency.

An interesting exception among the acetates is the acetate of anisic alcohol. It exhibits, along with the effect of the acid, the effect of the aldehyde (not that of the narcotic alcohol) and is, overall, clearly stimulating. The same holds for the less commonly used formate.

Propionates: Propionic acid is quite similar in odor to acetic acid but possesses a calming effect. Its esters are narcotic materials.

Butyrates: Butyric acid is a natural component of human perspiration or the result of its decomposition, and is in large part responsible for the characteristic perspiration odor; it is, therefore, a purely erogenous material. Since the effect of this acid is as strong as that of other odorants of far higher molecular weight, its esters with narcotic alcohols are sultry in effect.

The erotic effects of the isobutyrates are in all cases the same as those of the butyrates, even if their odors are not identical. The same holds, incidentally, for the free acids.

Valerates: Valeric acid is also a component of human perspiration and its odor accordingly possesses an erogenous effect. Its esters, which play a far less important role in perfumery than the butyrates, also exhibit a sultry effect throughout.

Phenyl acetates: Free phenyl acetic acid is a component of natural odor complexes and artificial compositions. It possesses a fecal, erogenous note which also makes itself fully felt in all of its esters. These show sultry effects with the exception of the *para*-cresyl ester which is, in line with both of its moieties, erogenous.

Benzoates, cinnamates, salicylates: Benzoic, cinnamic and salicylic acids are entirely odorless in their pure form. Their esters possess balsamic–narcotic

odor effects. Only in the case of methyl salicylate is this drowned out by a far stronger stimulating effect.

A relatively small number of *ethers, phenols, lactones* and *acetals* are also used in perfumery. Their odor effects are determined entirely by their radicals and no general rules can be enunciated here.

With these remarks about the relationships between the chemical nature and the odor effects of perfumery materials we have taken a step towards achieving our third and final objective, which is to describe these effects more precisely, to explain them and to use them in characterizing individual materials.

20 Personal perfume selection

Just as the single and compound perfumery materials can be characterized by their erotic effects, this can also be done for the compositions created from them. However, far greater difficulties are likely to be encountered, since perfume compositions are much more complicated. In fact, as we have seen, a complete perfume contains all of the erotic effects in varying degrees and the overall effect depends not only on the kinds of effects represented by the components but also, in a very decisive way, on their strength.

An added complication arises from the fact that different effects may be attenuated but may also reinforce each other by contrast effects. Therefore, the overall effect which characterizes a perfume with respect to its erotic action cannot be calculated or even be predicted with certainty. Thus, the erotic effect of a perfume can be determined and, if necessary, changed and improved only after examining the finished and appropriately aged perfume.

An adequate vocabulary greatly facilitates the characterization of odor sensations. Experience shows, nevertheless, that it is not at all easy to give even a rough idea of the odor of a single material, an odor complex, let alone a fantasy perfume, by means of a purely verbal description. In experiments of this kind it has been observed time and again that when describing the odor of a composition, of a perfume, it is relatively easy to characterize individual components. It is far harder and often impossible to characterize in words the odor impression as a whole unless one is dealing with a generally known natural or fantasy complex or can at least compare the odor at hand with such a familiar complex.

The question naturally arises why it is necessary at all to characterize an odor or any other sensory impression by written or spoken words; it seems far more obvious and simple to address the sense modality involved directly. Perfumes are best experienced by smelling, music by hearing, foods and drinks by tasting to know what they are like, whether they are in keeping with our taste and – this is the most relevant question in actual practice – whether we want to take possession of the experience by purchasing the object that elicits it. There is no general answer to this question since our senses operate rather differently in this respect. For the sake of a better understanding of our arguments it is certainly worthwhile considering this question not only with reference to the sense of smell, our main theme, but also in a general way.

In one way or another, we can provide ourselves with the passing or continuing pleasure or utility of a material or spiritual product. In doing this, we usually have a purpose in mind. We first select a number of options that come close to serving this purpose and finally we choose one among these. Our

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decision will be the more directed and certain the more clearly and precisely we can delineate the purpose that we have in mind. If we want to buy a pair of shoes, we go into a shoe store and tell the salesperson our wishes to the extent that we have these clearly in mind and can readily express them in words. We give our shoe or foot size, name the color and the kind of shoes they should be: high shoes or low ones, good for sports perhaps, or for dancing. The more precise and detailed our indications, the narrower will be the range of shoes among which we shall finally have to choose by trying them on. If we want to buy a picture, we go to an art dealer and ask to see the collection or we make our choice in an art exhibition.

When buying shoes we have no trouble in expressing our wishes and the salesperson can readily find them out by asking questions, since here a whole range of precise parameters, such as size, color, specific use, kind of closure etc., are in common use. In the purchase of a picture, a description of our wishes is more difficult since the purpose here is more general and the most decisive factor, taste, is special and even purely personal. In both cases, however, there is ample opportunity to let all wishes come into play in the selection process without creating particular difficulties or costs for the buyer or the seller.

The situation is different when we buy a food item or a drink. Here we cannot examine the entire range of options to find out which ones correspond to our wishes. Apart from the fact that our taste buds would probably be numbed after a few trials, these trials entail the use and waste of material and hence costs which become a factor to be reckoned with, especially in the case of small purchases.

For these reasons, the restaurant owner tries to describe the fare offered as clearly as possible by the use of a menu. The wine dealer knows the taste characteristics of the different varieties offered for sale and tries to describe them in words. In a similar manner, tobacco and smoking goods dealers, purveyors of tea, coffee and other foods and beverages, and booksellers describe their offerings to their customers in written form or orally. These attempted descriptions of specific features all serve to emphasize certain differences between varieties within an array of similar products.

In all of these cases there is a tendency first to establish a few main groups with common characteristics, then to break these up into subgroups and only then to list and describe the individual products. The determining factor in dividing up and describing the products is always the consumer's ultimate objective. Thus, a restaurant menu groups the food offered into soups, cold and warm appetizers, vegetables, salads, desserts and main dishes. The latter are subdivided into fish, fowl, game and other meat dishes. Then there are the various methods of preparation: the different kinds of meat may be boiled, baked, fried, smoked and eaten warm or cold. The wine merchant distinguishes between table wines and dessert wines, red and white wines, light and rich wines, sweet and dry varieties, etc.

How now do the seller and purchaser of fragrances communicate to arrive at the perfume that best corresponds to the wishes of the consumer? Leaving aside the case in which the purchaser directly asks for a product that he or she knows and finds satisfactory, we must admit, if we have any experience at all in the matter, that the consumer usually has as little precise knowledge of his or her wishes as has the seller of the products. Assuming that the buyer is also the end user and assuming, to simplify matters, that it is a woman, although the situation is the same for men, she will probably express her wishes in a very vague manner. She wants to have a 'modern' perfume that has 'personality' or is 'delicate' and nearly always also 'long-lasting'. If she also mentions that it should be 'not too sweet', 'definitely not heavy' 'in good taste' or 'a little sexy' she displays a degree of discrimination that is well above the average. The perfume seller's wisdom usually consists of knowing a range of fine-sounding perfume names and names of perfume houses, and he or she uses practical sales arguments in the demonstration of precious flacons and tasteful packages whose suggestive power is meant to influence the buyer's selection process and usually does so to the point of clinching the decision.

In more favorable cases, the purchaser can be presented with samples to smell. Judging them should lead to a decision on the spot. However, even this service, costly and not offered by very many firms, does not really provide the buyer with a great deal of help. Apart from the fact that the characteristic odor of a perfume develops only some time after applying it, it can never be smelled well and judged correctly in the scent-laden atmosphere of a perfumery shop.

The purchaser has the best opportunity for selecting a fragrance that satisfies her taste and that suits her if she is given a little collection of samples of different types of perfumes and in this way has the opportunity to try their fragrance in her customary surroundings, observe them and have them observed by others, and then to make her decision. This, however, is a rare practice indeed. Although some generous perfume houses do provide retailers with free-of-charge perfume samples to give away to their customers, it would not be possible for the seller to give a sample of each creation to each customer even if all perfume houses provided them. Apart from the high costs that such elaborate customer service would entail, many users would certainly satisfy their fragrance needs for long periods with these free samples and thus refrain from buying any perfume altogether.

Looking at the relationship between seller and buyer in various trades it becomes apparent that in most cases modern sales technique is closely linked to adequate customer consultation. The customer expects the seller to know not only the products on sale but also to possess background knowledge, and usually prefers to make purchases where he or she feels the best advice is given. Help in selecting is usually looked for only in the form of having the special features of the various items explained, i.e. their advantages and drawbacks compared to other items of the same kind and the applications for which each is most suited. In the case of objects whose value lies less in their

utility and is determined more by personal taste, the buyer is not much interested in the salesperson's taste but likes to hear, in an objective and unassertive way, for what or for whom these objects are best suited, what adds to their effect or detracts from it, and when and how they can be brought out to best advantage. The customer, although happy to be stimulated and aided in considerations of this kind and ready to acknowledge the salesperson's expertise and experience, insists on being able in the end to make his or her own decision, freely and according to personal taste. Only if the customer feels, rightly or wrongly, to have done this is the purchasing act fully satisfying and it can then serve as a basis for the desired trust and loyalty towards the salesperson. Thus a salesperson's knowledge of the products offered and ability to articulate this knowledge and to place it at the customer's service not only conforms to the customer's wishes but is also of vital interest to the salesperson. This is precisely the point of weakness in the buying and selling of fragrances.

Let us consider the product category most closely related to fragrance: cosmetics. Here, every skilled salesperson knows the general purpose and specific features of the products as well as the ways in which these can and should be applied. This knowledge and the ability to express it in words is acquired from the manufacturer who has created products with definite practical purposes or varieties of taste and style in mind. In this way, the manufacturer transmits to the consumer not only information about the wares but also knowledge regarding their specific purpose and type of activity. How can the manufacturer or the perfumer communicate the specific features or effects of the perfumes to the public if they themselves do not have a clear notion of purpose or of target but have created intuitively and sense purpose as vaguely as does the consumer? If a way is to be found, in the interest of the producer, of the retailer and of the consumer, to achieve or at least to facilitate verbal communication regarding the specific features of each individual perfume, it is necessary to start at the origin, i.e. at the producer.

The perfumer's profession encompasses two tasks that are fundamentally quite distinct. One of these consists of creating compositions which lend a pleasing scent to certain objects in order to make their use more agreeable to the user. In composing such fragrances as are appreciated in toiletries, on garments or in cupboards, the perfumer's efforts should be devoted to the limited aim, to reproduce favorite scents, usually from the realm of nature, in a suitably long-lasting form, be they scents of flowers, herbs, fine woods or whatever. Difficulties in describing such fragrances are rare since they nearly always represent odors from nature and no special effects are expected of these compositions.

The other task, of far greater interest here, is to create perfumes in the strict sense, i.e. to compose perfumes and eaux de toilette used to lend fragrance to the body or garments in order to affect others or, more precisely, the other sex. The perfumer's task here is to create an aphrodisiac whose effect is triggered by

a pleasing odor sensation. Until now the perfumer has had little conscious understanding of the nature of this task and has, in the great majority of cases, only sensed it intuitively. On the basis of the exposition presented here, he can now attack this task with a clear notion of its purpose and using existing knowledge of the erotic effects and of the perfume materials that bring them about as the basis of creative work.

Where perfume is used as an aphrodisiac, as a means to an end, its effect is paramount. Since, as we have seen, an odor impression can have an erotic effect in a variety of ways, it is of prime importance, when describing a perfume, to designate clearly the way in which it acts. This is done not only in order to draw the consumer's attention to the most essential and decisive characteristic of the perfume, i.e. its erotic effect. It is done above all in order to simplify the act of selection. For now, the consumer only has to make a choice, first among the four primary varieties of erotic effect – erogenous, narcotic, anti-erogenous and stimulating – and then perhaps among the composite or transition effects – fresh, exalting, sultry and calming. Knowing these effects, she will often be able to select correctly the type of effect that best suits her on a purely intuitive basis. It is then not so difficult to arrive at a choice among the relatively small number of fragrances that exhibit the desired kind of effect. Odor descriptions such as floral, mossy, hay-like, rose type, etc. will soon lead to a final decision which can, however, be greatly facilitated by small test samples.

The most difficult aspect of the selection process, i.e. the decision regarding a specific type of effect, need and should not be taken on a purely intuitive basis. The Odor Effects Diagram can be of great help here. On the basis of the four type diagrams (Figures 14.1–14.4), the age (Figure 14.5) and the activity diagram (Figure 14.6) and finally the use of the calculation diagram (Figure 14.7), a salesperson familiar with the use of the diagrams can aid the customer in determining a suitable perfume type for her with a great degree of certainty and precision, rather than on the basis of feelings. In this approach it is of course necessary for the producer to indicate the erotic effects of the various creations. This can be done readily using the basic and composite odor effect designations, especially if only the overall focal point or a clearly dominant effect is indicated. This provides a practical way for arriving at the selection of a suitable fragrance for any specific type of female consumer. With this we have, in effect, achieved our goal.

If, however, the manufacturer wants to provide an even clearer characterization of a perfume or provide a more detailed description of its erotic effects, this becomes difficult with the use of words alone. Apart from the fact that, as previously discussed, a true perfume incorporates all four of the basic erotic effects, it is imperative to indicate the relative strength of each since this is what determines the position of the focal point. Because opposing effects may either attenuate or accentuate each other by means of powerful contrast effects, the overall effect cannot be determined either by mathematical or by graphic means. This would not even be possible if we could know precisely the kind

and strength of all components that contribute to the overall effect, which is not the case. In our current state of knowledge we must make do, therefore, with an experimental, empirical determination of the focal point in each individual case. It then turns out that in complex compositions, i.e. in nearly all perfumes, a clear overall effect can hardly ever be made out since the various single or composite effects remain perceptible within the overall impression. We have, therefore, spoken only of a 'focal point' of the effects, which indicates by its position the most strongly pronounced effect of the composition. For a precise indication of a perfume's effect, the manufacturer would have to show, qualitatively and quantitatively, all of the components of the overall effect that are noticeable by their odor and are hence effective. In the absence of absolute values for the intensity of odors and their effects, the problem of indicating relative effectiveness would also have to be solved.

Clearly, an attempt to provide the necessary information regarding the kind and intensity of the odor effects induced by a perfume, using words or numbers, would lead, if it could succeed at all, to a quite complex and confusing result. A way out of this difficulty is offered by the use of graphic color bars symbolizing both the odor effects and their relative strengths. In the Odor Effects Diagram shown in Figure 20.1 each of the erotic effects corresponds to one of the main colors according to Ostwald. The colors are arranged in such a way that complementary colors correspond to the effects which are placed opposite to each other being, in a way, complementary odor effects. It turns out that the effects of the colors on feelings, as experimentally determined by Zeylmans van Emmichoven (1923), by and large correspond to

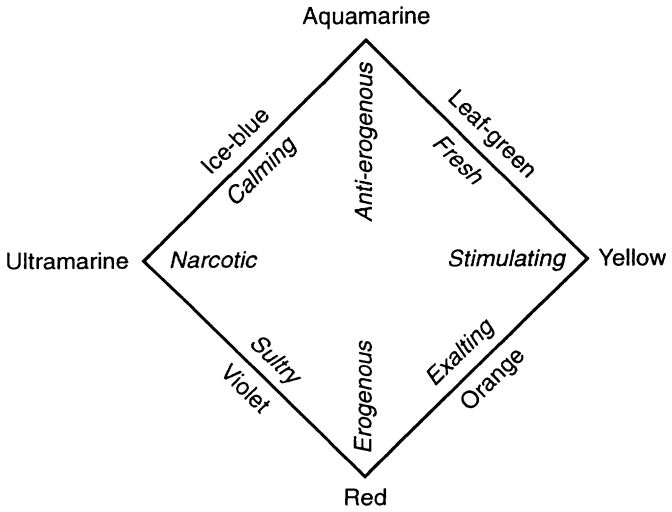


Figure 20.1 Odor effects and colors.

Table 20.1 The correspondence of odor and color effects

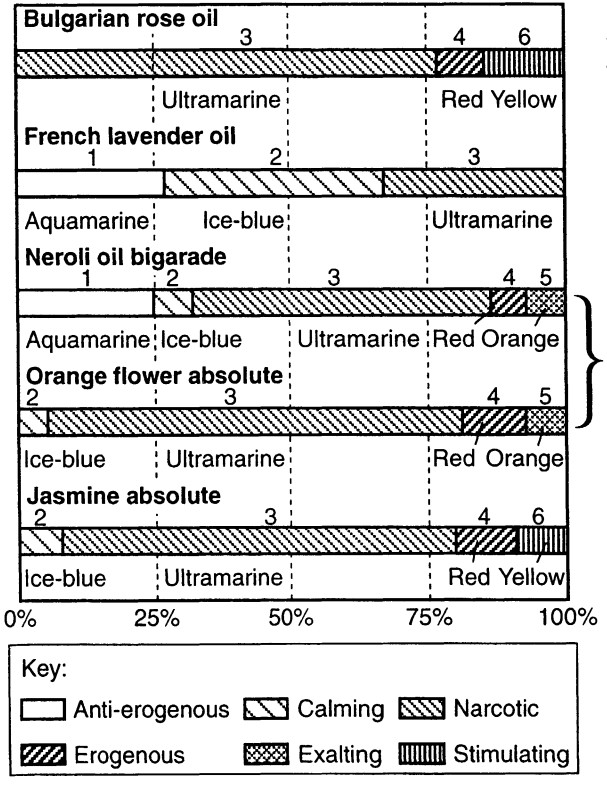
Odor effect	Color*	Color effect (according to Zeylmans)
Erogenous	Red	Tending towards passionate, sexual arousal
Sultry	Violet (purple–violet)	Gives a feeling of warmth
Narcotic	Ultramarine (blue II)	Calming, dreamy, melancholy, magical
Calming	Icy blue (blue I)	Distinctly calming effect
Anti-erogenous	Aquamarine (green–blue)	Feelings of coldness
Fresh	Leaf-green (green)	Feeling of joy and gaiety
Stimulating	Yellow	Activating, radiant
Exalting	Orange (orange–red)	Activating, warming, sensual

*The special color names used by Zeylmans are shown, where needed, in parentheses.

the odor effects in the diagram. The effects of colors found by Zeylmans are shown, along with the odor effects of the diagram, in Table 20.1. This arrangement is known as the *odor effects spectrum*, analogous to the color spectrum since the various odor effects blend into one another like the spectral colors, and the circle of effects is closed.

When representing the effect of perfume materials by colors, the single aroma chemicals correspond to one or more spectral lines or bands and natural or artificial complexes occupy a large part of the spectrum. Each true perfume, containing all erotic effects, is represented by the full color circle in which certain hues (odor effects) occupy larger segments and others occupy smaller segments. This can be shown by representing more pronounced effects by wider or longer bands, and the lesser ones by narrower or shorter bands. The use of the odor effects spectrum is demonstrated in a few examples in Figure 20.2. In the legends next to the bars the effects of only the most important components of each complex are presented. With the classic Chypre type, as with any perfume in which all of the odor effects are represented, the color bar representing the odor effects spectrum can also be shown in the form of a closed circle (Figure 20.3).

The sales consultant is now in a position to serve or at least to consult the customer on a truly personal basis by using, on the one hand, the description of a perfume provided by the manufacturer (be it in the form of a focal point or of an odor effects spectrum), and on the other the determination of the perfume type suitable for this customer using the type diagrams, the age and activities diagrams, and the calculation diagram.



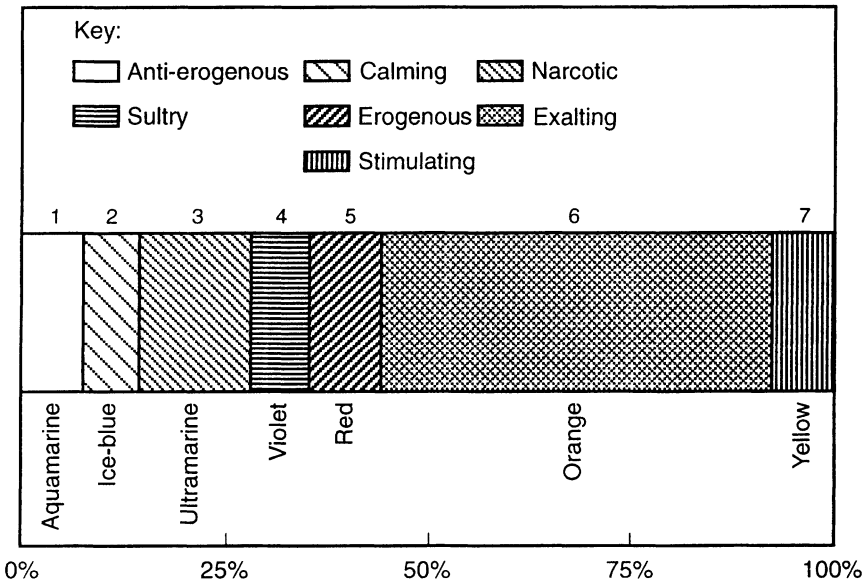
3. Narcotic: rose alcohols
4. Erogenous: nonyl aldehyde, phenyl acetic acid
6. Stimulating: eugenol, citral

1. Anti-erogenous: terpenes, borneol, cineol
2. Calming: linalyl acetate
3. Narcotic: linalool, geraniol

1. Anti-erogenous: terpenes
2. Calming: linalyl acetate, terpineol
3. Narcotic: methyl anthranilate, linalool, phenyl ethyl alcohol, nerol
4. Erogenous: indol
5: Exalting: decyl aldehyde

2: Calming: linalyl acetate
3: Narcotic: methyl anthranilate, linalool, benzyl acetate, benzyl alcohol
4. Erogenous: indol
6. Stimulating: jasmone

Figure 20.2 Odor effect spectra of some natural perfume materials.



1. Anti-erogenous: lemon oil, orange oil
2. Calming: bergamot oil
3. Narcotic: rose oil
4. Sultry: jasmine absolute
5. Erogenous: ambergris, musk, castoreum
6. Exalting: = 5–7
7. Stimulating: oak moss, vetiver oil, patchouli oil

(The effect of jasmine absolute extends in fact from 3 to 7)

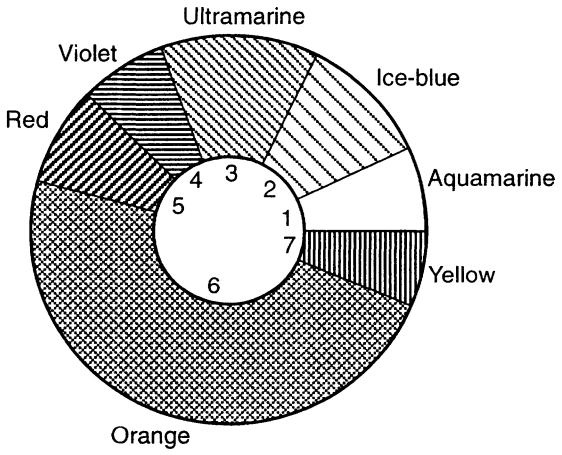


Figure 20.3 The odor effect spectrum of Chypre represented in bar and circular form.

The objection will certainly be raised that the method described here for determining the personal perfume type is too complicated, troublesome and time-consuming for practical use. Is such an objection really justified or does it just manifest the resistance against the new and unfamiliar that is so well known in all areas? If a sophisticated woman chooses the fabric and color for her dress, selects its design and tries on the dress several times before she accepts it and wears it, putting great store by expert advice before taking each of her decisions, we accept this as a matter of course and as perfectly justified. Is then some deliberation which, compared to the process of getting a new dress, demands relatively little time and trouble exaggerated and unjustified when it comes to selecting a perfume? Answering this question it must be remembered that a woman is usually faithful to her perfume over a longer period of time than to any one dress and that the fragrance with which she surrounds herself, felt the more deeply for being unconsciously experienced, influences the way others perceive her personality as much as her outward appearance does.

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21 The chemistry and semiology of human body odors

JOHN N. LABOWS

21.1 Introduction

Since the original writing of *The Psychological Basis of Perfumery*, new information has been generated about the chemical nature and semiochemical properties of human body odors. This has been made possible by dramatic improvements in chemical isolation and analysis techniques which have lowered the concentration levels at which odorous chemicals can be characterized. These techniques have been combined with innovative behavioral assays to test isolated fractions. In studies with mammals, semiochemicals have been shown to be responsible for both immediate behavioral responses (releaser pheromones) and longer-term physiological responses (primer pheromones).

The combination of gas chromatography and mass spectrometry (GC-MS) is the primary method to detect and identify trace levels (nanograms to picograms) of chemical compounds from biological sources including body odors (Sastry *et al.*, 1980). The first detection of androstenol in the axilla required an extract derived from pads worn by 12 individuals for a period of seven days (Brooksbank *et al.*, 1974). The same analysis for all odorous steroids can now be done from a single pad worn overnight. In an example of dynamic headspace sampling, air was passed over subjects in a glass cylinder and the volatiles collected on polymeric adsorbents (Dravnieks, 1975). This was an attempt to create individual odor signatures as chromatography traces. Malodor peaks were selected but not identified as the system was not as sensitive as the olfactory detector. This approach of sniff chromatography was later used with GC-MS for identification of axillary acids.

The behavioral testing of signalling chemicals (semiochemicals), initially tested with insect pheromones, has been successfully extended to experiments with mammals (Albone, 1984). In humans, several studies are suggestive of the effects of body chemicals on defined behaviors, such as the menstrual cycle, but the effects on mood and sexual behavior are more difficult to demonstrate. The analysis of brain wave patterns has added an additional dimension with which to study the human response to odorants but has not been applied in this context.

The primary sources of odorous chemicals include the mouth, vagina and skin areas. The latter includes the scalp, foot and axillary areas, each of which is responsible for distinctive odorants (Table 21.1). In all cases, the odorants are the result of the metabolism of specific body secretions by microorganisms

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Table 21.1 Human odor sources and major odorants

Source	Odorants
Scalp	C_4–C_5 (iso) acids, methyl ketones, γ-lactones
Mouth	H_2S, CH_3SH, CH_3SCH_3, indol, scatol, phenols, C_2–C_5 acids
Foot	Isovaleric acid, C_2–C_5 acids, methylthioacetate (infection)
Vagina	C_2–C_5 (iso) acids, trimethylamine (infection)
Axilla	Trans-3-methylhex-2-enoic, 4-ethylheptanoic, 7-octenoic acids, isovaleric acid, 5α-androst-16-en-3-one, 4,16-androstadien-3-one, 5,16-androstadien-3β-ol, androst-16-en-3α-ol

unique to that environment. This chapter will give an overview of the sources of body odors, their chemical characterization and their possible role in human behavior.

21.2 Role of skin glands, secretions and microorganisms

21.2.1 *Origin of axillary odors*

There are primarily three glandular systems which result in supplying chemicals to the skin surface: the eccrine, sebaceous and apocrine glands. The eccrine gland is the primary secretory organ and delivers an aqueous secretion directly to the skin surface. These glands are distributed over the body surface, responding to thermal stress to help regulate body temperature. The presence of eccrine glands enables humans to tolerate temperature extremes better than other mammalian species. Chemically, the secretion from the gland reflects the composition of plasma, although in a much diluted form. Analysis has shown the presence of proteins, enzymes, glycoproteins, lactic acid, glucose, amino acids and inorganic salts (Quinton, 1988). Cultural differences in body odors are often related to diet and in these cases would be noticeable as odorous metabolites in eccrine secretion.

Sebaceous glands are also present over most of the body surface but are concentrated in the forehead, facial and scalp areas and associated with hair follicles. The sebaceous secretion is rich in lipids including cholesterol, cholesterol esters, squalene, fatty acids and triglycerides. The secretions from these glands are not usually odorous, but do provide moisture and lipid substrates, respectively, for the growth and metabolism of skin microorganisms.

Apocrine glands are located around the nipples, in the genital area and in the axilla. The gland secretes into the hair follicle above the sebaceous gland as a response to emotional stress. The secretion can be induced by injections of epinephrine into the axilla and this approach provides a method for the collection of the secretion (Leyden *et al.*, 1981). The secretion contains a high concentration of cholesterol as well as precursors of axillary odorants. Protein

is present in the secretion and several enzyme activities have been detected in excised apocrine glands including β-glucuronidase, 3-hydroxysteroid dehydrogenase, 4-ene-5α-reductase and esterase. These enzyme activities correspond to the reactions suggested for the formation of odorous acids and steroids.

Both the sebaceous and apocrine glands are secondary sexual characteristics and fully develop during puberty. This results in a distinct change in body odors particularly in the axillary and scalp region. At puberty it is possible to discriminate between the sexes based on axillary odor. The apocrine glands, androgen target organs, are analogous to the apocrine/sebaceous glands in other mammals and could be considered as the human scent gland. Steroids are transported in the body as water-soluble conjugates, sulfates and glucuronides, while acids are linked to proteins and excreted in apocrine secretion in these odor inactive forms.

The glandular systems described above provide substrates for skin microorganisms which are responsible for odor development. Apocrine secretion is odorless as collected and develops distinctive odors on incubation with skin bacteria. Thus, incubation with the micrococcus *Staphylococcus epidermidis* produces a distinctive sweaty odor in culture that was shown on analysis to be isovaleric acid (Leyden *et al.*, 1981). Similarly, axillary diphtheroids gave a characteristic urinous odor with apocrine secretion. Other experiments with protein isolated from apocrine glands have shown that *trans*-3-methyl-hexen-2-oic acid can be released on bacterial hydrolysis (Zeng *et al.*, 1991). Bacterial involvement has been confirmed in numerous experiments where both antibacterials and enzyme inhibitors were effective in reducing or eliminating axillary odors. The genital area also contains apocrine glands associated with the pubic hair follicles; however, the lack of occlusion and moisture reduces bacterial growth and odor development under normal conditions.

The distribution of microorganisms on the body surface has been studied with particular attention to the axilla (Leyden *et al.*, 1981; Jackman and Noble, 1983). The axilla is a stable mixture of organisms dominated by the lipid requiring Corynebacterium species with an 85% prevalence in males and a 66% prevalence in females. There is a 25% prevalence of large colony diphtheroids and 100% prevalence of Micrococcus species in both males and females. The latter is predominantly *Staphylococcus epidermidis* and is at a lower absolute concentration. The higher prevalence of Corynebacterium (*C. lipophilicus*) in males correlates with a stronger, pungent odor as compared with females, and also with the incubation studies with apocrine secretion. Odor characterized as 'apocrine–musky' correlated with high levels of Corynebacterium while that described as 'non-apocrine–sweaty' was associated with Micrococcus species (Leyden *et al.*, 1981). This association of odor with bacteria *in vivo* has been confirmed in a more extensive study (Rennie *et al.*, 1990). Axillary extracts from low-odor formers gave a strong axillary odor on incubation with Coryneforms, suggesting that odor differences may

not be in the quality of apocrine secretion but in the make-up of the bacterial population (Rennie *et al.*, 1991).

21.2.2 *Identification of axillary odorants*

Initial studies focused on determining the type, abundance and origin of the androst-16-enes. These studies paralleled work in the analysis of the same compounds in boar saliva and boar fat, where it was necessary to quantitate the boar taint odor due to androstenone. Prelog *et al.* (1945) commented on the intense urine–perspiration-like odor of the androst-16-ene ketones, particularly 5α-androst-16-en-3-one (androstenone). These initial observations prompted the investigation of these volatile steroids in the axillary region.

Techniques such as isotope dilution mass spectroscopy using deuterated steroids and radioimmunoassay (RIA) were necessary because of the low levels and low-odor threshold of these steroids. Using mass spectrometry, Gower (1972) was the first to detect androstenone in the axilla and later, with RIA, Bird and Gower (1981) showed differences between males (range 12–1134 pmol/24 h or 3–310 ng) and females (13–39 pmol/24 h or 3.5–11 ng). The differences in the geometric means of 51 and 9.5 pmol/24 h for men and women, respectively, were highly significant. There was some variation among individuals on a retest over a 2- to 3-day period; however, there was no difference with handedness and no relationship with age among adults (Gower *et al.*, 1985). Androstenol was also detected on axillary pads, as indicated earlier, as well as in urine, along with androstadienol as glucuronide derivatives (Brooksbank and Gower, 1970; Kingsbury and Brooksbank, 1978).

Separate studies have also quantitated the steroids from extracts of cotton pads worn overnight in the underarm. GC-MS analysis using multiple ion monitoring is sensitive enough to detect all the androstene steroids which are quantitatively determined by comparison of the intensity of specific ions: androstenone (molecular ion = 272), androstadienone (270), β-androstenol (274), α-androstenol (274) and androstadienol (272) (Labows, 1988). Subsequent studies have also detected the androst-16-enes in apocrine secretion (Rennie *et al.*, 1988) and in axillary hair where androstadienone was at a higher concentration than androstenone in all subjects (Nixon *et al.*, 1988).

The descriptors used for axillary odors include hircine (goat-like) and sweaty or acid. Analyses show the involvement of isovaleric acid and similar short-chain acids (Labows, 1988). A re-evaluation of pad extracts employed both an odor panel and 'smell chromatography' to attempt to identify compounds responsible for these characteristic odors (Zeng *et al.*, 1991). Olfactory comparison of the chromatographically separated odors from six male subjects with the original concentrated extracts identified a region in the chromatogram which had characteristic axillary odor. This region did not correspond to either steroids or short-chain acids in retention time. Analysis of

these components by GC-MS showed an array of C_6 to C_{11} straight chain, methyl- and ethyl-branched chain and unsaturated acids.

The major characteristic odor component was identified as *trans*(*E*)-3-methylhex-2-enoic acid (TMHA) which was distinguished from the (*Z*)-*cis*-isomer which was also present as a minor component in the axillary extracts. In addition, 7-octenoic acid, a compound with a high odor impact, is also present (Zeng *et al.*, 1991). TMHA was once thought to characterize the odor of patients suffering from schizophrenia, since it was first identified in their body sweat (Smith *et al.*, 1969). It was later found in normal individuals (Gordon *et al.*, 1973). TMHA has a characteristic odor of human axillary sweat and represents one of the human odors for which there exists an as yet undefined specific anosmia.

The 'goat acid', 4-ethyloctanoic acid, was identified as one of the acids (Zeng *et al.*, 1991). This had been previously characterized as the main odor constituent of the sebaceous gland secretion of the mature male goat during the breeding season (Sugiyama *et al.*, 1981, Sasada *et al.*, 1983). It is active as an attractant to mature female goats in the breeding season. The odor of this compound provokes a mixed reaction in men while being disagreeable to women; a specific anosmia exists in humans as well as a low odor threshold (Boelens *et al.*, 1983). From the above studies, the axillary odor can be characterized as a combination of urinous, musky and sweaty primary notes resulting from the corresponding odorants. The predominant note is the sweaty odor of TMHA.

21.2.3 *Scalp odors*

As indicated above, the odors emanating from the body are the result of the specific metabolism of body secretion unique to different body regions. Studies have shown characteristic odors from scalp and foot through *in vitro* methods. Human scalp is populated with the yeast *Pityrosporum ovale* which is predominant after puberty when there is an increase in the output of the sebaceous glands. Lipid is both a growth requirement for this organism and also a substrate for odor formation. Incubation of this organism with lipids produces a characteristic fatty coconut–peach odor. Chemical analysis through extraction of cultures or directly by dynamic headspace analysis shows the presence of γ-lactones from C_8 to C_{12} with γ-decalactone the most abundant (Labows *et al.*, 1979). The relative concentration of lactones depended on the species of Pityrosporum and the type of lipid used as a substrate.

Scalp extracts (ether washes) have also been analyzed for typical odorants. Skin lipids from scalp and hair have been analyzed by both dynamic and static headspace techniques (Goetz *et al.*, 1988). The compounds identified represent a homologous series from most functional groups, including primary alcohols, acids, methyl ketones and γ-lactones. These materials are either the result of

lipid oxidation or specific yeast metabolism following lipid hydrolysis. Their dependence on lipid concentration is shown by the large differences between a 3-year-old subject's (few chemicals present) and a 30-year-old subject's scalp extract (many chemicals present) and can be related to the difference in activity of the sebaceous glands. Interestingly, the lactones detected up to C9 were shown to be racemic and not expected to be products of metabolism. From an odor perspective the volatiles include cheesy, sweaty and fruity odorants.

21.2.4 *Foot odors*

Recent analysis of acids from socks and feet showed a variety of short-chain acids with isovaleric acid the most abundant and characteristic of foot odor (Kanda *et al.*, 1990a). The intensity of the foot odor correlated with the concentration of isovaleric acid. Foot malodor could be created by incubating body sweat and lipid with bacteria from the feet of high-odor subjects. Interestingly, in the cultures from low-odor subjects, odor could be generated by lowering the pH. This raises the possibility that certain bacteria could act to complex acids through acid-sensitive derivatives. Bacteria could also modify the pH sufficiently to prevent the volatility of the acids. These studies on *in vitro* generation of scalp and foot odor were used to test deodorant approaches directly on the known malodorants (Kanda *et al.*, 1990b).

Eccrine sweat is the primary nutrient source on the foot and is sufficient to support bacterial growth. Under normal conditions a sweaty–isovaleric odor develops from amino acid metabolism. Pitted keratolysis is a condition of the foot where strong malodor is observed. In this condition the bacterium *Micrococcus sedentaris* was isolated as the predominant species and a cheesy malodor noted (Nordstrum *et al.*, 1987). Incubation of this organism with sweat or in culture produced thiols, sulfides and thioesters including methylthioacetate. Since occlusion is one cause of the development of malodor, odor control is often accomplished by air exposure or powders to reduce moisture, or in extreme cases through the use of antibacterials.

21.3 Oral and vaginal odors

21.3.1 *Oral odors*

The mouth is also an area where the metabolism of body secretions produces unique malodorants. Sulfur-containing amino acids from salivary secretions are metabolized to hydrogen sulfide, methyl mercaptan and dimethyl sulfide. These compounds are routinely analyzed in breath samples by gas chromatography with a flame photometric detector (Tonzetich, 1977). The effectiveness of treatments for oral malodor is judged on the ability of the treatments to reduce or eliminate these compounds. Additional compounds have been

identified in the headspace of incubated saliva, including the malodors, indol, scatol and phenols. Exogenous sources and food also account for some of the compounds which were detected (Kostelc *et al.*, 1981).

Volatile short-chain acids, such as acetic, propionic, butyric and valeric acids, have been determined in dental tissue and plaque fluid with the longer-chain acids increasing after exposure to sucrose (Stack, 1979). Experiments have reported that levels of volatile sulfur compounds (Tonzetich *et al.*, 1978) and dodecanol (Preti *et al.*, 1980) change with the menstrual cycle and peak in the periovulatory phase. The above odorous compounds increase in concentration in subjects with periodontal disease and alkyl pyridines appear to be unique to the disease process (Kostelc *et al.*, 1980). Androstenone, a major odorant in pig saliva and human axillary odor, has also been detected in human saliva (Bird and Gower, 1983).

21.3.2 *Vaginal odors*

The analysis of female reproductive tract secretions has focused on identifying metabolites which might indicate the time of ovulation, affect fertility or indicate reproductive pathologies. The vaginal secretions are composed of exfoliated cells of the vaginal mucosa, transudated through the vaginal walls, cervical mucus, endometrial and oviductal fluids, and vulval secretions. The resultant volatiles are the result of direct secretion or of microbial metabolism on the above materials. The analysis of the odorants has identified two populations of women with respect to production of short-chain acids (for a review see Huggins and Preti, 1981). The acid-producers have high levels of C_2–C_5 (iso) acids with considerable variation across the menstrual cycle. Lactic acid is present in all women and could contribute to odor in non-acid producers. Other less odorous chemicals identified include C_{12}–C_{18} alcohols, glycols, aromatic aldehydes, phenols and aromatic acids.

Fishy odors have been associated with vaginal secretions, particularly menstrual fluid, but no amines have been identified. Trimethylamine has been confirmed as the fishy odor reported in vaginal infections (Brand and Galask, 1986). Extracts obtained following sexual stimulation showed increases in the levels of the compounds described above but no qualitative changes. Studies on sponge contraceptives showed that the malodors which developed were due to residual semen. After five days enzymatic oxidation of semen polyamines resulted in the formation of propylamine imparting a fishy odor.

21.4 Pheromones

The two factors necessary for a chemical communications system in humans are the presence of sources of chemical signals, detailed above, and of a sensitive olfactory system. A clear understanding of the perception and

transduction mechanism of olfaction is beginning to emerge as well as evidence for the direct response of brain waves to specific odorants. The latter have been used to demonstrate the effects of odors on moods, i.e. stimulation vs. relaxation, and some odors which have been isolated from humans have been examined in this context (Van Toller, 1992). The direct link of olfaction to the limbic system or emotional brain means that the perception of odors which have learned or innate associations may be a significant factor in interpersonal relationships.

The pheromone concept was first defined by Karlson and Luscher (1959) with respect to insects and modified as discussed by Beauchamp *et al.* (1976) when referring to humans. To be considered a pheromone a chemical signal must have a well-defined behavioral or neuroendocrine function, be response specific, have species specificity and a degree of genetic programming. The overt display of attraction and copulation in insects is described as a chemical releaser effect on sexual behavior. More subtle endocrine-related effects are seen in rodents where puberty, estrus cycling and pregnancy may all be altered by the continuous exposure to chemical cues in urine. These were defined as primer pheromone effects in which a major change in physiology could be demonstrated. The human response to odors is complicated by past experiences, other sensory inputs and context variables, and this may preclude any observable behavioral responses, particularly those considered as 'releaser'.

21.4.1 *Releaser effects*

Studies which sought pheromonal effects in humans used chemicals from two classes of organic compounds, short-chain acids and odorous androst-16-ene steroids. The rationale for employing these compounds relied heavily on studies in non-human primates and pigs. Reports published in the early 1970s suggested that C_2–C_6 aliphatic acids found in the vaginal secretions of female Rhesus monkeys caused males to respond sexually to the presence of females scented with these acids. Though the behavioral responses were later questioned, this led to similar analytical studies on humans which showed that these acids were also part of human vaginal secretions, as described above (Michael *et al.*, 1974; Huggins and Preti, 1981). However, a double-blind study using these alleged attractants (females rubbed a mixture of control or acids on their upper bodies before retiring at night) showed no increase in sexual activity caused by the attractant mixture (Morris and Udry, 1978). Nevertheless, the mixture of acids was patented as a human sex attractant by Michael (1972).

Androstenol and androstenone, discussed above as having musk and urinous odors, were determined to be releaser pheromones in the pig. They are secreted in the submaxillary glands of the boar and induce the sow to stand for mating (Gower *et al.*, 1981). This fact, in addition to the presence of these

materials in axillary secretions, have made them good candidates for psychological studies.

Androstenone has been the singular attraction for several psychological, chemical and biochemical studies. There exists a unique trimodal sensitivity to its odor which involves: (a) individuals who are totally anosmic to its odor; (b) individuals who perceive it as pleasant; and (c) sensitive individuals for whom it is a strong urinous odor (lowest threshold 0.2 ppb with much individual variation). The anosmia is as high as 47% in adult males, appears to increase with age following puberty and has a genetic basis (Labows and Wysocki, 1984; Wysocki and Beauchamp, 1984). In addition, the anosmia can be reversed in some individuals through constant exposure. Anosmic subjects exposed to androstenone three times per day (3 min) over a six-week period became osmic to it (Wysocki *et al.*, 1987). A substantial decrease in threshold was found for 10 of 20 subjects. From a biochemical perspective, enzyme systems exist for androstenone formation in the axilla and for its reduction in the nasal cavity as a mechanism for odor clearance. Androstadienone shows the same odor characteristics, including the same anosmia and effectiveness, as a boar pheromone.

Both androstenol and androstenone have been used in psychological studies that have been extensively reviewed (Doty, 1981; Filsinger and Fabes, 1985; Gower *et al.*, 1988; Labows, 1988; Van Toller, 1988). The experiments require a subjective judgement while performing a particular task in the presence of the odorant (Filsinger *et al.*, 1985). Androstenol has been shown to positively affect the judgement of women considering males applying for a responsible position (Cowley *et al.*, 1977). Women in photographs were judged as more attractive in the presence of androstenol. These are examples of positive association. In general this type of experiment has been inconclusive and has not effectively compared these 'steroid odors' against other positive common odors, i.e. fruity, floral (Black and Biron, 1982). No experiments have been reported which have studied the effects of these steroids or musk odorants in a sexual context.

In other studies on sex discrimination based on the odor evaluations of T-shirts, the more intense characteristic sweaty odors are assigned to males in line with the higher concentrations of steroids and, potentially, acids in the axilla. Female odors are often described as pleasant, musk-like and sweet. Use of synthetic analogs of the steroids also linked a urine-smelling ketone with maleness/unpleasant and a musk-alcohol with female/pleasant descriptors (Köster *et al.*, 1987).

21.4.2 *Primer effects*

Detailed studies with rodents have demonstrated that reproductive behavior is modulated by odors. The effects of female odors on males include puberty acceleration, hormonal surge and odor production while male odors can

induce estrus or block pregnancy in females. Female odors can advance or delay the cycle of competing females thus inducing estrus synchrony (McClintock, 1983). Human studies have also provided evidence for odor modulation of the menstrual cycle.

The anecdotal observations of the synchrony of women living in college dormitories has been confirmed in several experiments; this represents a potential human pheromonal effect (Graham and McGrew, 1980; Doty, 1981; Quadagno *et al.*, 1981). In an initial investigation of this phenomenon Russell (1983) demonstrated that axillary odors could affect menstrual synchrony. In a more extensive double-blind study, axillary odors were collected from throughout the cycle of four donor women and were combined into 10 extracts each representing 3-day periods of a 'synthetic' 30-day menstrual cycle. The odors from the appropriate phase were placed on the upper lips of female subjects and their cycles were found to approach the cycle of the donor women by the third menses (Preti *et al.*, 1986). In a subsequent analysis of the steroid content of the extracts, it was demonstrated that androstenol concentrations varied over the cycle and peaked at the mid-follicular phase (Preti *et al.*, 1987).

The same protocol for odor application was used in an experiment with male axillary odors. Here women who had a history of unusually long or short cycles showed a statistically significant change in their cycle length toward the normal length (29.5 ± 3 days) on exposure to male odors (Cutler *et al.*, 1986). In each case, it was possible to have an objective measurement, change in cycle length, rather than the subjective measures used to define the releaser effects.

The studies on both behavioral and judgement changes and primer effects are still open to interpretation. It is interesting to speculate that since the axillary steroids are related in structure to physiologically active steroid hormones, are volatile, and do function as an active pheromone in one mammalian species, they are possible candidates for semiochemicals in humans. The synthetic analogs used in perfumery as musks and urinous–sandalwood odorants may have the same effects. Thus it might be anticipated that exposure to the proper variation in concentration of a perfume musk would affect the menstrual cycle.

21.5 Proteins in olfactory communication

Recent studies have been successful at identifying the role of specific proteins in both the storage and release of chemical communicants and in the mechanism of olfactory perception. Biological responses have been demonstrated with non-volatile fractions isolated from mammalian secretions; this suggests the complexing of active chemicals with carrier materials. In hamsters, an odorant-binding protein, called aphrodisin, is alone active in stimulating male copulatory behavior. The amino acid sequence of this protein showed similarities to other proteins with transport functions (Singer and Macrides, 1990). Pheromaxein was characterized as a steroid-binding protein for 16-andros-

tenes in boar salivary secretions with a role in the storage and transport of these compounds (Gower and Booth, 1986). A similar situation involving covalently linked acids with proteins has been found for TMHA in axillary secretions. Here such a complex acts to store and deliver odorants to the axilla for hydrolysis by bacterial enzymes (Zeng *et al.*, 1991).

The unique three-dimensional structure of an odorant molecule is translated, via receptor binding and nerve transduction, into a characteristic odor quality. Here several roles for the interaction of proteins and small molecules have been identified. Soluble odorant-binding proteins, which act to bind chemical stimuli (fragrance molecules, malodors, etc.) and transport them to the receptors on the cilia of the olfactory neurons, have been characterized in the olfactory mucosa (Anholt, 1991). The pyrazine-binding protein has been characterized and belongs to this class of hydrophobic ligand carrier proteins. The binding correlates with human detection thresholds for a series of pyrazine analogs and the protein demonstrates binding with odorants from several chemical classes (Pelosi and Maida, 1990). Olfactomedin is an olfactory tissue-specific secretory glycoprotein deposited at the chemosensory surface with a possible similar role in olfaction (Pevsner and Snyder, 1990). Proteins, through their role as enzymes, are also involved in inactivating odorants through chemical degradation and/or transformation to either an odor-inactive or -reduced form.

A multigene family has been identified which codes for proteins whose expression is restricted to the olfactory epithelium and which may represent the initial odor receptors. These proteins have seven transmembrane domains which embed them in the cell membrane (Buck and Axel, 1991). They are members of a superfamily of surface receptors that traverse the membrane seven times. There are three subfamilies with a higher degree of amino acid sequence homology which may code for specific odor classes with the differences matched for small changes in chemical structure and odor quality. This work has formed the foundation for studies at the molecular level to link receptor proteins with specific odorants.

21.6 Summary

There are a variety of chemicals which comprise human body odor arising from the microbial metabolism of skin gland excretions and vaginal and oral secretions. Experimental studies with axillary odor and apocrine secretion have shown the presence of both unpleasant odors (androstenone, *trans*-methylhexenoic acid) and pleasant components (androstenol) which vary in concentration with age, sex, bacterial population and possibly the menstrual cycle. The extent to which these odorants act as chemical messengers as well as influence moods and judgements is uncertain. However, extracts of axillary secretions which contain these odorants were successful in the alteration of the

menstrual cycle and may act as primer pheromones. The olfactory properties of androstenone have provided a unique opportunity for studying the influence of age, sex, genetics, receptor induction and odor–structure relationships on olfactory sensitivity. Most body odorants have been generally characterized as malodorants (acids, sulfides, phenols) with the lactones associated with the scalp and the musk note of androstenol having the closest relationship to the pleasant odors of fragrance chemicals.

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22 Human pheromones?

D.B. GOWER

22.1 Introduction

The evidence concerning the occurrence and importance of pheromones in insects and numerous species of animals, such as rats, mice, rabbits and pigs, is incontrovertible. Whether humans produce odorous substances which influence other humans, most likely at an unperceived level, however, is still a question which is strongly debated – hence the question mark after the title. The possibility of human pheromones was argued for cogently three decades ago by Wiener (1966) and, more recently, by Comfort (1971, 1974). Since that time numerous experiments have been designed by researchers in attempts to determine whether human pheromones exist, and it is the purpose of this chapter to survey critically the growing number of experimental results and to discuss the problems inherent in the design and interpretation of such experiments.

22.2 The nature of putative human pheromones

Much of the thinking about pheromones in human beings has been coloured by the very much better-documented insect and animal counterparts. Often (but this is not always the case), the substances concerned are odorous. It was logical, therefore, for researchers in the field of human olfaction to consider odorous substances, endogenous to men and women, as potential candidates for pheromones. Again, it was almost inevitable that analogies should be drawn from the occurrence of, for example, specialized scent glands or sebaceous glands, not to mention behavioural patterns involving 'scent-marking' with urine or faeces. It was natural, therefore, to consider anatomical counterparts of humans which might also be useful as sites for the formation/accumulation or dispersal of odorous substances. Some of these have been examined, e.g. the axillae where, especially in men, the axillary hairs assist in odour dispersal and provide a moist, warm environment suitable for resident microflora. Montagna and Parakkal (1974) discussed these aspects of olfaction in detail and called the axillae 'the perfect site for odour dispersion'. As well as the axillae, researchers have highlighted the ano-genital regions and the areola tissue of the breasts as important in odour production/dispersal. Taking the axillae as an example, however, what odorous chemicals are

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present and which, if any, might be involved in human interactions? Chemical analysis has shown in axillary secretions the presence of an extremely complex mixture of substances. Many of these are odorous *per se*, while some can be converted microbiologically within the axillary ecosystem into odorous substances, as noted below. The subject of the contents of axillary sweat has been reviewed by Labows (Chapter 21, this volume) and will only be referred to briefly here. It is generally considered, however, that the 'acrid', or sweaty, notes in axillary secretions are due to shorter-chain fatty acids, especially propanoic, butanoic and 4-methyl butanoic acids, and we know from the work of Preti *et al.* (1987) that the whole range of fatty acids, from C_2 up to C_{16}, occurs. In addition, Zeng *et al.* (1991), Baydar *et al.* (1992) and Spielman *et al.* (1995) have published evidence for the presence of branched-chain compounds such as 3-methylhex-2-enoic acids, which are reported as possessing an 'unwashed' or 'unhygienic' odour.

The second type of odour note in axillary secretions is said to be musky and undoubtedly these notes are derived from the 16-androstene steroids. These are not all odorous but the precursor, 5,16-androstadien-3β-ol (androstadienol) can be converted microbiologically into more powerfully smelling members of the series, as explained below. The presence of such steroids in axillary sweat/hair is now well-documented, e.g. Labows (1988), Gower *et al.* (1988), Nixon *et al.* (1988), Mallet *et al.* (1991), Gower and Ruparelia (1993) and Gower *et al.* (1996).

The third component in axillary odour is often referred to as 'burnt-like' and is possibly derived from higher molecular weight and less volatile substances than fatty acids and volatile steroids. As far as putative human pheromones are concerned, it seems likely that the short-chain fatty acids and odorous 16-androstene steroids may be of importance, and certainly it is these two groups of substances which have been tested most frequently in human experiments, as discussed below.

22.3 The sources of the 16-androstenes

The source(s) of the 16-androstenes in axillary secretions has been the subject of intensive study for over a decade. There is no doubt that the presence of axillary bacteria is necessary for odour production; this was shown in early experiments by Shehadeh and Kligman (1963) and, more recently, Bird and Gower (1982) provided tentative evidence that the odorous 5α-androst-16-en-3-one (5α-androstenone) content of axillary secretions in men was markedly reduced when the axilla concerned had been treated with an anti-bacterial solution. Of the bacterial populations present, it seems that it is the Coryneform spp. (of which there are at least 350 strains; Jackman, 1982) which are not only important in odour production in the male axilla (Leyden *et al.*, 1981; Rennie *et al.*, 1991) but which also have the ability to metabolize steroids, not

least the 16-androstenes (Mallet *et al.*, 1991; Rennie *et al.*, 1991). In contrast, although the Micrococcaceae (i.e. Staphylococci and Micrococci) are important in the formation of the 'acrid'-type odours, they do not seem to produce as much musky smell and this seems to correlate quite well with their relative inability to metabolize steroids (Rennie *et al.*, 1990a, 1991; Mallet *et al.*, 1991). Since freshly produced, sterile apocrine secretions are odourless and contain only very small quantities of 5α-androstenone and 5α-androst-16-en-3α-ol (3α-androstenol) (both of which have extremely low olfactory thresholds; see Gower and Ruparelia, 1993 for a review), it seems that some bacterial modification occurs, presumably on the axillary skin surface, by which low- or non-odorous substances are converted into more intensely odorous substances. In this context, Froebe *et al.* (1990) have suggested that axillary bacterial β-glucuronidases and sulphatases could convert the non-odorous glucuronide/sulphate conjugates of 3α (β)-androstenols into the odorous free steroids. Recent studies in the author's laboratory (Gower *et al.*, 1996) have shown that axillary *Corynebacteria* spp. and *Staphylococcus hominis/epidermidis* possess sulphatase activity which catalyses the desulphation of 3β-androstenyl sulphate. An alternative mechanism has been suggested by Mallet *et al.* (1991) according to which the Coryneform spp. on the axillary skin surface may convert low-odour precursors, such as androstadienol, in the apocrine glands into the potent-smelling 16-androstenes, 5α-androstenone and 3α-androstenol. Consistent with this idea is the finding that the concentrations of these last-mentioned compounds are higher than in the sterile apocrine secretions (Rennie *et al.*, 1990b; Gower *et al.*, 1994).

Studies in the author's and other laboratories have shown that human testis possesses the appropriate enzymes for converting pregnenolone into 5, 16-androstadien-3β-ol (androstadienol) (Gower and Bicknell, 1972; Weusten *et al.*, 1987, 1989; Smals and Weusten, 1991; Kwan *et al.*, 1992a, b). This steroid is thought to be the precursor of the more odorous compounds, 5α-androstenone and 3α-androstenol, and the biosynthetic pathway is well-documented, at least in porcine testis (for a review see Gower, 1991). It now appears (Gower *et al.*, 1992) that androstadienol can be metabolized further in human testis preparations into small quantities of 3α- and 3β-androstenols. All the intermediates, originally well-known in porcine testis, have been proved to occur in human testis (Kwan *et al.*, 1997). Other studies (Kwan *et al.*, 1992b, c) have shown that human semen contains measurable quantities of odorous 16-androstenes.

22.4 Odour and individual recognition

Further evidence suggesting the importance of odorous substances in human relationships/social interaction has been published during the past fifteen years or so. Several groups, e.g. Macfarlane, 1975, Schaal, 1986, and Schaal

and Porter, 1991, have shown that human neonates can distinguish their own mother's breast odours from those of 'foreign' lactating mothers as early as four days after birth. Further studies (Cernoch and Porter, 1985; Schaal, 1986) showed that the source of the maternal odour was unimportant, since pads worn either on the neck or in the axillae of the lactating mother could be detected and discriminated by the neonates. Older children (2–4½years) also prefer the odour of their mothers (e.g. Schaal, 1988), while a high proportion (88%) of the young children tested were able to identify correctly), T-shirts which had been worn by their mothers for 2–3 consecutive days, rather than by other adults. Similarly, a mother can recognize her own children's odour, which she prefers to that of other children. Sex discrimination of pre-pubertal children, however, was not possible by mothers but after puberty discrimination could occur (Schleidt and Hold, 1982). This difference presumably reflects the different types and proportions of odorous substances present in sweat post-pubertally. In this context the results of Sommerville and Green (1989) and Sommerville *et al.* (1990) are of interest because precise 'patterns' of what may be fatty acids appear to be important in the recognition and discrimination of the axillary sweat of adults and children. Dogs can apparently use such 'odour prints' in the discrimination of siblings but not of identical twins.

22.5 Human pheromone research

22.5.1 *General problems of research design*

22.5.1.1 *Introduction.* In view of the points made above, research to determine whether short-chain fatty acids and 16-androstene steroids can act as putative human pheromones is not unexpected. However, the design of such experiments so that they at least approximate to a 'real-life' situation is extremely difficult. In such work various physiological and psychological parameters can be, and have been, measured and will be discussed in detail below. These include changes in skin conductance, changes in the extent and frequency of verbal exchanges between human subjects, changes in heart rate or respiration, changes in psychological attitudes, such as judgements of character or choice of seating in the presence of other people, effect on skills in solving problems, effects on menstrual cycle length, etc. As Cowley and Brooksbank (1991) point out 'the problems of controlling variables in any social situation are immense'.

22.5.1.2 *Avoidance of response-distorting conditions in the presentation of the stimulus.* During the past 15 years or so researchers have attempted to design experiments in which certain variables are controlled. One problem in doing this is the way in which the odour to be tested is presented to the subjects

concerned. The obvious way in early experiments (e.g. Cowley *et al.*, 1977) was to use face-masks impregnated with either the putative pheromone or a control (often ethanol). In this situation all volunteers involved in the trial, whether subjects or controls, would conceivably know that 'something was going on', even if they were not told the true purpose of the experiment. Black and Biron (1982) criticized the use of face-masks, suggesting that this might lead to an unnatural situation. Instead, they argued for a situation in which the odorous substance(s) to be tested were worn as perfumes (in this case, 3α-androstenol or the synthetic musk, Exaltolide). They believed that this situation was more akin to a natural one in which '... a subtle and varying odour of androstenol emanates', rather than an experiment using face-masks in which the subjects could breathe in an unvarying amount of odorous substance.

In their more recent work Cowley and Brooksbank (1991) have used a novel way of exposing their subjects to the odours of 3α-androstenol or short-chain fatty acids. In this study volunteers wore 'necklaces' of hard plastic tubing (4.5 cm long) which had two rows of slits spaced at regular intervals along approximately two-thirds of the length. Inside the tube was a dental swab which could be impregnated with a solution of the putative pheromone in a volatile solvent; this readily volatilized through the slits and open ends of the tube. The 'necklaces' were tied loosely around the necks of the volunteers and were worn through the night. In this situation, they were exposed to the odour of the putative pheromone (or controls) in a fairly natural way. This is probably the nearest that experimenters have got to producing a study in which subjects are exposed unconsciously to an odour.

22.5.1.3 *Presentation of the stimulus without creating awareness.* To produce a situation in which volunteers were entirely unaware not only of an odour (except, presumably, when asleep, as in the Cowley and Brooksbank (1991) experiment) but also of the purpose of the experiment is obviously an extremely difficult problem. One successful attempt was made by Kirk-Smith *et al.* (1983), who exposed one-half of their male and female volunteers to a low, unperceived concentration of the volatile aldehyde, triundecylinic aldehyde (TUA). During this time the volunteers were asked to perform stressful tasks against the clock. There followed a second session in which subjects were asked to fill in questionnaires concerning their mood at that time (anxious, relaxed, tense, etc.) and then to judge photographs of people. Finally, there was a third session in which a second mood-scoring exercise was undertaken in a room where TUA was present, again at an unperceived level. It was of particular interest that the female subjects who had been subjected to the odour of TUA in the initial 'stressful' session showed marked increases in anxiety ratings even in the third session when they were not working against the clock. The authors interpreted their findings as evidence that association of an unfamiliar odour with a stressful situation may later elicit changes in mood

and judgement even though the subjects may be quite unaware of the odour. In other words, the female subjects were thought to be conditioned unconsciously by initial exposure to TUA.

In several other studies the researchers concerned have been successful in designing situations fairly similar to 'real-life' ones in which the participating volunteers were thought to be unaware of the purpose of the experiments. Kirk-Smith and Booth (1980) set up an experiment concerned with choice of seating in a dentist's waiting room in which one of the chairs had previously been sprayed at different times with three known concentrations of 5α-androstenone. A rota of receptionists recorded the pattern of seating (i.e. the position and sex of the patients) on a blank seating plan but were unaware of the true purpose of the experiment, which was to study the effect of the odorous steroid on choice of seating by the patients. The 'marked' chair was moved every day and was detergent-washed after each of the three concentrations of 5α-androstenone was utilized. The whole experiment lasted for four days.

In their studies Gustavson *et al.* (1987) utilized a rest-room cubicle situation in which plexi-glass squares impregnated with odorous substances were attached to the doors. The number of times the cubicles were used by men and women, who were unaware of the experiment, was noted during a five-day study period. The point of the study was to see what effects, if any, the odours had on men and women with regard to their choice of cubicle. In this type of experiment, of course, it could be argued that the odorous substances were an uncontrolled variable rather than a controlled one.

A particularly good example of the effects of fragrance on human experience and behaviour at an unnoticeable level has been provided by Steiner (this volume, Chapter 23). Two test rooms were utilized, one of which was perfumed. Exposure to one fragrance (A) resulted in the subjects being in a significantly better mood, less depressed, more alert and extrovert than the controls, without fragrance. In earlier work, fragrance A was almost consistently described as mild and pleasant, and descriptors such as apple, green, fruity and sweet were used. In contrast, fragrance B, which was described as obtrusive, sharp, stinging or intrusive, resulted in subjects being more alert but their mood sank, they were more depressed, less self-confident and less motivated to action.

22.5.1.4 *Avoidance of extraneous (unintended) stimuli.* Van Toller and his collaborators (1983) have discussed the potential problems in using electrodermal response (EDR) as a measurable parameter in 'human pheromonal' experiments. One of the many problems highlighted in this type of research was that of truly isolating the subjects perceptually so that they concentrated solely on the odour being presented to them. It was also important that the odour presentation should be silent and unsignalled (the clicking on and off of switches, for example, could not be tolerated) and, moreover, should be made

at a standard point on the inspiration part of the breathing cycle. The researchers found that it was necessary to monitor the subjects' breathing cycles to ensure that their inspiration rate did not change on presentation of the odour as this could itself cause changes in vasoconstriction and, hence, skin conductance. It was also important to prevent interference from both auditory and visual clues and, by taking these and other precautions, the authors considered that their subjects were sufficiently well isolated perceptually (see Van Toller *et al.*, 1983 and Gower *et al.*, 1988 for further details).

22.5.2 *The problem of subject anosmia and allosmia*

Another obvious problem in such studies is whether the human subjects are osmic to the odours being tested and how they perceive them. Changes in olfactory acuity to 3α-androstenol and 5α-androstenone are well-documented (see, e.g., Gower *et al.*, 1988; Gower and Ruparelia, 1993). There is also good evidence for differing perception of a compound like 5α-androstenone which, to many osmic people, is perceived as 'urinous' but which to some smells 'pleasant' or 'floral' (Labows and Wysocki, 1984; Gower and Ruparelia, 1993). To obviate such potential difficulties, subjects have to be carefully screened for their ability to detect the odour being tested and in some experiments a 'control' is utilized which can be detected and perceived in a uniform manner by all the subjects. One example of the use of such a 'control' odour is aurantiol (hydroxycitronellal methylanthranilate) which was perceived as 'pleasant' by all subjects in the EDR studies of Van Toller *et al.* (1983). This was important because most subjects rated the odour of 5α-androstanone as 'unpleasant' but a minority perceived it as 'pleasant'. Thus, using these carefully controlled conditions, Van Toller *et al.* (1983) showed that 5α-androstanone caused changes in skin conductance 1–5 times greater than those caused by aurantiol, the effects being stronger for those subjects who perceived a hedonic difference between the odours. Another point of interest, which came out of the same study and which is also relevant to the present discussion, is that some subjects who were found to be anosmic to 5α-androstanone in trial experiments could nonetheless detect the odour under the specialized conditions used later for EDR measurements. This was suggestive early evidence for 'sensitizing' to an odour, a phenomenon which has been noticed more recently in the author's laboratory (unpublished observations). In this case, two researchers started work on problems relating to the biosynthesis and quantification of 16-androstenes (including 5α-androstenone) but were anosmic to the odour. Three months later, however, they could both smell the steroids quite easily, in their own opinions, but their olfactory thresholds were not quantified (D.B. Gower, unpublished observations).

In a detailed study Jellinek (1987) tested a large number of men and women for their ratings of intensity, pleasantness and their descriptions of the odours of 3α-androstenol, some synthetic androstenol analogues and the synthetic

musk, cyclopentadecanolide. Results concerned with the evaluation of intensity showed that all the substances tested were rated higher by women than by men. Women generally found the odour of 3α-androstenol 'moderately strong' whereas the male subjects considered it 'very weak' or 'undetectable', although in this case there was a far greater individual variation. As Jellinek (1987) points out, there may be a logical connection here between these findings and the fact that male sweat contains more 3α-androstenol than female sweat (Gower and Ruperalia, 1993) and one is unlikely to be aware of one's own body odour. When individual intensity–pleasantness relationships were studied by Jellinek (1987), some interesting phenomena were noted. Similar patterns were seen for 3α-androstenol and one of its analogues in that those subjects who found the odours weak or very weak mostly described them as 'pleasant'. When the rating of intensity was 'moderately strong', however, the pleasantness rating moved into the negative range, while intensity ratings of 'strong' or 'very strong' resulted in subjects strongly rejecting the substances.

In a further part of this study male and female subjects were asked to describe the odours of the test substances using a variety of possible descriptive adjectives relating either to the animalic realm (e.g. urine, sweat, animal) or to the realm of perfumes, flowers and fragrant woods (e.g. floral, sweet, perfume, green, citrus, etc.). It is of particular interest that the same subject hardly ever gave descriptions from both realms for any one substance. By way of explanation Jellinek (1987) suggests that some of the subjects 'recognized' the odours as animalic or body-related while others did not. For 3α-androstenol and one of its analogues the animalic-type descriptions were used most but with the synthetic musk the reverse was true. Another interesting finding to come out of the same study was that subjects who found the 3α-androstenol odour to be strong or moderately so, more often identified it as body-related; those who found it weak often described it as 'floral' and 'sweet'. Some of these findings are reminiscent of those noted above for the intensity and description of the odour of 5α-androstenone (Labows and Wysocki, 1984; Gower and Ruparelia, 1993) in that those individuals whose rating of the odour was not very high used the descriptors 'floral' or 'sweet', rather than 'urinous' or 'sweaty' which were used by more sensitive subjects.

22.5.3 *The problem of stimulus instability*

One other possible problem relating to the interpretation of 'human pheromonal' experiments is the possible chemical decomposition of putative pheromones during longer-term (say 4–5 days or more) experiments. Studies by Zinkevich (1988) have shown that carefully purified 3α-androstenol (said to have an odour of sandalwood) can be oxidized fairly readily to 5α-androstenone simply by allowing it to stand in air at room temperature. Indeed, panels of expert smellers, who were especially sensitive to the 'urinous' odour of 5α-androstenone, could detect this in the purified 3α-androstenol sample

after only a few minutes of it standing in air. Less sensitive members of olfaction panels could not detect the 5α-androstenone odour until after 24 h. Thus, it is possible that if 3α-androstenol is used as a putative pheromone, it may become partially oxidized during a 3–4-day period of experimentation and any 'pheromonal' effects might have to be attributed to a mixture of 3α-androstenol plus 5α-androstenone and the results reinterpreted accordingly. Further discussion of this point is provided by Gower and Ruparelia (1993).

22.6 Pheromonal effects of odorous steroids and fatty acids

22.6.1 *Effects on social interactions/judgement/behaviour*

In view of the numerous problems associated with this kind of experiment, as noted above, it is perhaps surprising that so many exciting results in this field of study have been obtained. It is the purpose of this and the succeeding sections to describe and evaluate the various experiments which have been published. Several other reviews have appeared already (e.g. Labows, 1985; Kirk-Smith and Booth, 1987; Gower *et al.*, 1988; Van Toller *et al.*, 1992; Gower and Ruparelia, 1993; Van Toller *et al.*, 1993).

In 1977 Cowley *et al.* set up an interviewing panel consisting of men and women whose task was to interview prospective candidates for a position of responsibility (secretary/organizer of the Students' Representative Council). It was intended that candidates should be assessed for their dependability, reliability, whether they could get on well with students, organizing ability, etc., as well as for possible lack of stability, staying power, etc. During the interviewing sessions the interviewers wore masks which had been impregnated with (i) 3α-androstenol; (ii) a mixture of short-chain fatty acids ('copulins') in the proportions already known to be present in human vaginal secretions (Michael *et al.*, 1974) or (iii) ethanol (controls). In brief, copulins appeared to have no effects on either male or female interviewers whereas 3α-androstenol was shown to have significant effects on the female interviewers. There were marked changes in their judgements in relation to favourable qualities, especially of male interviewees. Shortly after this work another study was published by Kirk-Smith *et al.* (1978) in which the participating subjects also wore face-masks impregnated with 3α-androstenol or with a control substance. Subjects were asked to study photographs of normally clothed people, of animals or of buildings and then to give their opinions about them. Both the male and female subjects who were exposed to the odour of 3α-androstenol judged the photographed women as more attractive, indicating some influence on judgements. Effects on opinions regarding the photographs of men were somewhat weaker.

As noted in section 25.5.1.2, Black and Biron (1982) perferred not to use face-masks in their experiments but instead used pairs of male and female students, one in each pair being a 'confederate' of the experimenters who wore

as a perfume either 3α-androstenol or Exaltolide or no perfume (as a control). In each case a male confederate was paired with a female subject or vice versa. In the study the couples were asked to view slides together for 15 minutes and then to fill in a questionnaire, which included an assessment of the physical attractiveness of the confederate. The results indicated that although the male confederates were judged to be more attractive than were female confederates by their male partners, there was no proven effect for either 3α-androstenol or Exaltolide.

Following up this study Benton and Wastell (1986) attempted to see if the odour of 3α-androstenol (300 μg) had any further effects on individuals who were sexually aroused, rather than studying subjects who were simply evaluating photographs in a 'cold' situation. However, even when some subjects were exposed to 3α-androstenol and became sexually aroused by reading a sexually explicit passage, there was no evidence for the odour increasing the level of sexual arousal.

Despite these last two negative findings, however, Gustavson *et al.* (1987) have provided evidence that 3α-androstenol may act as a 'space-regulating' pheromone. As noted in section 22.5.1.3, plexi-glass squares impregnated with 3α-androstenol or androsterone (a 'urinous' steroid) were attached to the doors of cubicles in rest-rooms. During the five days of experimentation, the number of times the various cubicles were used by men and women was recorded. Clear evidence emerged that the 3α-androstenol-treated cubicles were avoided by men, perhaps because their odour reminded them of other men. This effect was not noticed in the case of women, neither did androsterone have any significant effects on the choices made by men or women. Apart from the difficulty of interpretation of results in view of the possible decomposition of 3α-androstenol into 5α-androstenone during five days in air (Zinkevich, 1988; see section 22.5.3), the data provided evidence for a pheromonal effect only for 3α-androstenol and not for the other odorous compound, androsterone (which, incidentally, also occurs in the axillary hair of men; Toth and Faredin, 1983). The experiments were also carried out 'blind', i.e. the subjects were not aware of what was going on, and approximated to a 'real-life' situation.

Kirk-Smith and Booth (1980) have provided evidence that 5α-androstenone also has effects on choice, this time on seating in the vicinity of other individuals. In this study a chair in the University of Birmingham Dental Health Centre was sprayed at different times with 3.2, 16 and 32 μg of 5α-androstenone and placed along with untreated chairs in the waiting room. When the level of odour on the chair was to be changed, it was detergent-washed. The recorded results provided evidence that more women used the odorized seat at the 3.2 and 32 μg levels, while fewer men used it at the highest level. The authors suggested that the women might have been attracted to the 5α-androstenone, perhaps at a subliminal level, because of the association of the odour with men. The repulsive effect for men at the 32 μg level, however,

might have been due to the suggestion of the presence of other men, thus making the male patients feel uncomfortable and uneasy. Whether this repulsive effect occurred below full awareness is open to question.

Finally, the more recent results of Cowley and Brooksbank (1991), referred to earlier (section 22.5.1.2), should be discussed. It will be remembered that the subjects were asked to wear 'necklaces' during the night so that they were exposed to the odour of 3α-androstenol or copulins (or a control odour) in a reasonably unconscious way. The following morning after rising from bed the subjects were asked to record all of their verbal exchanges with other people, whether these exchanges were brief greetings, or more lengthy social talk or in-depth discussions. Analysis of the mass of data produced showed that exposure of the female subjects to 3α-androstenol, but not to fatty acids, caused a significantly greater number of exchanges with men. However, neither of the odours had any significant effect on verbal exchanges by male subjects with either sex nor on those of females with females. In some ways these results are reminiscent of the earlier work of Cowley *et al.* (1977), in which the judgements of women were shown to be modified by 3α-androstenol, but in the context of human pheromonal effects they are of particular interest.

22.6.2 *Effects on sexuality and menstrual cycle length*

Some data have been obtained for the effects of 3α-androstenol on the mood of women during the menstrual cycle. Cowley *et al.* (1980) asked female student volunteers to indicate if and when they felt irritable and/or depressed during their cycles. Exposure of the students to the odour of 3α-androstenol when they were completing their questionnaires did not alter the frequency with which depression or irritability were reported. Exposure to 3α-androstenol in the longer term, however, caused greater irritability than if the women had been in the two control groups, i.e. naphthalene-treated or no odour. These results suggest that 3α-androstenol may alter the student's perception of herself. On the other hand, in Benton's (1982) study the application of 3α-androstenol (150 μg in aqueous ethanol daily) to the upper lips of women resulted in the majority reporting that they felt in a submissive mood around the time of ovulation. This feeling seems to contradict the depressed or irritable feelings recorded by the volunteers in the study by Cowley and co-workers (1980). It should be noted, however, that Black and Biron (1982) were unable to reproduce the results of Benton (1982).

The possibility that odorous substances may have effects on the length of menstrual cycles in women and cause synchrony in women living together has been explored by a number of workers. McClintock's work on menstrual synchrony is well-known and was published more than two decades ago (McClintock, 1971). It has been cited as evidence for the possible existence of human pheromones. More detailed studies have been the subject of a review

(McClintock, 1983). If such an effect was a pheromonal one, it was natural for researchers to ask questions at that time about the nature of the odour(s) emitted by certain women who were able to 'drive' the cycles of other women so that they synchronized with their own. Several attempts have been made to study this phenomenon, one being by Russell *et al.* (1980). This group suggested that female axillary secretions might contain the active principle(s) which caused the synchronization effect and female volunteers were asked to wear on their upper lips ethanol extracts of axillary sweat from women over a four-month period. The control group received only ethanol. It was noted that, for the 'treated' group, the time of menstrual bleeding was synchronized to three and a half days. In contrast, the mean separation for the control women was statistically greater at slightly over nine days. However, because these studies were criticized as they lacked double-blind conditions, another group (Preti *et al.*, 1986; Cutler *et al.*, 1986) set up similar studies but with a double-blind protocol. One of these studies involved the application of male axillary sweat extracts and the other the application of female extracts to the upper lips of female volunteers for three months. One group of women studied had only sporadic sex and were noted to have more 'abberant' menstrual cycle lengths (one subject as high as 60 days, the mean length for this group being near 48 days). A second study group had more frequent sex and showed more regular cycles. It was of particular interest that the male sweat extract resulted in less variability of cycle length and a smaller proportion of abberant lengths, the mean being reduced to coincide with that for the normal control women. In the second trial, published by Cutler *et al.* (1986), the normal women who wore the female axillary sweat extract had cycle lengths which synchronized with those of the sweat donor over three months. In this case there is the possibility that some factor(s) in the female sweat extract may be the driving force in the menstrual synchronization process (compare McClintock, 1971, 1983). The active principle(s) is still unknown but one or more of the odorous 16-androstenes may be considered as potential candidates. In this context it should be remembered that, although most women tested have little or no 5α-androstenone in their axillary secretions, there is the occasional report (e.g. Bird and Gower, 1981) of a woman having levels which are in the 'male range'. It is entirely speculative but if 5α-androstenone does have effects on the menstrual cycle in the way noted above, then it might help to explain the menstrual synchronization phenomenon.

As far as aliphatic fatty acids (copulins) are concerned, there appears to be little, if any, pheromonal effect in humans compared with, for example, 3α-androstenol (compare the work of Cowley *et al.*, 1977 and Cowley and Brooksbank, 1991). Preti *et al.* (1979) collected vaginal secretions from women before and after sexual arousal but found no changes in the concentrations of copulins present. In a second experiment, Morris and Udry (1978) recorded no remarkable effects for men when their wives applied mixtures of aliphatic fatty acids to their chests at bedtime.

22.7 The vomeronasal organ in humans: its possible significance in the perception of pheromones

The vomeronasal organ (VNO), or Jacobson's organ, was described as being present in many mammals by Jacobson as long ago as 1811. Since that time a very large body of evidence has been obtained with regard to certain aspects of the VNO, including its histology, its relationship to the accessory olfactory bulb (AOB) and its importance in responding to pheromonal substances. Indeed, Wysocki and Lepri (1991) have shown that removal of the VNO from mice and prairie voles affects, among other behavioural characteristics, male sexual behaviour, territorial marking, puberty-modulating interactions and maternal behaviour, e.g. maternal aggression towards unfamiliar males.

In mammals the VNO is located beneath the respiratory mucosa of the nasal septum, its sensory elements consisting of elongated neuroepithelial cells, which possess microvilli but no cilia, in contrast to olfactory cells (see, e.g., Vacarezza *et al.*, 1981; Wang and Halpern, 1980). In many species the central process of the VNO receptors projects to the glomerular layer of the AOB via the vomeronasal nerve (Barber and Raisman, 1974). The olfactory and VNO systems are considered to be separate and parallel (Wysocki and Meredith, 1987). In the pig the VNO can be dissected out reasonably easily (Gower *et al.*, 1981) and preparations of the organ bind the pheromonal substance 5α-androstenone non-specifically; cytosolic preparations have an active reductive capacity (Gower and Hancock, 1982). Whether this active metabolism of the pheromone is involved in 'switching-off' its signal remains to be established.

Although a VNO was described in humans a century ago (Potiquet, 1891), some researchers (for references see Stensaas *et al.*, 1991) have regarded the VN system as being absent, or at least vestigial, in adult humans and having a role only in the early stages of life. Others (see Stensaas *et al.*, 1991), however, have been doubtful about the alleged persistence of receptors in the human VNO and of the existence of a clearly delineated AOB in adults. In answer to these criticisms evidence has been accumulating for the past ten years for a functional VNO in adult humans which plays an important part in olfaction. For example, Johnson *et al.* (1985) have published clinical and histological evidence showing that vomeronasal pits are visible by light microscopy in the anterior third of the human nasal septum. In addition, several groups, e.g. Stensaas *et al.* (1991), have published electron microscopic evidence for the human VNO occurring as a blind-ending tube lined by a unique pseudostratified columnar epithelium. Moran *et al.* (1991) found paired bilateral pits in all of their 200 subjects, one on either side of the anterior third of the nasal septum. In this study the occurrence of the VNO was shown to be independent of race, whether Oriental, Negro, Caucasian or mixed-race. In the electron microscopic study by Stensaas *et al.* (1991) mentioned above, VN pits were observed in all of at least 2000 people studied, except those where pathological conditions had affected the septum. Electron microscopy (EM) revealed the

presence of two potential receptor elements in the pseudostratified epithelial lining, (i) microvillar cells and (ii) unmyelinated intraepithelial axons. The study by Garcia-Velasco and Mondragon (1991) was also an extensive one in which a VNO was believed to be present in 1000 humans, even though visual identification of the duct orifice was not always possible in cases where there was septal pathology. If the septal deviation was corrected by surgical means, the VNO could be seen in virtually all cases. Despite these exciting data, however, it should be remembered that, at present, it is not clear whether activity in the VNO translates to information in the brain.

Of particular interest in the context of the present chapter on the possible occurrence of human pheromones is the recent work of Monti-Bloch and Grosser (1991) who have devised a system to stimulate the human VNO and record its electrical activity in unanaesthetized subjects. In each case stimulation of the olfactory epithelium was performed for comparison. It was shown that when the VNO of a 31-year-old woman was locally stimulated with 25 pg of putative pheromone isolated from human skin (ER-795, Erox Corporation) a typical negative potential was produced. Depolarization rose steeply, reaching a peak at 2 mV and then decaying to base-line with a slower slope. If the stimulating electrode was positioned in nearby respiratory mucosa, stimulation produced no effect. In other experiments in three men and six women, clove oil (25 pg) produced a typical electro-olfactogram (EOG) accompanied by a clear olfactory sensation in all subjects when the olfactory epithelium was stimulated. In contrast, the putative human pheromones had a minimal effect on the olfactory epithelium and most subjects reported no odorant sensation following stimulation. Only one male and one female subject associated ER-795 and ER-700 (Erox Corporation) with unpleasant odours. This interesting phenomenon could possibly relate to what is often thought about human pheromones, that they may bring about their effects at a subliminal or unperceived level. Monti-Bloch and Grosser (1991) also measured other effects. For example, when ER-830 (25 pg) was delivered locally to the VNO of a 36-year-old man, a large (6 μV) depolarization was recorded with 200 ms latency, followed by an electroencephalogram (EEG) evoked potential. Changes in skin conductance, which appeared with a delay of 3 s, suggest that pheromonal activation of the human VNO may trigger reflex activity at multiple sites and may involve routes which differ from those utilized by most olfactory stimuli. In general, ER-670 caused significant activity from the VNO of females whereas ER-830 stimulated the VNO of males, but not vice versa. Further details of the structure and function of the human vomeronasal organ have been reviewed recently (Moran *et al.*, 1995).

22.8 Perspectives for further study

The possible sources of the 16-androstenes in humans have been discussed above. It is not yet understood, however, whether these may be significant *per*

se as human pheromones or whether the 'precursor' substance, androstadienol, formed in the testes, is transported to the apocrine glands via the blood. Should this prove to be the case, or should the apocrine glands themselves have the capacity to synthesize this compound, then it could be possible for it to be converted microbially, perhaps specifically by Coryneform spp. resident on the male axillary skin surface (as discussed above), to the putative human pheromones 5α-androstenone and 3α-androstenol. Given the fact that as little as 25 pg of odorous substances (E-795, Erox Corporation) can stimulate electrical activity in the human VNO, without actual perception of the odour by the human subject concerned (Monti-Bloch and Grosser, 1991), then the quantities of 16-androstenes present endogenously would presumably be adequate for this purpose. Admittedly, some of these arguments, especially with regard to the transport and utilization of androstadienol, may be speculative at present but the ideas may warrant further study.

If 3α-androstenol and 5α-androstenone exert the extremely interesting effects on human behaviour as indicated by Cowley and Brooksbank (1991) and other workers noted in this chapter, then detailed studies of the mechanisms of human olfaction are needed. Thanks to the elegant studies of several groups (for a review see Gower and Ruparelia, 1993), we are beginning to understand something of the transduction mechanisms involved in olfaction in some other species. It is known, for example, that certain glycoproteins, associated specifically with rat olfactory cilia, are very much implicated in transduction mechanisms (e.g. Anholt *et al.*, 1990) and recent work from the author's group has revealed that the pheromonal steroid 5α-androstenone binds with high affinity to porcine olfactory cilia. Furthermore, glycoproteins of M_r approximately 70–90 kDa, associated specifically with the olfactory cilia of the pig, are intimately concerned with such binding (Kraevskaya *et al.*, 1992a,b; Gower *et al.*, 1992). Whether complementary transduction mechanisms are involved in the initial stages of human olfaction, especially in relation to the putative pheromones described above, requires further study.

22.9 Conclusions

This chapter has been concerned largely with the sites of formation of putative human pheromones and with a critique of the growing number of experiments which have been designed in attempts to determine the possible effects, whether behavioural, physiological or psychological, of such substances.

The concept of pheromones, first defined by Karlson and Lüscher (1959) and discussed in relation to humans by Beauchamp *et al.* (1976), has been referred to in this volume by Labows (Chapter 21). In assessing whether a substance is a pheromone it is necessary to determine whether it has well-defined releaser or primer effects. The former are usually rather rapid in

their onset involving, for example, behavioural responses. Good examples are afforded by 5α-androstenone and 3α-androstenol, the odours of which cause sows in oestrus to adopt the mating stance and to stand still, waiting for the boar to mount them (Perry *et al.*, 1980). On the other hand, primer pheromonal effects tend to be of longer duration than releaser (or signalling) effects and are often concerned with accelerating the onset of puberty or with modulating reproductive behaviour. The pig again provides an excellent example in that research has shown the necessity for the presence of the boar in the acceleration of puberty of piglets. Kirkwood *et al.* (1983) and Booth (1984) showed clearly that it is one of the boar pheromones, 3α-androstenol, which is responsible for this important primer pheromonal effect.

Using these guidelines, it is now possible to evaluate the possible pheromonal status of fatty acids and 16-androstene steroids in humans:

(a) *Fatty acids* (copulins): In the three experiments cited above in which mixtures of short-chain fatty acids have been tested, little or no evidence has emerged for well-defined effects. No changes in human judgement (Cowley *et al.*, 1977), sexual behaviour (Morris and Udry, 1978) or in verbal interactions with the opposite sex (Cowley and Brooksbank, 1991) were noted. Neither was there evidence for an increase in concentration of vaginal fatty acids when female subjects were aroused sexually (Preti *et al.*, 1979).

(b) *16-androstene steroids:*

(i) *3α-androstenol.* In contrast, despite several experiments where there appears to be no effect in humans on, for example, sexual arousal (Benton and Wastell, 1986), exposure to the odour of this steroid does seem to cause changes in judgement in women (Cowley *et al.*, 1977) or in both men and women (Kirk-Smith *et al.*, 1978) and also to increase verbal interactions of women with men (Cowley and Brooksbank, 1991). Further, in the experiments of Gustavson and co-workers (1987), men were affected in that they refrained from using toilets whose doors had been treated with 3α-androstenol. As noted earlier, however, it is conceivable that this interesting 'space-regulating' effect may be due to the presence of 5α-androstenone in the test samples, formed by oxidation of 3α-androstenol after exposure to air.

(ii) *5α-androstenone.* The accumulating evidence suggests that this odorous steroid also causes 'space-regulating' effects – the scenario of the dentist's waiting room (Kirk-Smith and Booth, 1980) will be recalled – but here both men and women were affected. Men tended to avoid the odorized chair, a similar effect to that noted above for 3α-androstenol by Gustavson *et al.* (1987), but women, in contrast, were attracted to the 5α-androstenone-treated chair in the Kirk-Smith and Booth (1980) experiment but were indifferent to the 3α-androstenol-treated toilet doors in the Gustavson *et al.* work (1987).

The possible effect of 3α-androstenol on the mood of women during their menstrual cycles was explored by Cowley and co-workers (1980) and there is also evidence for the odour of axillary sweat being involved in the modulation of cycle length. Whether the active principles involved are odorous 16-androstene steroids is still unclear but further work may help to elucidate this point. If it is shown that one or more of these interesting axillary steroids are important in these effects and in the well-known 'cycle synchronization' phenomenon, then it will provide added weight to the accumulating evidence for their role as pheromonal substances in human beings.

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23 The effect of odors on human experience and behavior

WALTER STEINER

Just a few decades ago odor was practically a taboo topic. Only when people became more conscious of the need to take care of their bodies, only when dimensions such as body awareness and quality of life began to be considered important in themselves, when people also began to think and speak more freely about matters erotic, did awareness of the sense of smell and its effects begin to spread. Along with the trend towards health awareness, increasing use of cosmetics and narcissism, as well as the success of scientific investigations into the action of pheromones, publicized also in the popular press, have contributed to an ever-growing interest in odor.

An abundance of facts testifies to the fundamental role of odors and olfactory communication not only in insects but also in higher animals such as mammals. A well-known example is the effect of 5α-androstenol, a metabolite of testosterone, on the wild and the domesticated pig: it has been proven to induce readiness to mate in the female (Butenandt *et al.*, 1959). The substance has also been found in human male perspiration.

In many ways *Homo sapiens* exhibits characteristics that would normally be expected in species disposing over an intact system of olfactory communication (Stoddart, 1988), for example the apocrine sweat glands which occur together with the hair follicles at certain human body sites. Russel *et al.* (1980) mention a case of synchronization of menstrual cycles between female room mates, apparently caused by steroid metabolites contained in axillar perspiration. However, scientifically exact observations of this kind are rare in humans.

Worth mentioning is the well-known experiment by Kirk-Smith and Booth (1980). A chair, normally rarely selected by women in a dentist's waiting room, was sprayed with different concentrations of androstenone, a component of male axillar perspiration. After spraying the chair was selected significantly more often by women; at a high concentration of androstenone the chair was avoided by men. According to the authors the effect might be attributed to an olfactory association on the part of the women with the presence of men or with men's fragrances.

Some 40 years ago, far ahead of his time, Paul Jellinek arrived in a deductive manner at the notion of stimulating, calming and, above all, erogenous odor complexes and single odor materials. However, it seems that only now has the time come for scientific experimentation designed to explore the extent and the

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kind of influence that odor has on contemporary human experience and behavior. The science dedicated to such questions has been called aromachology or aroma science, as distinct from aromatherapy which attempts to attain healing effects with individuals.

To begin with, a study will be cited in which the semantic space of the term 'scent' (German: Duft) was explored. A method of free association was employed to find, among other things, the extent to which odors can affect people.

23.1 Explorations of the semantic space of scent and its effects

This investigation was conducted at the Institute for Organizational and Economic Psychology at the University of Munich*. Two hundred and twenty-two students were questioned, of which 58% were female and 42% male. The test subjects were given two questions:

1. What comes to mind when you think of scent? Please write down briefly what comes to mind.
2. What effects do you think scents can have?

The phrasing of question 1 was entirely free in order to obtain a broad spectrum of associations. Being presented with unguided and unrestricted possibilities for responding, the test subjects were encouraged to build long and personal chains of associations. These would provide the broadest possible realm of experiences related to this item of opinion and imagination. In question 2 the procedure was more guided. Here, not the entire realm of experiences was tapped but only a limited part of it, namely the effects of scent. Again, the test subjects were free to respond in terms of spontaneous chains of associations.

Question 1 generated 1717 responses; their classification is shown in Figure 23.1. The category 'people' accounted for 47.3% of the responses, the category 'nature' for 23.2%. The sub-category 'flora' contained 12.9% of all responses; in many cases these pertained to odor sources. Another frequently mentioned topic was air/smell.

Figure 23.2 shows the results obtained from question 2. Of the 1172 responses more than 50% may be assigned to the category 'specific activation'. Apparently, a great deal of attention is given to the ability of scent to promote or inhibit social contacts (i.e. attraction, repulsion and sexuality). Another frequently mentioned category was the effect of scent on subjective state (i.e. mood) (20.7%). Scents affect moods and feelings, they call forth feelings of well-being or of disgust and nausea. Another 18% of responses can be assigned

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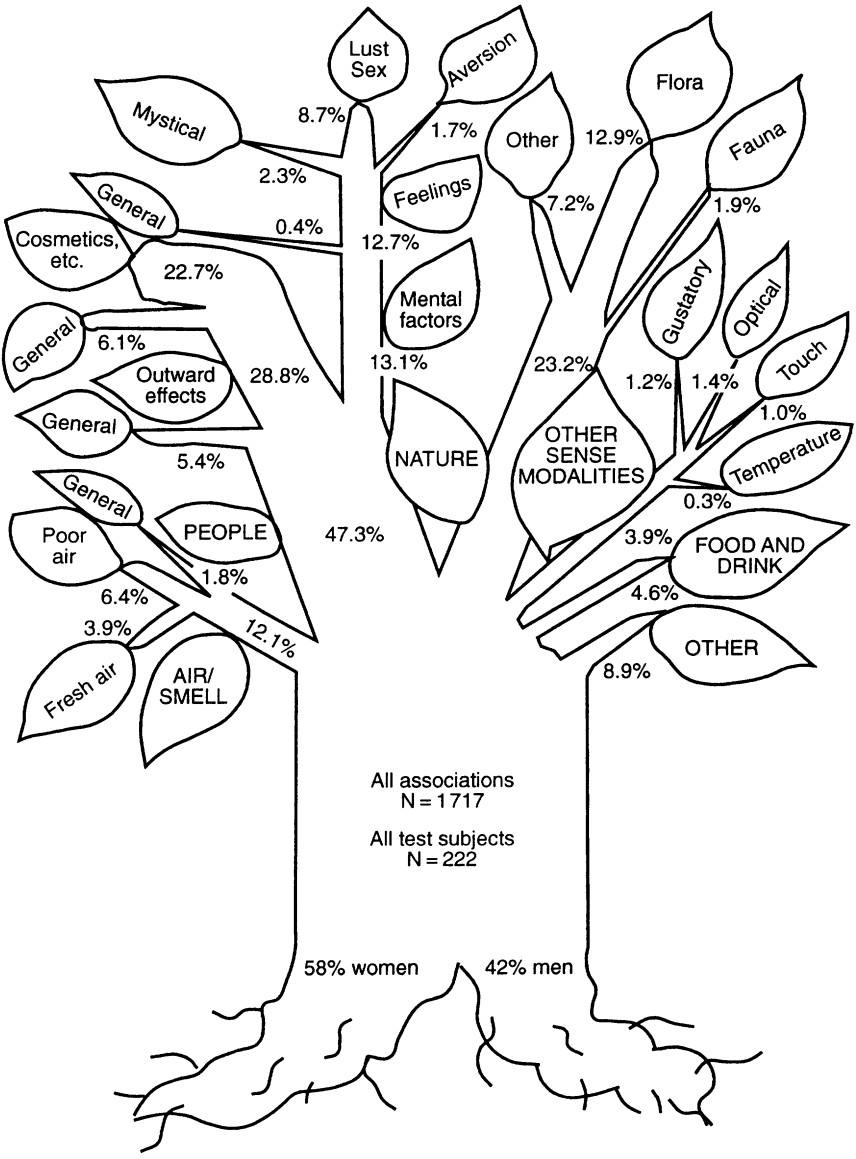


Figure 23.1 Classification tree of associations to question 1: 'What comes to mind when you think of scent?'.

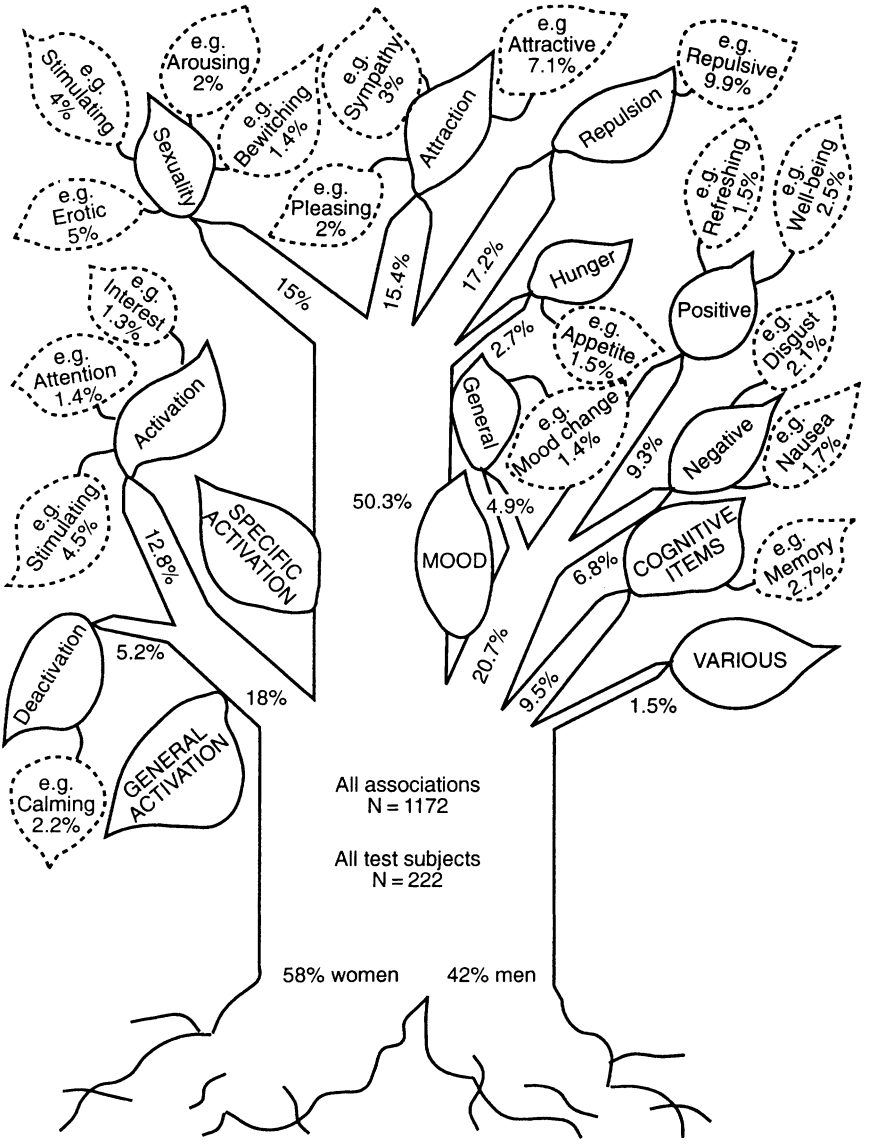


Figure 23.2 Classification tree of associations to question 2: 'What effects do you think scents can have?'.

to the class 'general activation'. Of these 12.8% are in the 'activating' and 5.2% in the 'deactivating' direction. It is curious that question 2 generated 32% fewer associations than question 1. Are the effects of scents less relevant to people than their sources?

The responses to the second question clearly indicate that the influence of scent is greatest in the dimension activating–deactivating. This is also one of the dimensions found by Paukner (1965) in his study which is discussed in section 23.4. A second major factor is the effect of scents on subjective state. Fifteen per cent of all collected responses dealt with sexuality.

The human senses are input channels serving to maintain our communication with the external world. Each unexpected signal coming from the outside, be it optical, acoustical, olfactory or otherwise, generally causes an activation of the body and a directed arousal of attention, probably in order to find out the cause of the signal. If an unexpected event, such as a flash of light or a bang, occurs, the pupils dilate in a reaction that is both uncontrollable and unnoticed by the person concerned. From the biological perspective this dilation may be considered an uncontrolled reaction but its magnitude indicates the degree of attention given by the person to the event. An attempt can be made to apply this unspecific reaction to the sense of smell and to explore the relationship between pupil dilation and an olfactory experience.

23.2 Odor experience and pupil dilation

With the aid of an infrared television camera the pupil dilation of 12 test subjects was measured continuously with a precision of 0.01 mm. (Steiner *et al.*, 1977). Four different odors (see Table 23.1) were presented, each in two concentrations: neat and 10% solution. In each case a dilation of the pupil was registered the moment the odor was perceived. On repetition of the 2×4 exposures (i.e. two concentrations of four different odors), each individual person's reactions were closely replicated. The second exposure generally triggered smaller responses, perhaps because the subjects knew what to expect and were therefore less attentive than the first time.

When the values for each odor are averaged across all of the test subjects, no significant differences are found between the mean values for the different substances. In other words no differences could be detected between the effects

Table 23.1 The test odors in the pupil dilation test

Description	Scent
Bananas	
Tuberose	Heavy, sweet
Bromostyrole	'Chemical', unpleasant
Rosemary oil	Fresh

of the substances due to large interpersonal differences for each individual substance. This could probably have been overcome only in an experiment with a far greater number of test subjects.

In order to help interpret the results the test participants were asked to describe their odor experiences by means of a polarity profile and a paired comparison. From these measurements it is possible to deduce the degree of activation experienced by each person when exposed to each of the odors. When comparing the *experienced* activation with the pupil dilation measurements for the 2×4 odors, which may be considered a measure of *physiological* activation, no correlation is found. This finding, which is discussed in more detail in section 23.9, indicates that measurements of odor effects at different planes do not necessarily lead to analogous or identical results.

Whatever the interpretation of these findings they indicate that it is possible to show general effects when humans are exposed to odors. As the next step one might ask whether there are specific areas in which an odor impression might be expected to give rise to particularly strong effects and how such effects could be measured. An obvious field for exploration is that of the effect of erogenous odors. A study is discussed in the next section in which an attempt was made to prove the erogenous effect of a commercial perfume.

23.3 The effect of erogenous perfume materials on the visual perception of erotic stimuli

The test method (Steiner *et al.*, 1978) is based on the fact that both the perception of objects and behavior are influenced by endogenous and exogenous stimulation. In other words the human organism can influence the efficiency of its sensory organs depending on its momentary needs. Two examples illustrate this: many women note that they see more pregnant women than usual when they themselves are pregnant; a hungry person notices food-related stimuli under conditions where a satiated person is oblivious to them. One may pose the analogous question: does a male notice sexual stimuli more readily when stimulated by a perfume than in the absence of perfume?

The experiment (Steiner *et al.*, 1978) consisted of presenting photographic slides for very brief periods, flashing them on a screen for 0.005 s. These slides showed both a view of Munich and an erotic scene, superimposed on each other. The idea was to create an ambiguous perceptual situation in which the participants had to decide whether they had seen, in the brief flash, one item or the other. Eight slides were presented in four series (replications) in random order. During the presentation of series 1 and 3, the perfume was present; during series 2 and 4, it was not. The 25 male test subjects were told that they would be shown either a city or a woman and were accordingly provided with three response options: 'city', 'woman' or 'I see nothing'.

The results were striking but logical. They showed, first, that nearly all participants gave more 'woman' responses in the presence than in the absence of perfume. Secondly, the effect of odor was strongest with the two slides on which the intensity of the 'city' and the 'woman' impressions was about equal, i.e. the decision between 'city' and 'woman' was quite arbitrary, favoring neither alternative.

To follow on from these results, another study, in which a different approach was used to measure the erogenous effect of a perfume, will now be examined.

23.4 Odor classification applied to erotic odors

Odor descriptions are notoriously incomplete. Paukner (1965) therefore proposed a polarity profile approach developed by Hofstätter (1959) who based his method on that of Osgood. The central feature of this approach is the use of 29 pairs of opposite adjectives ('polarities') selected from an original set of 40 pairs according to statistical criteria. For any given stimulus the participants, using a seven-point scale, were asked to indicate which member of each pair was more appropriate to that stimulus.

Thirty participants evaluated 11 odors, including that of natural ambergris, using these polarities. For ambergris, for example, they indicated on the first polarity, on average, that it is more exciting than calming and on the seventh polarity that it is more ugly than beautiful. The total set of averages constitutes a profile which, according to this study, is typical for ambergris and which proves reproducible.

At the end of the test, the same participants were asked to imagine and describe their 'ideal erotic odor'. Thus, an ideal profile was obtained that could then be compared with that of any other odor. Using factor analysis the author of this study reduced the odor profiles to points in a three-dimensional space. The proximity of the points for different odors is a measure of their perceived similarity. The author concluded that the point corresponding to the perfume that, on the basis of its composition, would be expected to be the most erogenous indeed came closest to the point for the imagined ideal erotic fragrance. Unfortunately, he conducted no determinations of statistical significance from which the precision with which the points were localized could have been derived. It would certainly be worthwhile to pursue this approach with additional experiments.

The examples cited so far show how different are the ways in which activating odors may affect people and how diverse are the methods that can be used to measure such effects. There are, at this time, no recognized standard or routine methods. The simplest method is direct questioning leading to scalar values. Two methods for tests of this kind will now be described. The first illustrates an interesting approach that is new to the field of olfaction.

23.5 Investigation of the dimension 'activation' with twelve odors

The test subjects in the investigation were asked to evaluate the activating effect of twelve odors using two different methods based on pattern assignment and on direct ranking of the activation effect. The first may be called a covert approach, the second is overt.

The test odors are listed and briefly described in Table 23.2. They represent a very diverse array of shampoo and air-freshener perfumes ranging from very sweet through fruity to extremely fresh.

The objective of the experiment was to record the subjective evaluations of the activation effect of these fragrances. Two questions were of particular interest:

1. How do the test subjects evaluate the activation effect?
2. Do the two 'subjective' measuring techniques provide different answers?

The test was run as a double-blind study with 48 students, 24 of whom were female, serving as subjects. The odors were presented in the form of scented gels contained in small cream jars.

23.5.1 *Pattern allocation*

In this procedure the test subjects were not told about the true purpose of the experiment, which was the measurement of activation. This 'covert' test had to be conducted prior to the overt one. The participants were asked to allocate each of the test odors to one of five circles differing in their degree of patterning. The test is based on a hypothesis by Meyer-Hentschel according to which activating stimuli tend to be allocated to busily patterned designs, a thesis which has been empirically verified for visual stimuli. The degree of activation is deduced from the frequency of allocation of stimuli to the different designs. The test subjects were asked to smell each sample and spontaneously assign it

Table 23.2 The test odors in the activation test

Odor	Abbreviation	Description
Top moments	TM	Woody, powdery, floral
Yuzu	Yuz	Very fresh, citrus
Clarity	Cla	Floral–woody, musk
Mango, variety	Man	Fruity, floral–woody
Powder fresh	Pow	Woody, powdery, balsamic
Honeysuckle	Hon	Floral, heavy, sweet
Odors eclat	OE	Citrus, fresh, green
Natasha	Nat	Floral, woody, green
Moussage	Mou	Floral, spicy, woody
Yuzu–Fougère	YF	Citrus, fresh, woody
Polan	Pol	Woody, spicy, balsamic
Tuscal	Tus	Woody, spicy, green

to whichever pattern best fitted it in their estimation. They were left free to pick the order in which they smelled the stimuli.

Because of the scales used and owing to the occurrence of polymodal distributions, neither the arithmetic mean nor the median was useful as a measure of tendency. Therefore the odors were ranked in order of the frequency with which they were assigned to the two extreme patterns of the scale. Thus a ranking in order of decreasing activation was obtained as well as a ranking in order of decreasing calming effect (Figure 23.3). According to the

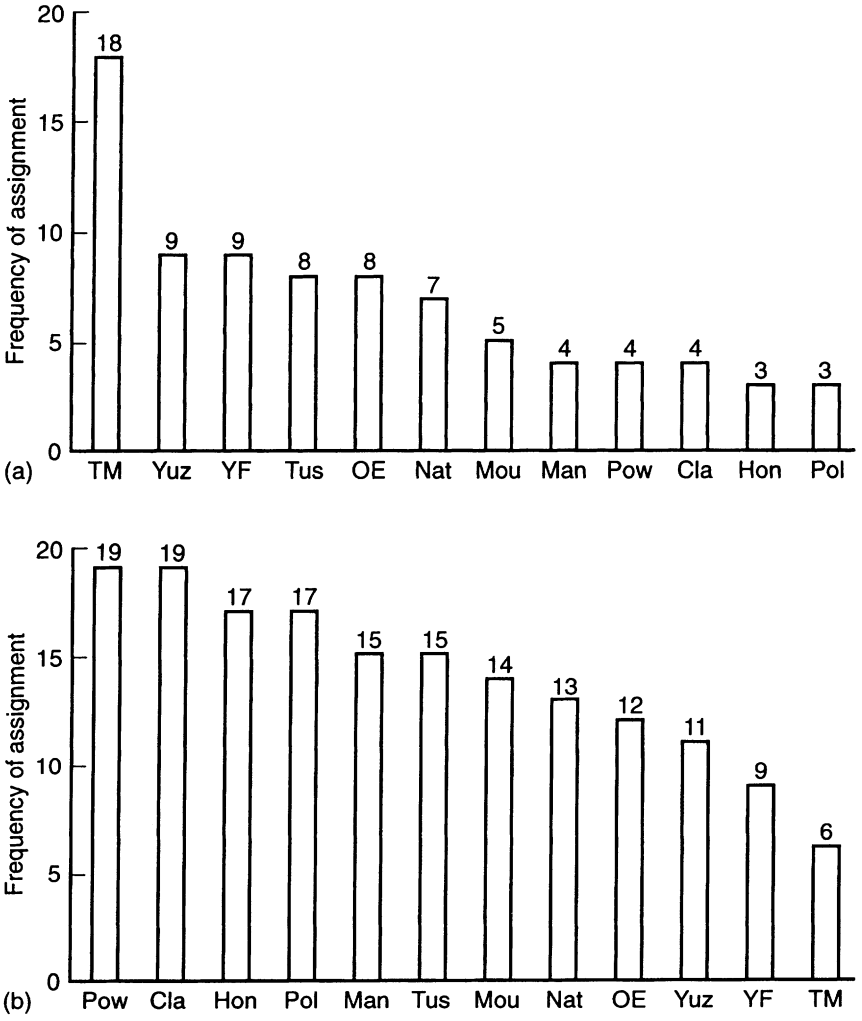


Figure 23.3 (a) Activation rating of twelve test odors according to Meyer-Hentschel. (b) Rating of calming action of twelve test odors according to Meyer-Hentschel.

two rankings, the fragrances TM and YF are the most activating ones; Cla and Hon are relatively calming.

23.5.2 *Activation ranking*

The activation effect of the 12 test fragrances was also determined by direct ranking. The test subjects were presented with the samples and told they could sniff at them in any order they wished and should rank them from most activating (rank 1) to most calming (rank 12). From the data obtained the average ranking was calculated for each fragrance.

23.5.3 *Intensity ranking*

In a subsequent part of the test the participants were asked to rank the odors in order of intensity. Rank 1 was assigned to the weakest fragrance, rank 12 to the strongest. Average rankings were calculated for each fragrance, as with the activation ranking.

The results of this test demonstrate the difficulties that arise in trying to find a satisfactory interpretation. As expected there was a very high negative correlation between the activation and the calming rankings, according to the Meyer-Hentschel method. However, the correlation coefficient between the activation ranking according to Meyer-Hentschel and the direct activation ranking was only 0.43, which was not significant. On the other hand, there was a very high positive correlation between the activation ranking and the intensity ranking results. This shows that a great deal depends on finding the right concentration for the individual test fragrances and demonstrates once again the many pitfalls in odor testing. In addition, when testing 'with odor' against 'without odor' conditions, such factors as weather conditions, time of day, test room and, above all, experimenter-related factors may decisively affect the results.

Comparisons with the higher apes and other reflections led to the view (see Stoddart, 1988) that at earlier evolutionary stages human social and sexual life was strongly influenced by odor. As Freud (1929) pointed out many years ago, certain evolutionary factors appear to have greatly reduced the strong influences of odors in the later stages of evolution. Brill (1931) suspected, however, that erogenous stimuli still have certain effects, including emotional ones, on humans.

The senses of hearing and sight are younger than the chemical senses in the evolutionary sense. They are localized in the cerebral cortex (Stoddart, 1988). The chemical senses, however, are closely associated with the limbic system, where the emotions also originate. No concrete evidence of direct interactions between olfaction and the limbic system has, however, been found to date (Van Toller, 1988).

If the sense of smell affects emotions or moods, experiments in which moods are measured in the presence and the absence of odors should be valuable. As Lawless (1991) noted there are two ways of doing this: the completion of adjective lists, using pencil and paper, and the measurement of physiological parameters. In the test below a significant effect of odor on mood was demonstrated by the use of adjective lists.

23.6 The effect of two fragrances on human experience and behavior

In this test, carried out by Steiner (1986), two equally large and identically appointed test rooms were used, one of which was scented. In the replication of the test the other room was scented. There were 76 subjects in each room. The 2×76 test subjects were not aware of the presence of the odor, i.e. it was subliminally effective. The experiment consisted of a series of six very diverse tests. The experience and behavior of test subjects under the influence of room fragrance A was compared with the experience and behavior of participants in the no-odor room. In the first part of the experiment 20 advertisements for cigarettes and alcoholic beverages were projected onto a screen for exactly 1 s each. The test subjects were asked to indicate how much they liked each advert using a seven-point scale. As expected, there were no significant differences between the 'odor' and the 'no-odor' groups.

In the second part of the experiment, the test subjects were given a list of 123 adjectives, an abridged form of the adjective list developed and tested by Janke and Debus (1978). The list contains adjectives such as restless, unsociable, carefree, sad, meditative, indefatigable, happy, etc. These words occur in an arbitrary sequence in order to eliminate position effects as much as possible. They are selected to represent 14 groups or dimensions provided by Janke and Debus: state of activity, lethargy, tiredness, daze, extroversion, introversion, self-confidence, high spirits, arousal, sensitivity, annoyance, anxiety, despondency and dreaminess.

The test subjects were asked to indicate, without any reflection, whether each adjective at that moment could or could not be applied to their current state by checking the appropriate words. The results were very interesting and represent the core of the entire experiment. The number of times each adjective was checked was divided by the number of test subjects in the group. This figure was compared with that of the other group. In 5 of the 15 dimensions of the adjective list, differences significant at the 5% level were noted. In the odor condition 'high spirits', 'extroversion' and 'arousal' were higher while 'despondency' and 'introversion' were lower compared to the no-odor group. In the other dimensions the differences between the two groups were not significant. Obviously the findings are consistent within themselves: as high spirits increases, despondency goes down and as extroversion increases, introversion decreases. Tests 3, 4 and 5 of the experiment will not be discussed here.

In test 6 the test subjects were asked to reproduce freely the advertisements shown in test 1. Their instructions were as follows: 'At the beginning of today's session you were shown a series of slides, each projected for 1 s. You had to state how much you liked them. Which of these adverts can you remember now? Name the product or describe the slide briefly if you can no longer remember the name.' A surprising result came to light: for 18 of the 20 slides recall was better under the odor condition than under the no-odor condition; for the group of adverts as a whole the difference in recall was statistically significant. This result may be explained by the linkage between arousal and performance: increasing arousal (up to an optimal point which was certainly not reached in this investigation) leads to increased performance. A relationship between increased memory performance and increased extroversion, spirits and arousal is therefore suggested.

In this study the same test was also conducted with another fragrance, B. With the exception of 'arousal', B elicited effects that were in the opposite direction from those of A.

Nearly all theories about emotion assume a relationship between emotions and physical activity (e.g. Grings and Dawson, n.d.). Bodily functions react to emotionally meaningful stimuli. It is therefore appropriate to measure psychophysiological parameters such as blood pressure, skin conductance, heart rate via electrocardiograms and the parameters of breathing, as well as various encephalographic measurements.

23.7 The influence of odors on subjective mood estimation and systolic blood pressure

A European patent application (Warren *et al.*, 1985) will be discussed as an example of the influence of odor on physiological conditions. The patent is entitled 'Methods, compositions and uses thereof for reduction of stress'. The special feature of the compositions is that each contains one or both of two substances referred to as 'actives', namely nutmeg oil and myristicin. In addition, they may contain additional 'active materials': mace extract, neroli oil, valerian oil, elemicin and isoelemicin are listed. The preferred mode of administration of the compositions is by inhalation. However, the claims include transdermal methods of application. The anti-stress effectiveness of the odors is demonstrated by means of a reduction in systolic blood pressure under stress conditions, as well as by subjective self-reports of test subjects which show a significant increase in calmness and happiness, and a significant decrease in embarrassment and anger under stress conditions.

Several experiments were conducted, the largest of which involved four cells each of 30 test subjects. Blood pressure and subjective state were measured at the beginning of the experiment and again after the subjects had responded to

six 'low stress' and six 'mild stress' questions. The test subjects then smelled either a perfume with one of the 'actives' or one without. These were presented on a paper smelling blotter. Subsequently, another set of six 'low stress' and six 'mild stress' questions was answered, and changes in stress were measured as in the first part of the experiment.

Examples of the 'mild stress' questions included the statements: 'The thing I like least about myself is ...' and 'If my child were dating someone from a different race I would ...' which had to be completed using the first phrase that came to mind.

After administration of the 'mild stress' questions measurable changes were registered both in systolic blood pressure and subjective state. Exposure to the compositions containing the 'actives', however, significantly reduced these changes.

In the patent description a clear distinction is made between the compositions described and so-called 'anti-anxiety' drugs. The compositions of the patent reduce the reactivity to stress when stress conditions exist. Unstressed people do not respond to the method of the patent.

23.8 EEG measurements and odor impressions

Not to be overlooked are the methods used to determine the effects of odors that deal with electrical processes in the brain. A number of such studies involve electroencephalogram (EEG) measurements. A review of the techniques of EEG investigations is given by Empson (1986). Brandl *et al.* (1980) report relationships between EEG potentials and subjective ranking of odors in terms of pleasantness. Lawless (1991) and Sugano (1989) report changes in certain brain currents in response to sensory stimulation. Potentials produced by visual, acoustical and olfactory stimulation could be demonstrated, although it was difficult to distinguish these signals from the background of electrical noise.

A relatively large number of studies are based on the measurement of a parameter of EEGs named *contingent negative variation* (CNV). This parameter represents a change in brain current patterns which occurs when people expect a certain event. Test subjects, usually with six electrodes attached to their skull, register a warning signal, e.g. a tone, which is followed by a second signal, e.g. a light. The subject's task is to extinguish this light as quickly as possible by pushing a button. Between the two signals a characteristic negative component of the EEG can be recognized and registered. This CNV usually occurs only in situations of arousal and expectation. If, prior to the test, the person is exposed to a certain odor, the magnitude of the CNV effect changes. From these changes a stimulating or a sedative effect of the odors may be deduced. This reasoning is backed by the finding that the administration of caffeine increases the CNV and nitrapezam reduces it.

Torii *et al.* (1988) conducted experiments of this kind with jasmine, lavender and 19 additional essential oils. On the basis of their findings they assigned calming or arousing effects to these oils. According to their studies bergamot oil, camomile oil, geranium oil, lavender and sandalwood oil are sedative, and clove oil, neroli oil and ylang-ylang oil are stimulating. Kanamura *et al.* (1988) conducted CNV measurements with jasmine, camomile and others. Sugano (1989) reports effects of odors such as lavender and alpha-pinene observed by means of CNV measurements and other observations on brain currents. The paper by Torii *et al.* (1988) provides additional information on CNV measurements.

23.9 The effect of odors on human experience and behavior as measured by EDA and direct questioning

An attempt was made to replicate part of Torii's findings by measurements of electrodermal activity (EDA) and by direct questioning. As with some of the work reported above this investigation was conducted at the Institute for Organizational and Economic Psychology at the University of Munich in cooperation with the firm drom, Baierbrunn, Germany.

Torii's classification served as a point of orientation in the selection of odor stimuli; both activating and sedative odors from his classification were selected. In addition, natural perfume materials were compared with artificial blends of the same odor type and two fantasy room fragrances were also included in the test. Cassis has a very fresh, green note, while Sea Breeze evokes fresh air at the seashore. The odors used are listed in Table 23.3.

The odors were presented in the form of perfumed gels contained in small white plastic jars. This way of presenting odors has proved very useful in many of our odor experiments. The objective was to study the twelve test odors with respect to their activating effectiveness. The study design was double-blind;

Table 23.3 Odor stimuli and their abbreviations

Material	Abbreviation
Bergamot oil	Ber
Lavender oil (40/42)	Lav
66% Bergamot + 34% lavender	BL
Jasmine absolute	Jas
Jasmine composition	JC
Rose oil (Turkish)	Ros
Rose composition	RC
'Cassis'	Cas
'Sea Breeze'	SBr
Ylang-ylang oil extra	YY
Sandalwood oil (East Indian)	San
Geranium oil (Bourbon)	Ger

neither the test subjects nor the experimenter knew which odors were in which jars. The total number of test subjects was 220. In order not to overexert the test subjects, each was presented with only three odors out of the array of twelve. The subjects were tested individually.

In the laboratory, the EDA of the participants was measured. Afterwards the subjects were given a questionnaire in which they were asked, among other things, to rank the odors in order of perceived activation and calming effect. The questions were: 'Which of the three odors is the most activating, which is the least activating?' and 'Which of the three odors is the most calming, which is the least calming?'.

The EDA measurement serves to register physiological activation. A steady current flows between two electrodes applied to the skin surface. A change in resistance leads to a change in current flow which is magnified and registered by the instrument. A strong current, leading to greater amplitudes, is interpreted as a sign of activation. It is an unspecific measure of activation and gives no information as to the evaluation, positive or negative, of the stimulus. It is important to eliminate or keep constant all external variables, such as visual, acoustic or motor inputs, in order to be sure that any activation observed is due exclusively to the olfactory stimulus.

The laboratory experiment was carried out as follows. The test subject was seated on a relaxing chair. The electrodes, connected to a monitor in an adjacent room, were attached to the subject's hand. To eliminate interference by optical stimuli the subject was given a sleeping mask (dark eye mask). The subject was instructed to refrain from moving as much as possible. An air-conditioning unit was running both to ensure optimal air quality and to provide a steady background noise. The test set of three odor samples was different for each subject. Each stimulus was offered for 10 s.

The data were treated as follows in order to obtain a ranking of the twelve stimuli in order of physiological activation. Each subject's evaluation was converted into a numerical score by assigning a value of 1 to the most activating sample and a value of 3 to the least activating sample. The activation index was calculated by subtracting the total number of third placements from the total number of first placements. Thus positive values stand for larger than average activation, negative ones for lower than average. Finally, the indices of the twelve substances were ranked.

A ranking was also established on the basis of direct questioning which was conducted immediately after completion of the EDA measurement. The two rankings are shown in Figures 23.4a and 23.4b. Clearly, they are not identical. Using the Spearman rank correlation test, we calculated the correlation coefficient between the EDA measurement (physiological activation) and the direct questioning (subjectively perceived activation) to be 0.50, indicating borderline significance at the 5% level.

In a similar way as for the activation dimension, the calming dimension can also be analyzed from the data of the direct questioning. The correlation

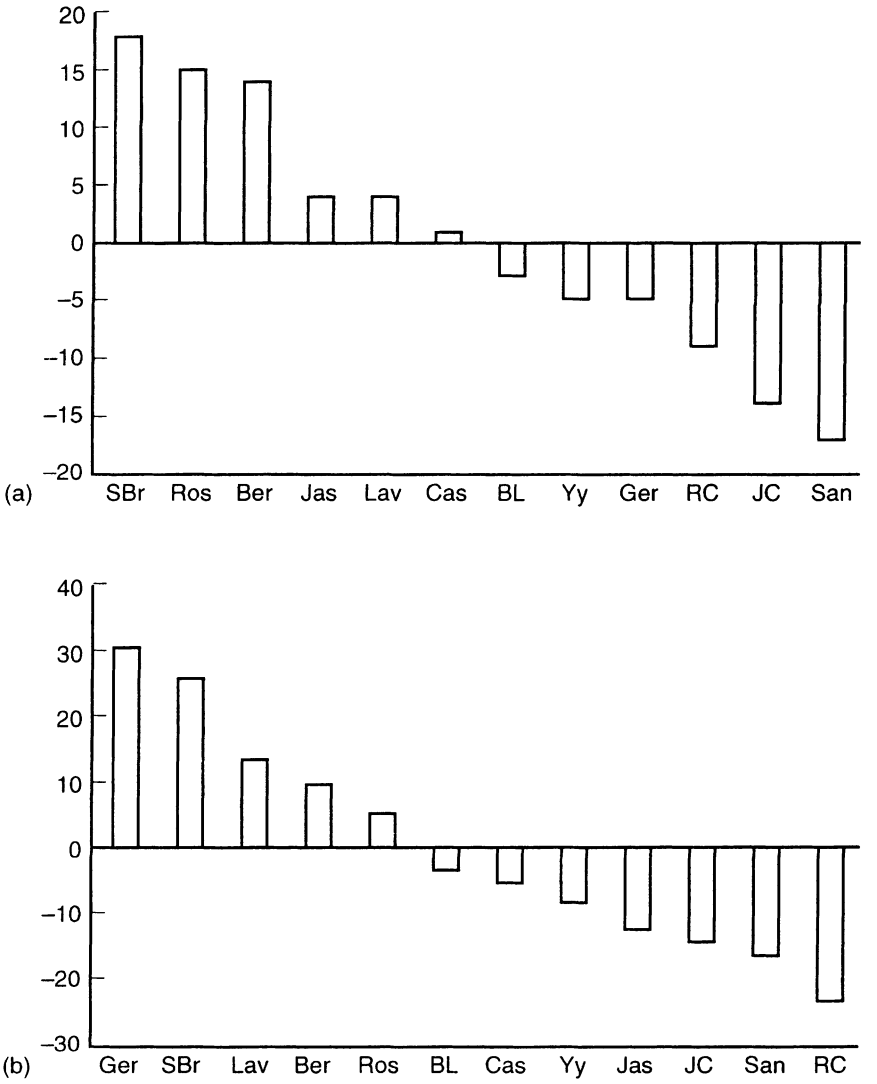


Figure 23.4 (a) Ranking of the twelve test odors according to physiological activation (EDA). (b) Ranking of the twelve test odors according to psychological activation.

coefficient between the dimension calming and the EDA measurements was −0.64, significant at the 5% level (the minus sign indicates a negative correlation between the two variables). As expected there was a high (−0.82) negative correlation between the two dimensions, activation and calming, from the direct questioning data.

A comparison of our results with those of Torii show little, if any, correspondence. Thus, bergamot oil and rose oil are activating (and to about the same degree) according to both the activation questioning and the EDA test; according to Torii, they have the opposite effect. According to our measurements, ylang-ylang oil shows relaxing tendencies while Torii found it to be stimulating; sandalwood can be considered calming according to both our measurements and to Torii.

If these results are to be believed, the conclusion must be that if the effects of odors are measured at different planes, different results may be obtained. This hypothesis is supported by the comparison between pupil dilation and direct questioning described earlier in this chapter. It is also supported by medical experience. It is a common finding that severely ill patients may feel well momentarily although the course of their fatal disease is far advanced. Many smokers light a cigarette after a stressful situation although at the physiological level cigarettes are stimulating.

23.10 Effects of odor stimulation on performance and stress in a sustained attention task

A final example of the complexity of odor effects is provided by a study by Warm *et al.* (1991). In this study 36 test subjects conducted a performance test of 40 min duration in which they were exposed to certain optical stimuli and had to react to critical signals by pressing a key. The participants wore masks and were periodically given 30 s administrations of peppermint odor, lily of the valley odor or pure air. In independent pre-tests peppermint had been established as stimulating and lily of the valley as relaxing. The authors' hypothesis was that the stimulating odor would positively affect performance and that the relaxing odor would reduce tension and the feeling of stress. The authors further argued that stimulating odors also might reduce stress by increasing alertness and the subject's ability to master the task. Odors that promote alertness also promote well-being.

The test results showed that both odors, peppermint and lily of the valley, positively affected performance. The test subject exposed to both odors reacted more sensitively to the critical signals without providing more false positive results. Both odors were equally effective in this and neither had a significant impact on the feeling of stress.

23.11 Conclusions

In this chapter a number of published and unpublished studies have been recorded with the objective of showing the variety of ways in which the effects of odors can manifest themselves and the variety of methods that can be used

to demonstrate these effects. The author's practical experience suggests that the checking of adjective lists during exposure to odors at subliminal levels is a reliably reproducible method. There are a great many studies in the literature which use CNV measurements. The comparison of results obtained by different methods demonstrates the complexity of the situation and, in the final analysis, of the human organism. We are still a long way from producing a general theory regarding the effect of odor on human experience and behavior, or even from determining rules of general validity in limited areas.

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24 The motivation for perfume choice

A naive-psychological reinterpretation of findings in odor and perfume psychology

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Advances in odor and perfume psychology have, paradoxically, been accompanied by a growing sense that we do not, as yet, know very much about the perceptions and the function of the sense of smell, about the psychological utility of perfumes or about the social importance of (cosmetic) fragrances. Hence, commonly used introductory phrases in articles and lectures about these subjects point to open questions or to limits to knowledge and caution against rash generalizations. Thus, Gschwind (1990) writes: 'Few things have been scientifically proven, our knowledge is incomplete and no comprehensive theory is available.' Klutky (1989) remarks that up till the present 'but few psychological studies... have dealt explicitly with the sense of smell and its relation to other fields of research', while Richardson and Zucco (1989) critically note that 'psychological research... has paid very little attention to the olfactory modality.'

The paradox is readily explained. On the one hand the growing body of knowledge prohibits the formulation of bold, research-stimulating theses such as that of Paul Jellinek (1951), presented in this book. On the other hand advances in knowledge always lead to an exponential increase in unanswered questions. Knowing more, we know about all the things we do not know yet – *scio, nescio.*

Curiously, a major gap in psychological odor and perfume research concerns the naive-psychological study of the consumer's more or less conscious cognitive processes regarding selection and employment of scents and fragrances. By this, we do not mean to say that insufficient subjective data have been collected concerning the rating and evaluation of fragrances but rather that such data have hardly ever been collected with the objective of creating a model of the individual's subjective calculations that govern the process leading from the initial and as yet indistinct inclination to use a perfume, to the act of purchase and regular use. This is a striking hiatus in olfactory research since precisely this psycho-logic of subjective considerations is the subject matter of modern motivation psychology (compare Heckhausen, 1980) – a discipline which, using this approach, has been extraordinarily successful. Therefore, we do not, as yet, understand the 'motivation' of perfume selection from the inner perspective – we do a little better with the external viewpoint.

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In other words we do not yet know what happens inside the head of consumers.

A naive-psychological or 'everyday-psychological' investigation of perfume selection is not unscientific, it is, rather, the scientific exploration of the individual's implicit theories or of her or his more or less conscious reflection underlying perfume selection. This is a well-established psychological approach (e.g. Heider, 1958, 1977; Laucken, 1973) based on the premise that an understanding of the mechanisms of internal reflections can lead to an improvement of psychological predictions. Man selects and reshapes sensual impressions, incorporates them into a calculatory system of individual considerations and thus grapples productively with external reality. Whether his cognitions are objectively correct is not essential – the important thing is the role they play in motivation and their capacity for guiding actions. The better we know a person's subjective logic, the better we are able to understand his behavior and to find new starting points for intervention. A simple thesis of psychological motivation might be stated thus: 'People, using perfumes, link this use with certain expectations about achieving an objective.' This thesis is taken to be so obvious that it is hardly questioned: 'However, it is clear that perfume is used as a means to an end' (Byrne-Quinn, 1988).

An analysis of this thesis leads to a series of questions that may be the subject of psychological clarification.

1. The assumed function of perfume as a means to an end presupposes something like a category identity of an odor. The user must reproducibly identify the means, store it in memory and recognize it when needed. To what extent are these conditions met from the perspective of odor psychology?
2. What makes people link expectations of effects with the use of perfume? By what mechanisms do they learn about such effects?
3. In people's subjective estimation, what specific objectives can be achieved by the use of perfumes?

A very rationalistic scenario emerges from these questions. At times this has been made into a reproach to cognitive motivation psychology (compare Thomae, 1988) since irrational aspects appear to be excluded and with them more exciting perspectives. This is not necessarily so, for it is just the deviations from rational use patterns and the discovery of rapid, more or less unconscious cognitive processes which make up the, at times, startling charm of this approach and which enable us to derive hypothetical models of behavior.

Unfortunately, no empirical findings are available that would permit us to answer the above questions in the way we would have liked. However, indications may be derived from survey data, from the experiences of the perfumery industry and from basic research in olfactory psychology.

24.1 Subjective and objective category identity of odors

The first question in the above list, regarding the category identity of perfume, touches on the central themes of odor psychology: the dimensions of the mental representation of odors, their identification, recognition and communicability. In order to play a role in the context of means and ends, a means must be identifiable with certainty and be recognizable, i.e., capable of being stored in memory. Identification is possible only if there is discrimination and clear distinction from other means. How would olfactory and perfume psychology respond to these postulates? Probably by expressing strong reservations about the reliability of our sense of smell and by pointing to its 'inferiority' compared, for example, to hearing and vision.

Successful odor identification (not to be confused with odor detection) is difficult to achieve. It is often beset with errors, it rarely comes in verbal form but usually by way of personal memories and rudimentary biographic episodes (compare Richardson and Zucco, 1989). Apparently, this is the 'normal' form of cognitive representation of odors. While we can readily learn accurately to attach verbal or numeric labels to any visual shapes whatever, this appears to be far more difficult with odors (Davis, 1975, 1977). The distinctly longer training time required is one indication of this. Apparently, odor impressions are so diffuse and non-verbal that it is difficult to link them to concepts (compare the reviews of Richardson and Zucco, 1989; Schab, 1991). Perhaps this is due to indistinct differentiation in memory storage (compare Schab, 1991). The average person can, after training, absolutely identify no more than some 10–20 previously unknown odors (Engen and Pfaffman, 1960). When presented with small selections of *familiar* odors (100 at most) from the total array, estimated at 400 000 odor types, he or she is able to identify only 40–50% with certainty. Sumner (1962) reduced the number of familiar odors (e.g. coffee) to be identified by 200 test subjects down to four and found that only one-third of the respondent collective was capable of correct verbal identification. Consequently, Engen, an odor researcher, characterizes 'odor language as both idiosyncratic and impoverished' (Engen, 1982). Curiously, poor recognition ability is coupled, in the case of odors, with a rather flat memory performance curve: after an initial marked loss of odor information coupled with poor recognition performance, what remains is scarcely subject to forgetting (Engen and Ross, 1973). From the naive-psychological perspective, poor and imprecise verbal identification and recognition is not a serious matter as long as it is better than a mere 'tip of the nose' (Davis, 1981) or if it is made with subjective certainty. Moreover, odor memory can be improved by training in verbal or visual encoding (Richardson and Zucco, 1989). According to research conducted by Wippich (1990) recollections of odors depend nonetheless on the actual presence of 'olfactory traces'. Simply by 'presenting a name' or 'even when attempting to generate autobiographic recollections', it was hardly possible to 'imagine the odor itself as a sensory experience'. Studies

in which something was smelled that was not actually present (so-called 'false alarms') throw a particularly interesting light on the failings of our sense of smell. Engen (1972) reports a study, involving, however, only three subjects, in which a subjective odor impression was clearly produced by individual expectations. What do these findings signify with regard to a naive-psychological interpretation of the individual? Evidently he or she moves in a nebulous terrain when it comes to identification, recognition and discrimination of odors. The crucial point for this interpretation would be the subjective certainty about the category identity of a scent appearing within the cosmetic context, not the objective uncertainty of judgement in relation to a correct response known only to the experimenter in olfactory psychological research. The question regarding the individual's subjective certainty or uncertainty about his or her own performance in odor identification and recognition remains largely unanswered. In a study by Lawless and Engen (1977) the correct naming of an odor took a long time, the generation of associations was more rapid and more rapid still was the estimation of the degree of familiarity. This time-factor is suggestive with respect to subjective uncertainty. Recognition and the generation of associations improve with familiarity and pleasantness of odors, both objectively and subjectively (Lawless and Cain, 1975). The individual's naive-psychological subjective certainty to have in perfume X a reliably recognizable means becomes socially relevant to the motivation of perfume selection even though this subjective certainty cannot be communicated intersubjectively due to the fact that everyone experiences things differently.

An additional source of evidence concerning the category identity of odors as a precondition for their employment in intersubjectively communicable means–ends relations comes from studies on the classification of odors. In studies using the entire gamut of available odors we find a large degree of intersubjective agreement with respect to the rating of odors on a pleasant–unpleasant scale (Burdach, 1988). This hedonic dimension also emerges in studies on the rating of odors with respect to their similarity. Berglund *et al.* (1973) find only one common dimension, like–dislike, for 20 odors. All other dimensions are purely individual. Woskow (1968) came to similar conclusions in a factor analysis. The dominance of the hedonic dimension has been explained physiologically by the close links between the olfactory part of the brain and the limbic system (Klutky, 1989). The primacy of affect in the experience of odors has physiological origins.

The failings in olfactory encoding and decoding, its intra- and interindividual variance and instability, and the largely personal and idiosyncratic nature of dimensionality and recognition do not necessarily impede subjective category identity but because of them the sense of smell must be regarded, in the words of Schachtel (1959), as an 'autocentric' or 'subject-centered' sense modality, as opposed to the 'allocentric' or 'object-centered' visual and auditory senses. This autocentric character is surmounted only at the level of

the hedonic dimension. In other words, an 'objective' category identity is achieved only at the level of evaluation.

Thus, the intersubjectively good-smelling stuff, appropriately packaged and declared to be a perfume and rendered familiar to everyone in various social situations, meets the requirements of a means to an end. Accordingly, studies of the olfactory classification of cosmetic fragrances demonstrate the existence of a 'planet of perfume' (Jellinek, 1988a) possessing considerable category identity within a multi-dimensional space of odors in spite of the differences between the perfumes located in it. Jellinek lists the characteristics of substances that can be assigned to the planet as follows:

1. It must not smell like something else.
2. Complexity.
3. A touch of the unnatural.
4. A touch of body odor.
5. Harmony, beauty, balance.

The planet of perfume is surrounded by musk, sandalwood, cloves, lemon peel, lily of the valley, rose and jasmine. In a classification based on consumer responses, it will be hard for a perfume to leave this realm. Here again, however, the question of category identity *within* the planet of perfume remains unanswered. Probably each perfume is again marked by the general uncertainties of identification, recognition and verbal labeling. Moreover, the average citizen is, most likely, able absolutely to identify and recognize only very few commercial perfumes, probably only those which he or she has personally used (Jellinek *et al.*, 1992).

Indicative stimuli from other sensory modalities apparently facilitate the identification and recognition of odors. This is a finding not only of basic research in olfaction but also of perfumery research. Le Norcy (1988) reports an experiment with the perfume 'Oscar de la Renta'. Test subjects did not discover that three unlabeled perfume samples, one in the original flacon, one in a black plastic bottle and one in a classic flacon, actually contained the same fragrance. Apparently, different packaging is enough to upset the stability of identification. In a study of the dimensionality of odor perception based on similarity of associations, Gschwind (1990; compare also Jellinek *et al.*, 1988) was able to show that different dimensions emerged in a multi-dimensional representation of ten feminine perfumes depending on whether the scent was presented as such or in its original packaging. In a similar vein Byrne-Quinn (1988) found a different factorial structure of odor evaluation depending on whether a set of odors was contained in toilet soap or in household cleaners. Thus, the field of use, the context and available indicative inputs affect the category identity of odors. Indicative inputs such as brand label, color and form of the container are essential determinants of the category identity of odors, more so than the readily swayed and idiosyncratic experience of the scent itself.

The pleasantness–unpleasantness dimension, so important to the category identity of odors and fragrances, is also subject to various influences. Richardson and Zucco (1989) list complexity of composition, concentration, room temperature, the physiological hormonal condition of the smelling subject, the order and frequency of presentation as well as irrelevant external stimuli as influential. Of course an awareness of the susceptibility of odor evaluation to external influences does not of necessity enter into the subjective feeling of certainty. However, the objective uncertainty becomes relevant when odor impressions enter the social context. Here they are faced with limitations in their ability to be communicated relative to visual and auditory stimuli, and this has consequences for their usefulness in a means-to-ends context: the user is confined to the condition of self-reference.

No empirical answer is as yet available to the question: What is more conducive to frequent use of a perfume, a diffuse or a clear subjective identity?

24.2 Subjective and objective effects of odors

A cosmetic fragrance affects our partners in contacts. This being public knowledge surely also has become part of the implicit theories of laymen. It is noteworthy that objective proof of this ability largely comes from experiments not aimed at exploring subjective awareness of it. The effects of androstenol on the judgement of the attractiveness of persons shown in photographs have been demonstrated by Cowley *et al.* (1977) as well as by Kirk-Smith *et al.* (1978). A chair in a dentist's waiting room scented with androstenone (male pheromone) was used more frequently by women (Kirk-Smith and Booth, 1980). The general state of cosmetic grooming affects perception and evaluation by others (e.g. Cash, 1985). Men in particular found perfumed women more attractive, especially at night (Graham and Furnham, 1981; Moskowitz, 1980).

In three very carefully designed studies (reviewed in Baron, 1988) Baron explored in more detail the effects of fragrance in simulated social interactions (largely employment interviews). The use of perfume positively affected 'liking' and 'attractiveness' but only in combination with other factors. In one study, it was the combination with informal (as opposed to formal) attire, in another the sex of the interviewer (males are particularly sceptical with respect to excessive positive 'impression management' strategies) and in another the avoidance of additional non-verbal tactics. Summing up, Baron (1983) comments that overuse of cosmetics proves 'too much of a good thing' and advises 'use artificial scents and other grooming aids with caution'. What makes these studies so relevant to our exploration is that they demonstrate that a truly effective use of perfumes as means to an end presupposes quite detailed and conscious knowledge. Who would dare to claim to know Baron's findings in advance? In view of the many factors affecting evaluation, how in the world is

one to decide what effects a scent may possibly induce in a partner in a social interaction? Perfume users have to predict effects on others from a position of 'social blindness' and are thrown back on their own judgement in their decision of what to do and what not to do when and where. Baron's studies may be taken to offer additional evidence of the thesis that self-reference has greater impact on perfume use than does social validation. We use a perfume because *we* like it, not because we know its effect on others.

In the light of massive evidence indicating the social conditioning of odor preferences and perfume functions this thesis may sound odd. Factors of socialization, as well as biological and physiological characteristics, have clearly been shown to account in large part for variances between social strata in hygienic and cosmetic habits, and in the evaluation of the body, grooming and physical beauty (e.g. Bourdieu, 1984), in the evaluation of scents and the functionality of cosmetics as a function of sex and sex-role (e.g. Moncrieff, 1970) and in age-dependent variations in odor preferences (Moncrieff, 1965; Plattig, *et al.*, 1980). However, the fact that preferences are socially conditioned does not contradict the argument that, in spite of social conditioning of odor preferences, we gain certainty about effects only by referring to our own dictionary of odor effects. A socially agreed on dictionary of dictionaries, an olfactory meta-language does not exist.

Apart from this, the studies pertaining to the conditioning of responses to odors are very impressive. Children exhibit great plasticity of olfactory perception. They only learn in the course of the first years of life to abandon their original tolerance *vis-à-vis* pleasant as well as unpleasant odors and to smell the way adults do (compare in particular Engen, 1988). On the other hand, they quickly learn the odor markers that are important to them. As early as the first and second week of life they show significant preference for the odor of the perfume which their breast-feeding mother has applied to her breast (Schleidt and Genzel, 1990). Engen (1988) states: 'The olfactory system is a tabula rasa, which prevents rigidity and permits flexibility with the environment.' Hedonic differentiation usually does not occur before the fifth to eighth years of life. Thus, pre-school children are not able to differentiate perspiration, feces and amyl acetate in the hedonic sense (Stein *et al.*, 1958); they even prefer perspiration to pleasant odors (Engen, 1974) or when playing are insensitive to malodors in the environment that greatly bother their mothers (Lipsitt *et al.*, 1975; Engen, 1982). Experimental conditioning to odors with distinct after-effects has also been recorded. Kirk-Smith *et al.* (1983) paired an odor with stress in the learning phase of an experiment and were able to demonstrate that the same odor elicited stress some time later. Accordingly, the therapeutic and commercial applications of odors and fragrances are based on their acquired emotional associations. Thus, a fragrance conditioned with relaxing associations can be used as a relaxant in anxiety therapy (e.g. King, 1988).

How can a person come to know the ways in which perfume use leads to

effects? He or she must possess or believe to possess this knowledge if fragrance is to be used as a means to an end. If this knowledge is not explicitly imparted in the process of socialization, the user has to depend on observation of the effects of fragrance use on the people around. In a sample of 800 respondents (Byrne-Quinn, 1988) only 43% claimed paying attention to scent in a first impression – how many would they be in the field, under realistic conditions? A study by Nesbitt and Steven (1974) provides evidence for a more or less conscious perception of a fragrance worn. People standing in line for a county fair attraction maintained a greater distance from a test person wearing fragrance than from an unperfumed control person, presumably for reasons of optimizing stimulus intensity.

Beyond this, the many available studies concerning the effects of fragrances provide no evidence as to the extent to which people subjectively know about possible fragrance effects nor, in particular, how the expectations of effects are acquired. To begin with a kind of learning by observation could be imagined, i.e. relating the positive impression which person X has made to the fragrance he or she uses. This type of attribution of cause is rather unlikely since impressions are based on a wide range of additional information about the person (appearance, attire, speech, friendliness, etc.). When and under what conditions would impressions be related to a pleasant odor? Even if it were to be practised, learning by observation offers only vague conclusions for it is unlikely that the perfume could be identified when smelt on the user or otherwise, far less recognized in the perfumery store when shopping.

Let us consider a different case: a fragrance is used and its positive effect registered by the user by noting the reaction of the people around. Again, this ping-pong feedback would have to be related to the eau de toilette out of all other factors in order to acquire subjective knowledge about odor effects. Moreover, a specific non-verbal (e.g. mimic) reaction that is interpreted unequivocally as a positive reaction to one's own odor emissions is not known. Sniffing or turning up one's nose are too crude forms of olfactory feedback to be socially permissible in most everyday situations. Again, in view of the existence of more central and more powerfully operative aspects of personality (e.g. motivations of achievement), an attribution of causative effect to perfume is relatively unlikely.

Explicit conversation and verbal feedback, a type of olfactory meta-communication which could provide insights about effects presupposes a highly trustful relationship with others and is, again, relatively rare in everyday situations. A few significant partners might, if anyone, provide the social points of reference for knowing about effects.

In summary, what likely sources of knowledge about the effect of perfumes remain? Next to socializing influences and advice from the family, the media and advertising, the main point of reference remains, most likely, oneself. *I* experience disgust or pleasure from my own or other people's odor emissions and draw my own conclusions from this feeling. The inadequacy of the

olfactory sense and of odor communication makes social construction of an olfactory reality an impossibility. In the construction of expectations about the effectiveness of the scent of perfumes one is, for lack of social referencing, thrown back on self-reference.

Earlier authors have remarked on the possibility of self-reference in the formation of expectations of effect. Henning (1916) suspects that the 'desire to mask one's body odor' is a motive for the use of perfume. In his 'adaptation model of cosmetics' Freytag (1972), following Gumpert (1931), proposes the struggle against and the prevention of 'olfactory disfigurement' as a motive for the use of cosmetics and perfumes. This thesis is not in conflict with a social conditioning of odors – what smells offensive and what smells pleasant is learned, within limits, only in the social context. The central step, however, is the application of what has been learned to oneself and hence self-reference in olfactory diagnosis and therapy.

24.3 How a lower sense is enlisted to serve higher aims

Data about the subjects' aims in using perfume have been collected as a by-product in a great many surveys. These aims may be roughly classified into self-referential and other-referential. They include the personal aesthetic experience with an odor one likes, the acceptance by a group with which one identifies oneself, the consciousness of expressing taste, health or success, or the expression of one's personality (compare, e.g., Byrne-Quinn, 1988). Perfumes can be signs of being present, of having been present, of conditions and characteristics, of personal identity and of belonging to a group (Jellinek, 1991). Used by men they may demonstrate good grooming, be used for refreshment or be an expression of self-realization (Jellinek, 1978). Certainly, men also use fragrant cosmetics without giving the matter much thought, simply using fragrances which their partners have bought for them (for purchasing decisions regarding cosmetics compare Kirchler, 1989). In the catalogs of spontaneous replies to questions about objectives, often assemblages of anecdotes, and also in the subjective catalogs of consumers' motives constructed from years of marketing experience, the results of more probing questions are usually lacking, e.g. questions such as what is meant by the 'expression of personality'. Is it an ultimate or an intermediate objective? Is it independent of social feedback, i.e. a perfect example of a self-referent objective?

In one of the few published surveys about the subjective experience of using cosmetics Schaupp (1982) observed that the use of cosmetics, although socially motivated by the wish that others may find the user attractive, does not serve to obtain explicit social approval. Schaupp (1982) writes: 'It is primarily a matter of enhancing one's appearance. This becomes apparent... by the link between the use of cosmetics and the assumption of being judged attractive by

others. Contrary to expectations the data related to the construct of social dependence provide no empirical proof of a connection between this variable and cosmetics. Therefore, it seems that cosmetics are not used to satisfy a need for being accepted by others.' Because of group differences between students and employees, the findings in this study do not lend themselves to generalization. However, there appears to be in cosmetic use 'an aspect of self-presentation' (Schaupp, 1982). There is a particularly close link between cosmetics and 'aspects of the self' (Schaupp, 1982). Evidently, the respondents were content with just one criterion of 'fittedness', namely that the cosmetic product used fits the self. In this study perfumes play a subordinate role. It would seem that the self and cosmetics are symbolized on an abstract plane in such a way that they become compatible. This may be interpreted as the attainment, by abstraction from merely concrete sensations, of a new level of amodal presentation on which new rules, e.g. the rule of fitness, are operative. Thus, low senses are transformed into higher ones.

Perfumery research is rich in empirical indications pointing to an amodal representation, i.e. a cognitive representation that is independent of sense modality, hence abstract. Turning into symbols of something, stimuli leave the lowly ground of their sense modality behind them. Richardson and Zucco (1989) write: '...the efficacy of olfactory experiences as cues to recall of information that has been visually or verbally encoded seems to depend on the subject's ability to access a more abstract, amodal form of knowledge representation...'. The problem is that some of these abstract representations can be interpreted as, or proven to be, associations or correlate sensations. As early as 1916 Henning anecdotally described correlate sensations such as the experiencing of colors and tones when odors were presented. The question of physiological links between sensory modalities goes beyond the scope of this chapter. The author believes, however, that available experiments and surveys provide evidence that by means of associations, in whichever way generated, odors can partake in systems of social signs that are more readily identifiable and communicable. For example, each perfume has an image at the verbal level. Using the semantic differential Klutky (1990) finds that the polarities mild, bright, conventional, warm, clean and soft go with 'pleasant'odors while sharp, dark, exciting, heavy, disharmonious, cold and hard go with 'unpleasant' ones. She did not use actual fragrances in this test. According to a study by Jellinek (1988b) colors can be clearly assigned to certain odors; on the other hand, the description of scents depends on the color of their label. The Dutch design scientists Smets and Overbeeke (1989) asked students of design to create little sculptures, each fitting to one of a set of synthetic fragrances. Non-informed test subjects were then asked to guess which shape went with which fragrance. The result was a statistically significant correct recognition of the appropriate sculptures. In other words, on a symbolic plane, odors can be coded as words, colors and shapes, and they can thus obtain, on this plane, a subjective meaning as a means to attain symbolic ends. It is not surprising

that odors can also elicit associations with specific personalities which are not only deliberately created by advertising but arise from an analogy between the images of fragrances and of people descriptions. Thus, Jellinek (1980) could show correlations between descriptions of the character of women and the character of fragrances. The extensive investigations of Mensing and Beck (1988), in which correspondences were found to exist between colors, perfumes, the self-evaluation of individuals and lifestyle associations, offer additional proof of the symbolization of fragrances in rather complex planes. There are in this no magic relationships between colors and scents or the self-evaluation of people. Rather, all phenomena partake of a symbolic plane common to all, be it through associations which have come into being in a collective or individual history of conditioning (compare Dollase, 1988; Dollase *et al.*, 1986), or through abstraction. Thus, one might imagine that among ten Oriental odors one floral one could be labeled an 'outsider', without any conditioning necessarily having taken place. By means of such structural, formal or also 'collative' characteristics (a term coined by Berlyne, 1971) the low sense impression 'odor' is translated into a symbolic plane where, along with the odor, higher mental operations also become communicable.

A classical experiment from the 1940s, familiar to all psychology students, consists of the task of assigning two nonsense words, 'maluma' and 'takete', to two tangles of lines, one angular and one round. Nearly everyone succeeds in the task (with the exception of small children) and it seems subjectively evident to everyone: the round, soft sound must be connected with the round, soft figure and vice versa. It is probably likewise with odor and fragrance impressions: on an abstract plane they become manageable as means to achieve ends which can then be socially defined on the symbolic plane.

24.4 Summary and conclusions

The motivation of perfume selection, observed from a naive-psychological perspective, has been explored in a detailed tracing of subjective considerations and patterns of information processing. In the framework of this scenario, as yet hypothetical, three questions are examined:

1. Do fragrances possess category identity enabling them to be used as a means to achieve ends?
2. How does the consumer learn about the effectiveness of perfumes as means to an end?
3. What objectives at what planes enter into perfume selection?

We found first that very little information directly pertaining to the naive-psychological perspective is available in scientific literature. However, a re-interpretation of recorded findings reveals that in all probability a strongly self-referring process of motivation must be involved, characterized by highly

personal category indentities and expectations of effectiveness which must be derived, not exclusively but largely, from self-observation. The declared objectives of using cosmetics and perfumes may consist of influencing other people but the certainty that comes from social verification is lacking. Hence it is not surprising that aspects of expression of personality predominate. This becomes possible through a symbolic abstract, amodal representation of the odor sensation which links it with symbolic objectives and with other fields of consumption. Of course, the olfactory self-expression of the consumer may also be compensatory, as formulated, for example, in the theory of symbolic self-completion (Wicklund and Gollwitzer, 1982). A problem in this context is the invisibility of the self-anointment or its becoming evident only to a small social circle of intimates. This being said, there is the possibility, in the context of the motivation of perfume selection, of a self-referent attitude that finds its satisfaction in a strong internalization of symbolic values. The symbolic linking of the fragrance impression with the emblems of luxury (achieved, for example, by image transfer) gives rise to a 'psychological utility' beyond the aesthetics of the odor experience. Consequently, it should be possible to increase this utility in all facets and phases of the process of perfume selection – advertising, purchase, packaging, sampling, application – in short, to increase the psychological utility in the arena, accessible to marketing, and where motivation occurs.

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25 Why people use perfumes

HUGH BAIN

A central proposition of Paul Jellinek's important book was that the motivation for perfume use is firmly and unequivocally rooted in the biological sexual drive. Let us recall the opening lines (p. 1):

> All life in nature is characterized by the self-preservation drive which ensures the survival of the individual, and by the sexual drive which causes reproduction and hence the survival of the species. All functions of plant organisms and each animal action can be traced directly to the initiative of one of these drives which also induce, in the final analysis, every human action. Perfumery is rooted in the sexual drive not only by virtue of the origin of some of its most important natural raw materials; it has developed under the dominance of this drive, which has placed its stamp on the perfumer's art, and in all of its creations it unequivocally remains sexuality's servant.

The theory unfolded in Jellinek's book is an impressive undertaking aimed at explaining all aspects of perfumery on the basis of this linkage. These include the psychological effects of perfumes and perfume materials on the perceiver as well as the purpose of using perfumes. However, more than 40 years have passed since the book was first published and it is appropriate therefore to re-examine the validity of this proposition in the light of the developments which have occurred since then.

25.1 Biological drives versus cultural conditioning

Many contemporary scientists concur in the view that the culture of human odour has its roots in biology. Thus the zoologist Stoddard (1990) has pointed out that the receptor mechanisms involved in odour perception in primates, including humans, are relatively primitive in evolutionary terms. He refers to 'the continued persistence of the ancient structures and pathways which firmly link the sense of smell to sexual reproduction' and goes on to state that 'this persistence has substantial and significant consequences for human culture and human evolution.'

In a recent biography of his father (Marnham, 1992), John Simenon is quoted as attributing his father's extraordinary sexual vigour to the family's acute sense of smell. He wonders 'whether, since it is impossible to develop the capacity for sexual desire if one lacks a sense of smell, a heightened sense of smell leads to a heightened level of desire. Was Georges Simenon fated all his life to be led by the nose?'

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The implication is, clearly, that human reactions to odours and odour hedonics, that is the pleasure or repulsion elicited by odours, are firmly rooted in man's biological constitution. A different view prevails today among the majority of psychologists. A leading exponent of this view, Tryg Engen, expressed it in the statement that 'odour hedonics is a matter of learning in a Pavlovian sense and through modelling the modes of one's culture' (Engen, 1988). In support of this hypothesis he cites extensive observations from very young infants as well as from children of 3 years and older.

Tests with odours on infants suggest that, although the ability to detect odours is present at birth, infants show little evidence of liking or disliking odours as adults do. Lipsitt *et al.* observe also that 'parents are sometimes astonished at how tolerant their 1- and 2-year-old children are to odors... which the parents find repulsive' (Lipsitt *et al.*, 1975). They suggest that the development of odour preferences from infancy is 'possibly the result of physiological maturation but probably the consequence of experience.' The association of an odour experience with the pleasurable or disagreeable situation in which it occurs generates a hedonic response to the odour that is preserved into adulthood.

There is a clear implication here that infantile tolerance of odours with repugnant connotations to adults is deliberately repressed by parents from an early age onward in the interest of the socialization of the child, and that these repressions persist into adulthood. As a result, natural childhood curiosity about odours that adults consider socially undesirable or 'taboo' is inhibited and repressed in the adult.

In our experience, gained in a broad range of interviews with adults of different cultures, this seems to apply particularly to odours which are associated with uncleanliness, e.g. unwashed bodies, perspiration, dirty clothes, dirty homes, excretion, smells associated with menstruation, with sex, decay, poverty, sickness and death (compare also Schleidt *et al.*, 1988). The shame or guilt engendered in adults when forced to confront these perfectly natural phenomena is often evidenced by a reluctance even to discuss their feelings about such embarrassing odours. In contrast to the repression (negative conditioning) of curiosity towards and interest in socially embarrassing odours, there is also a good deal of empirical evidence of the 'positive conditioning' of adults towards the adoption of habits of personal cleanliness, good grooming and the use of products appropriate to such socially desirable habits, e.g. personal perfumes and aftershaves, perfumed soaps, shampoos, deodorants, toothpastes, etc.

Therefore, our ideas as to what constitutes an appropriate human smell nowadays appear to be social rather than biological in origin. They reflect the conditioning we receive as a result of exposure to a whole range of cultural influences, and the roles and expectations these impose on us in different social contexts.

The conditioning of odour perceptions over an individual's lifetime indeed seems to affect many areas of behaviour:

- In infancy it involves the inhibition of children's natural curiosity, possibly even pleasure, in smells of bodily functions.
- In adults it involves the positive encouragement of fragrance use, as part of good grooming, subject, of course, to constraints relating to the quantity, type or mode of fragrance use which society deems acceptable for different individuals and circumstances.
- As consumers, people are also subjected to deliberate conditioning by marketing activities related to products containing fragrances. Factors in the conditioning process include the formulation, naming, packaging, advertising, pricing and selective distribution of branded fragrances or indeed any products of which fragrance is an important feature.

25.2 The dimensions of fragrance use

When people talk about using perfumes three dimensions of perfume effects emerge: messages to certain specific persons, impressions created on others in general and feelings generated within the user him- or herself. We might call these the *interpersonal*, the *inner-directed* and the *social dimensions* of fragrance use.

25.2.1 *The interpersonal dimension*

Even if we question the thesis that the sexual drive is at the origin of all of perfume culture, there can be no doubt that the wish to be appealing to an actual or potential sexual partner is an important reason for the use of perfumes in cultures around the world.

> 'I want my husband to come near me to smell my perfume on, not when he first enters the room. A perfume is to enhance my body, not to tell everybody "Here I am", you know.'
>
> Nigerian woman

This simple statement clearly reveals both the expected appeal of the perfume and the risk associated with that appeal. If the perfume were so noticeable that one would be aware of it on entering the room and it would tell everybody 'Here I am', this could be viewed as an open admission of sexual intent by the wearer, which would have extremely pejorative social connotations.

Another young woman refers to this risk quite directly:

> 'Of course, in our society here, we don't like very strong perfume, because if you use a strong perfume and you pass by the men, I'm sorry to say that this is what they always say: "She's smelling like a prostitute. She always puts on high perfume like a prostitute so as to draw your attention"'.
>
> Young woman, Kano, Nigeria

The insistence of many women that the sexual message they send out through their fragrance is directed only at the one person with whom they

already possess an established intimate relationship is akin to the claim of girls who wear miniskirts that they do so because of fashion, or to please a particular man, and not because they wish to attract the attention of men in general.

The relationship with the specific person for whom one is wearing a perfume is not necessarily primarily sexual, and the choice of perfume may depend on the nature of the relationship and on the role which the perfume wearer intends to play in that relationship. The type of perfume the individual chooses to wear may differ depending on whether she or he sees the required role in the relationship as that of faithful spouse, responsible parent, sensible householder, efficient career person, lover, 'man about town' or 'femme fatale', to name but a few of countless possibilities.

25.2.2 *Inner-directed motives*

Very often, however, a woman will insist that she uses perfume purely to please herself rather than to attract a particular man or men in general. If this is indeed the case, the motive usually appears to relate to a need for fantasy in her life, as represented by an idealized image that she has of her true or her aspirational personality. Such fantasies are, of course, the stuff of which advertising is made and explain the use of glamorous role-models and aspirational lifestyles in promotion of perfume brands.

Other inner-directed reasons that women give for wearing perfumes are related to such considerations as the desire to express their femininity and individuality, and to increase their sense of self-esteem. The notion that self-esteem can be enhanced by wearing a perfume suggests that the need for social approval also plays an important role in motivating perfume use.

> 'I would say that it's a male misconception that women wear perfume to attract men, because perfume belongs to yourself. It's something very individual and it's a question of how you feel about yourself. They use sex in their advertising to show, well, that you want to be a sex goddess and attract as many men as possible, so they say "use our perfume". I think it's ridiculous. I think that wearing a perfume is for your own self-image, just to feel better, you know, to smell nice.'
>
> American woman

25.2.3 *The social dimension*

As people move out of subsistence patterns of life, their total lifestyle becomes ever more important. Rising living standards permit greater opportunity for more elaborate and diversified lifestyles, whether in actual or aspirational terms. One's lifestyle manifests itself in the way one presents oneself in public in terms of dress, grooming, mode of speech, demeanour and, increasingly, in terms of smell. There has been a huge expansion in the commercial exploitation of fragrances in personal grooming, such that women and men can feel

quite unprepared, or even 'naked', if they have forgotten to put fragrance on before going out.

> 'It's very much part of my preparation in the morning. In fact there are some mornings when I leave the house rapidly and forget to put cologne on. I have to get out of the car and run back in, because I do not feel complete without cologne on.'
>
> American male

People also lead increasingly compartmented lives, requiring them to play a greater variety of roles, in conformity with the different social expectations of the various groups of people with whom they are associated in the different segments of their lives. Fragrance studies conducted by us over the years reveal numerous examples of the influence of social expectations and role playing on people's perceptions of the appropriateness of perfume use and the suitability of different fragrance types for different contexts.

There is, moreover, a good deal of evidence from consumer research that perception of perfume suitability varies in accordance with the circumstances in which it is to be used. Again, this confirms the view that perfume is used as an accessory to prepare the wearer for and support him or her in social interactions. The considerations include the mood of the perfume wearer at the time a perfume is chosen, how the wearer of the perfume intends to dress, where and at what time of day or night the fragrance is to be worn, what the nature of the occasion is, whom the wearer is going to meet or may encounter by chance, the purpose of the encounter, the nature of the relationship between the wearer of the fragrance and the people he or she is likely to encounter, the atmosphere of the occasion, the ambiance of the location, etc.

> 'When I wear perfume it depends what I am wearing, like Chantilly is a pink smell. If I was to wear Tabu, I'd probably be wearing black and it would be nighttime.'
>
> American woman

The reason why such considerations are important is that wearing a perfume says a great deal about the kind of person the wearer is and about what his or her intentions are *vis-à-vis* the people who will perceive the fragrance. In choosing and wearing a perfume, the perfume user therefore attempts to exert a degree of conscious control over the message he or she is communicating. The perceptual characteristics and associations of the perfume are therefore extremely important considerations in perfume choice (compare Jellinek, 1992).

Perfumes can be expensive; their use can therefore represent an ostentatious display of wealth, status and power. This is true not only in modern consumption societies:

> 'Some of the rich men, when they go to the Mosque they will use a really expensive perfume. I know of an occasion when a colleague had got a bottle of perfume, very small, which cost him about 50 Naira, and he emptied the whole bottle in the front of his robe.'
>
> Old man, Nigeria

In this instance, it is difficult to disentangle the motives of status display and of piety, for fragrance also has mystical significance as a libation or offering to God. It sanctifies the place of worship, purifies the worshipper and symbolizes obedience to the faith. The more valuable the offering, the greater the piety of the worshipper.

25.2.4 *Mixed patterns of motivations*

Within any one individual, the interpersonal, inner-directed and social motives for fragrance use may not all be equally pronounced but most people appear to act on a mixed pattern of motivations. This observation prompts the inclusion of a quotation from a group discussion conducted by the author a few years ago in the US on the subject of men's fragrances:

> 'I'm self-employed, so I don't have to impress anybody. I wear a fragrance simply because I shave, so I wear an aftershave. If my wife didn't care, I'd probably throw rubbing alcohol on. It really doesn't make that much difference to me. My wife likes Lagerfeld, so I wear it, but I like the smell of people. I think that's a very nice smell and I don't see any reason to kill it. Besides, the fact is that I also do quite a bit of hunting and when you're out hunting for any type of big game, it's not a good idea to wear fragrance, or you're not going to see anything to shoot. I've got a set of old hunting clothes that have been sitting in deer urine for years and they stay that way. I just sprinkle it on my hunting clothes and keep them in a plastic bag in my closet when I am not using them.'
>
> American male

One cannot help wondering how the speaker acquired the deer urine in the first place but the quote provides an illustration of the effect of different social contexts and roles on attitudes to perfume use. The speaker, in the role of a hunter, expressly avoids perfume and uses deer urine to mask all traces of human odour. As an individual, he says that he actually likes the natural smell of people and, as a self-employed person, he does not need to wear perfume to impress other people. As a rugged individualist, he would just as soon use rubbing alcohol but, as a considerate husband, he wears Lagerfeld.

25.3 Changes of attitudes over time

A rooting of perfume culture in the immutable primal sexual drive would mean a culture that, in its basic structures, changes little if at all with time. Actually, however, we observe shifts in attitudes to fragrance use and in perceptions of perfume appropriateness that parallel changes in social contexts, expectations and roles.

Men's fragrances are a typical case in point. Studies in the UK and the US over the last 30 years have revealed a dramatic change in men's attitudes to wearing perfume. Strong consumer resistance used to be encountered to

fragrances promoted specifically at men, particularly from older men in manual occupations. They fully concurred with Paul Jellinek's statement (p. 26) 'the man of culture ... must not smell as though he were "using fragrance". The odor about him must be, so to speak, a side-effect of his grooming.' The initial adoption of the word 'aftershave' instead of the term 'perfume for men' or 'men's cologne' is of interest: it provided men with a convenient rational- ization for using scent.

Aided by the encouragement of women, this resistance has given way, over the years, to increasingly widespread use of fragrance by men. The rationalization implied in the term 'aftershave' is no longer required, and men's colognes account for steadily increasing shares of the market. It is not accidental that the contemporary American who, in our interview, said 'I do not feel complete without cologne on', used the term 'cologne'.

25.4 Conclusion

Despite our still inadequate understanding of the psychological mechanisms underlying human uses of and reactions to odours, the efforts of the many researchers interested in these issues are beginning to throw more light on the question of why people wear perfumes.

There is an increasing consensus that human reactions to odours are to a large extent learned rather than innate or 'hard wired'. In addition to biologically determined factors, therefore, we also need to recognize the importance of cultural and social influences on perfume use, bearing in mind the diverse variety of socio-psychological factors which influence individual behaviour. While we need to acknowledge the central importance of emotional factors in human responses to odours, we also need to appreciate the role played by cognitive processes in mediating these responses, particularly in the case of man-made perfumes. People's motives for wearing perfumes are, in many circumstances, undoubtedly sexually determined. However, in other circumstances, people also wear and choose perfumes for a variety of different reasons, incidental to the sexual arena. These include, among many others, the desire to reinforce social confidence, to express one's mood or personality, to conform to group expectations or to affirm group affiliation, to accommodate to the ambience of leisure or work environments, to demonstrate wealth and social status, and, last but by no means least, simply for pleasure.

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26 The psychological basis of perfumery: a re-evaluation

J. STEPHAN JELLINEK

Paul Jellinek's theory was the first to claim to offer a psychological explanation of the composition of perfumes and it has remained the only one of its kind up to this day. Some of its parts have been widely accepted in various contexts and belong today to the established wisdom regarding perfumery. Thus, the hypothesis that perfumes serve to enhance sexual attractiveness is restated time and again in the popular and women's press; it also forms the basis of a great deal of perfume advertising. The statement that perfumes owe their erotic effect largely to materials such as musk and ambergris was commercialized, with enormous success, in the musk perfumes of the 1970s and 1980s, although Jellinek himself had neither anticipated this development nor did he approve of it. A leading aromatherapist of our time found the Odor Effects Diagram to be a confirmation of his own insights regarding the effects of odors on the soul (Tisserand, 1988), although Jellinek had never concerned himself with aromatherapy. The thesis that the natural odor of the human body plays an important role, *also in the positive sense*, is the central thesis of the only book about perfumes that ever became an international bestseller (Süskind, 1985).

Occasionally, parts of the theory were also criticized. Thus, Schmidt found the 'view that all tendencies in perfumery and its psychological effects could be explained and registered purely from the erotic or sexual point of view' to be 'simplistic and in part even rather primitive' (Schmidt, 1953). An anonymous English reviewer (Anon., 1952) objected to the paucity of solid evidence for the hypotheses offered in the book. Mensing and Beck (1988) offered a system for personal perfume selection based on the relationship between personality structure and odor preference in place of what they called 'the view that outward attributes such as hair or eye color determine perfume choice' – alas, a highly oversimplified representation of Jellinek's thesis.

The most thoughtful criticism came from Blaizot (1963) who described the classification of odors in the Odor Effects Diagram as a merely practical one and suggested supplementing and verifying it by means of physiological measurements of the effects of odors on the human organism. A great many researchers have actually embarked on this undertaking during the past 10 years (Jellinek, 1994).

The attempt to offer a critique of Jellinek's theory as a whole on the basis of scientifically established and empirical findings, and to update it, is made for

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Table 26.1 The structure of Jellinek's theory

1. Odor sensations bring about changes in the momentary psychological condition of the perceiving subject.
   - 1a. Individual exceptions apart, the effect of a given odorous material is the same for all people.
   - 1b. The effects are context-dependent.
   - 1c. The effects are concentration-dependent, often also in their quality.

2. The effect of a mixture of odorous materials is the sum total of the effects of its components.

3. The basic dimensions of the effect of flower odors and of perfumes are described by the polarities
   - erogenous–anti-erogenous
   - narcotic–stimulating
   - 3a. Odorous materials whose odor is reminiscent of the odor of the human body are erogenous.

4. Modern perfumery aims at creating or enhancing sexual attractiveness.
   - 4a. Every perfume for women contains erogenous components.
   - 4b. The effect of a perfume on sexual attraction is the result of the interplay of its erogenous, anti-erogenous, stimulating and narcotic components.
   - 4c. The optimal balance of the four component effects differs from one person to another and results from a combination of the factors: hair color/skin type, type (mother/mistress, feminine/masculine), behavior (naive/artful), age and activity (home/office/sports/society).
   - 4d. In men's fragrances, erogenous components are to be avoided.

the first time in this fourth edition of his book. This closing chapter presents a summary of the results of this critique. Its organization will follow the basic structure of the theory outlined in Table 26.1

26.1 Odor sensations bring about changes in the momentary psychological condition

Although Jellinek does not explicitly state this thesis, it is a basic precondition for his theory. Ample evidence proving its correctness is available today. Lawless (1991) and Jellinek (1994) offer reviews of the relevant literature; additional findings are cited in the chapters by Gower, Steiner and Dollase in this book (Chapters 22, 23 and 24, respectively).

It should be noted that Jellinek employs this thesis in a rather restrictive sense. Although he defines odor effects as 'our physical and psychic reactions to odor sensations' (p. 90), he nowhere considers physiological effects such as changes in pulse rate or hormonal state to be objectives of using perfumes, nor does he touch on the field of aromatherapy. He distinguishes (p. 10) between the 'erotic' effects of aphrodisiacs, triggered with a time lapse, e.g. by the stimulation of certain glands, and the 'erogenous' effect of odors, elicited

purely and only by the perception of the odor and occurring more or less instantaneously, and he confines his attention only to the latter.

The effects to which he refers are always momentary; lasting effects are not considered. His concern, at least with alcoholic fragrances, is always with the effect on others, not with changes in the psychological state of the wearer her- or himself.

26.1.1 *Individual exceptions apart, the effect of a given odorous material is the same for all people*

Behaviorist psychologists have disagreed radically with this view. In studies on children, cited in Dollase's and Bain's chapters of this book, Engen and his collaborators (1988) found evidence which they interpreted as indicating that human reactions to odors, their enjoyment or rejection, are not innate but acquired. From this insight Engen (1988) concluded that human reactions to odors do not depend on the odor as such but only on the situation in which this odor was first or has regularly been smelled and with which it has become associated. According to Engen, a person who has consummated a love affair in a garage may find the odor of diesel oil erogenous. This behavioral hypothesis, however, has remained controversial to this day (Menella and Beauchamp, 1991).

Jellinek also recognizes and cites idiosyncratic associations resulting from individual experiences (p. 11) but he considers them to be troublesome individual 'peculiarities' rather than the rule. Although he does not mention anosmic and allosmic conditions, he probably would assign these to the same category.

Although Engen's hypothesis is fundamentally opposed to Jellinek's assumption of the universality of odor effects, the two are not entirely incompatible in practice. The situational learning of the meanings of odors (according to Engen) does not exclude the large areas of communality in the experiencing of odors which Jellinek postulated. It is, for example, quite plausible that the great majority of mankind has had its most memorable experiences with the odor of the sexually aroused body in the context of the act of love and that for them, therefore, this odor carries erotic associations.

Such communalities of experience may come about not only with odors of natural origin but also with the scents of widely known artefacts such as popular fragranced cosmetic products. An impressive manifestation of this phenomenon is the association, nearly universally present in the US, between the scent of Johnson & Johnson's baby powder with the world of mother and child, and hence with its emotional correlates such as mother love and protectedness. Not only has Johnson & Johnson's baby line (all products of the line have the same type of scent) dominated the American babycare market for generations, it has, by this very dominance, forced all other baby lines to adopt similar fragrances. The high acceptance of sweet powdery notes in

fragrances for adults in the US has been attributed to this learning process. The question of which plays the greater role here, the learning of the infant (with associations of being pampered) or that of the mother (with associations of self-realization in the mother's role), must be left unanswered. Incidentally, Jellinek never makes it clear to what extent the effects of odors are ascribed to cognitive learning effects or to neurophysiological processes. He explains the effect of erogenous materials by their association 'with images of the body, of the flesh' (p. 37), a purely cognitive argument. On the other hand, he explains the effect of narcotic odor materials by 'assuming that the odorant vapors do not take the detour through the blood circulation but enter the central nervous system directly by way of the sensory cells, through the cribiform plate and the olfactory nerve' (p. 51). Again, however, he excludes a physiological effect.

Jellinek does not take into account, however, that the odor effects based on learning from experience with artefacts are, in principle, culture specific. It is true that an investigation (Schleidt *et al.*, 1988) has uncovered amazing parallels in odor evaluation in cultures as different as Germany and Japan, and the largest odor test of all times, conducted jointly by the National Geographic Society (Washington, DC), and the Monell Chemical Senses Center (Philadelphia) and involving 1.4 million respondents world-wide shows a high level of agreement in the evaluation of six odorous materials across all cultures (Gilbert and Wysocki, 1987). (These tests do not deal with odor effects in Jellinek's sense but perhaps it is permissible to conclude similarity in odor effect from similarity in patterns of acceptance and rejection.) Nevertheless, wherever pre-cognitive mechanisms have not been proven it is prudent to confine the validity of odor effects to the culture in which they were observed and not to assume them to be universal to all mankind until and unless they have been shown to be so. It is, in fact, likely that some of Jellinek's observations regarding odor effects do not apply to, say, the Arab or the East Asian cultures.

26.1.2 *Odor effects are context-dependent*

Jellinek is well aware of the context-dependence of odor effects and cites a number of examples.

Dependence on momentary external conditions and inner dispositions. 'Time of day, season, temperature, lighting conditions, etc. are external circumstances; physical or mental fatigue, freshness, satiety or hunger, happy or depressed mood, etc. are personal predispositions which can critically affect the receptivity for and the judgement of external stimuli, especially in the case of odors' (p. 10).

Dependence on the composition in which a perfumery material is used. 'For example, neroli oil is judged to be erotic when used in the Eau de Cologne

complex but anti-erogenous in a gardenia or Quelques Fleurs composition' (p. 18).

Dependence on other, simultaneous impressions. This applies in particular to erogenous odor materials reminiscent of the odor of the human body: 'The odors of perspiration and feces as such are repulsive; they become erogenous only if accompanied by thoughts and imaginings of an erotic nature that may or may not have been elicited by these very odors. In the same way, the odor impressions generated by the perfume materials discussed here become erogenous only if accompanied by other simultaneous sensations' (p. 44).

Naturally, the context-dependence of effects amounts to a relativation and limitation of the assignment of specific effects to given perfume materials. It has been demonstrated that the effects of fragrances, i.e. of mixtures of perfume materials, also can be significantly affected by external influences such as knowing or not knowing their identity (Jellinek *et al.*, 1992).

26.1.3 *The psychological effects of odor sensations are concentration-dependent, often also in their quality*

This observation, cited by Jellinek on pages 11 and 32, has been confirmed time and again in olfaction research, for example in several of the investigations discussed by Steiner in this book (compare also Gross-Isseroff and Lancet, 1988).

26.2 The effect of a mixture of odorous materials is the sum total of the effects of its components

This is another hypothesis which Jellinek never states explicitly but constantly implies when he seeks to explain the effect of a flower odor or a fantasy perfume from the effects of its components. In view of the paucity of experimental investigations into the odor effects of mixtures it is perhaps not surprising that, as far as this author has been able to ascertain, only two published studies refer to this question. Using a semantic differential technique, Paukner (1965) tested several variants of a perfume, differing in the level of a musk–ambergris complex they contained, and found that the higher the musk–ambergris level, the closer the perfume came to an imagined 'ideal erogenous perfume'. Steiner (section 23.9) tested bergamot oil, lavender oil and a mixture of the two for activation by both an electrodermal activity and a direct-ranking technique and found in both cases that the mixture was less activating than either of its components. In both of these studies the statistical significance of the findings is hard to assess and doubtful. The sparseness of proof notwithstanding, the

perfumer in his daily work proceeds on the unspoken assumption that the components of a perfume and their relative quantities determine its total effect.

This thesis, although seemingly plausible, is irreconcilable with the behaviorist view that odors owe their meaning – and hence also, it is safe to say, their effects – to the situations in which they were perceived. The great majority of our odor experiences in daily life do not involve single perfume materials but mixtures, often very complex indeed. Therefore, the odor effects would be elicited first and foremost by mixtures, not by single materials. From this perspective, the odor of lemon oil, for example, is fresh not because the oil contains stimulating citral and anti-erogenous limonene but because the lemonade which we drank as a child used to refresh us on hot days. Citral and limonene owe their stimulating and anti-erogenous characters, respectively, to the simple fact that both remind us, in different ways, of lemonade. If we lived in a country where orange-flower water were a popular summer drink we would find the odor of orange flower refreshing.

In this way, the findings in two American studies in which heliotropin was found to be sleep-inducing or stress-relieving, respectively, could be explained (Badia *et al.*, 1990; Redd and Manne, 1991). Heliotropin is a component of the universally known Johnson & Johnson's baby products (compare p. 242). Commenting on the finding, also in an American test, that an apple–nutmeg odor possesses stress-reducing effectiveness, Lawless (1991) remarks that this is the odor of apple pie, the popular American dessert.

In its ultimate consequence, the view that odor effects originate in mixtures, not in components, negates the entire logical structure which underlies *The Psychological Basis of Perfumery*. In actual fact, a strict either/or is probably not appropriate here. Apart from any effects caused by direct action on the limbic system and on the central nervous system, the effects of individual perfume materials are probably rooted in our experiences with the mixtures of which they are characteristic components. However, the individual materials then contribute these effects to new mixtures in which they are employed.

We may consider the psychological effect of the perception of a mixture to be the result of three factors: the situation in which the perception occurs, earlier learning and conditioning processes, and the mixture's components. The relative contribution of these three factors differs according to the situation. When an odor is perceived in an emotionally potent situation, the imparting of meaning to the odor by the situation predominates. With odors which have been associated with emotionally significant situations at earlier points in time, the associations acquired by learning and conditioning play the main role. In more neutral situations, e.g. when we examine an unfamiliar odor on a smelling strip, the effects of the components predominate. Studies on mixtures have shown (Laing and Francis, 1989; Laing, 1991) that the components of mixtures are not normally recognized as such. Therefore, the components of a mixture would have to contribute to the overall effect without being recognized.

26.3 The basic dimensions of the effects of flower odors and of perfumes are described by the polarities erogenous–anti-erogenous and narcotic–stimulating

Jellinek derived his Odor Effects Diagram, based on the dimensions erogenous–anti-erogenous and narcotic–stimulating, from a consideration of the components of the jasmine complex (p. 49f). Blaizot (1963) proposed that the effects postulated in this diagram be objectively verified by 'organo-physical' measurements. Experiments of this kind have been conducted by a considerable number of research teams over the past 15 years.

The erogenous effect has been studied mostly on 5α-androstenone and 3α-androstenol as well as, less extensively, on some synthetic musk odorants. The findings are discussed in Labow's and Gower's chapters in this book. They are far from unequivocal.

Using a semantic differential approach, Paukner (1965) showed that a musk–ambergris complex makes perfumes more erogenous. Warren and Warrenburg (1993), using an adjective-list technique, showed that several flower bases enhance 'sensuality'.

The stimulating or calming effects of odorous materials have been and continue to be investigated by research teams around the world using a wide variety of methods. Electrical brain activity is measured, skin electrical resistance, pulse and breathing rates are determined, reaction rates are observed and people are asked to record their momentary state of feeling. In a number of instances statistically significant results have been obtained but the overall picture remains unclear. Where different test methods are used the results for the same substances often appear contradictory, and the methods or conclusions of one research team are often challenged by others. Lawless (1991) and Jellinek (1994) offer extensive reviews of this work. Steiner's chapter in this book also provides a taste of the contradictions facing research in this field. It is hoped that continuing research efforts will provide more clarity in the not too distant future.

26.3.1 *The empirical validation of the Odor Effects Diagram*

Although the erogenous, stimulating or narcotic effect of the individual perfume materials has yet to be proven scientifically, the Odor Effects Diagram has received remarkable confirmation by some investigations on perfumes. In a multi-dimensional scaling of ten commercial perfumes based on free descriptions by female perfume users, the two dimensions along which the perfumes were most clearly distinguished were heavy–light and floral–non-floral (Jellinek, 1992b). The kinship of these dimensions with erogenous–anti-erogenous and narcotic–stimulating was made even more apparent by the way the perfumes were assigned to these dimensions. Another consumer study,

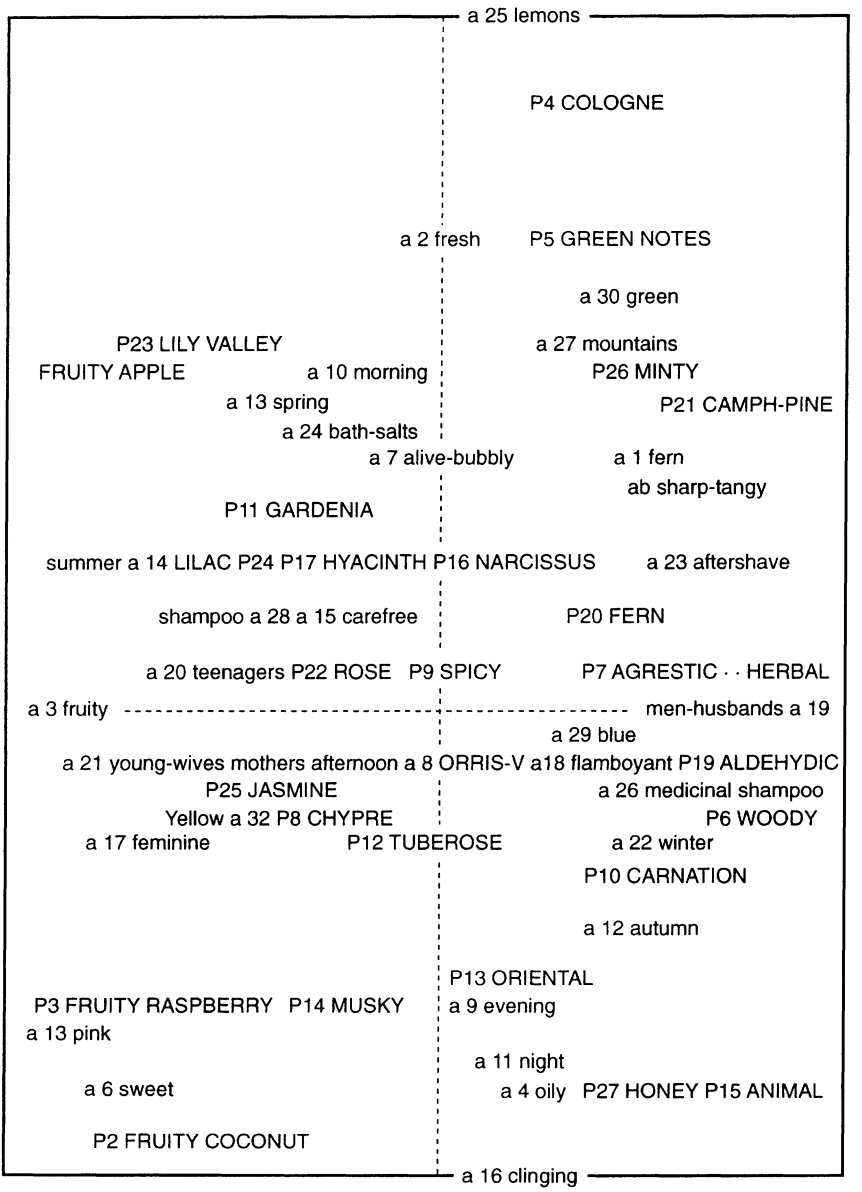


Figure 26.1 Two-dimensional mapping showing the relationships between odors and verbal concept statements (Thibout, 1991).

again with ten popular fragrances, resulted in a projection in which the dimensions sensual–cool and sensitive–passionate clearly emerged (Jellinek *et al.*, 1992), a confirmation once more of the basic dimensions of the Odor Effects Diagram.

A two-dimensional projection of a similarity matrix developed from interviews with consumers in the US, England, Spain, Brazil and Japan relating both to defined perfume bases and to verbal descriptions (Figure 26.1) also exhibits striking similarities with the Odor Effects Diagram (Thibout, 1991). Reviews of the fragrances used in commercial skin- and hair-care products as well as in soaps, fabric-care and household-care products time and again demonstrate the timeliness of the psychology of the Odor Effects Diagram. In gentle, caring products, for example, the dominant note of the fragrances used is almost universally calming or narcotic, no matter whether the product category studied is skin cream, shampoos or furniture-care products. In products marked by activity, either literally, medicinally (e.g. dandruff shampoos or acne lotions) or metaphorically (as in sport-related products), the focal point of the fragrances used is almost always fresh or stimulating. Fragrances with a marked erogenous note are to be found almost exclusively in products in whose positioning the beauty and elegance of the (female) user is stressed. In spite of male emancipation in matters of fashion the focal point of fragrances for masculine products is to be found in the right-hand half of the diagram, for feminine products in the left-hand half. The unisex products are to be found at the top (refreshing waters) or at the bottom (musks) (Anon., 1985).

A typical example of such a survey is shown in Figure 26.2 which comes from a consumer test of commercial and experimental toilet soaps conducted in 1992 in Göttingen, Germany with 108 respondents (Scharf *et al.*, 1992). If the graphic is turned clockwise by 90°, 'fresh' and 'sporty' appear on top, 'mild' in the left upper region, 'floral' right on the left, 'sweet' and 'women' at the lower left, 'Oriental' at the bottom, and 'men' and 'dry' to the right: a spontaneous, unintended but nearly perfect reproduction of the Odor Effects Diagram by respondents who had never heard of it.

In summary, the odor effects postulated by Jellinek still await verification in the physiological or neurological sense despite a great number of relevant investigations. The Odor Effects Diagram, however, has been repeatedly confirmed as an adequate representation of the psychological impressions created by commercial fragrances among consumers belonging to the Euro-American culture.

26.3.2 *Odorous materials whose odor is reminiscent of the odor of the human body are erogenous*

The claim that a number of materials commonly used in perfumery are similar in odor to components of human body odor has been confirmed by analytical findings during the past 20 years. First and foremost, the discovery of

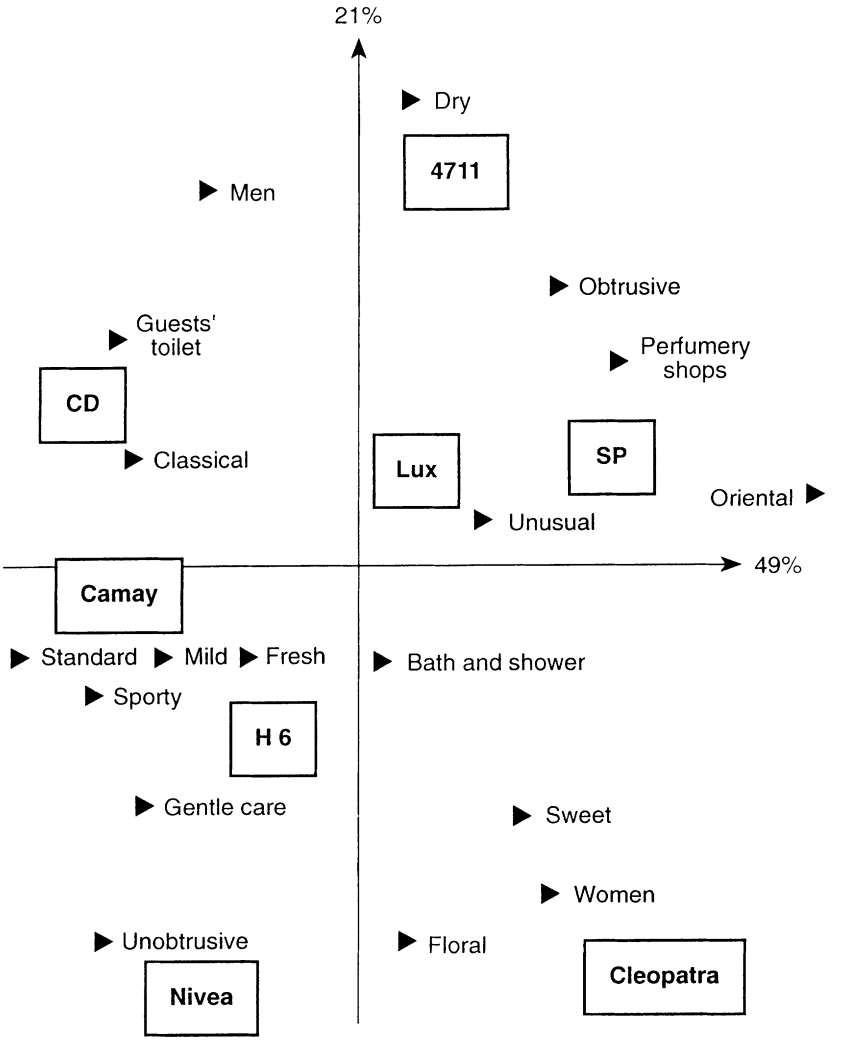


Figure 26.2 Soap perfumes and descriptions in a blind test (Scharf *et al.*, 1992).

androstenone* and androstenol, with their musk-like odor, must be mentioned. This discovery is fully described in the chapters by Labows and Gower in this book (Chapters 21 and 22). Since the odor of androstenol is also distinctly related to sandalwood, the latter should be inserted into the list of perfumery materials reminiscent of human body odor.

* Paul Jellinek, incidentally, did not believe the media reports regarding a pheromone-like, irresistible sexual attraction exerted by androstenone which appeared in the early 1970s.

Far more is known today than in the days when the first edition of this book was written about the lactones that play key roles in the odor of the hairy parts of the body and about the fatty acids in perspiration and genital odor (see Chapter 21). On the basis of these and other recent analytical findings it appears perfectly legitimate to include a number of fruity odors, including blackcurrant and several tropical fruits and also chamomile oil with its distinct isovalerianate component, among the perfume components reminiscent of the human body. Recently, materials which smell like algae and seafood have also been used in perfumery. The kinship of such odor notes with the smell of the urogenital region has repeatedly been noted (Blaizot, 1963).

There exist, therefore, quite a number of perfume materials which may plausibly be assumed to possess the capacity for evoking associations with the human body, even though such associations have hardly ever been experimentally demonstrated. However, the thesis that such associations are of necessity linked to erotic images appears less plausible. Jellinek himself qualified it by remarking (p. 44) that 'the odor impressions generated... become erogenous only if accompanied by other simultaneous sensations.' In our current view this qualification must be taken quite seriously. At the root of the thesis is the notion that each emotionally positive image of the closeness of another human body must be erotic in tone. This reminds us of the Victorian age, when public morality proscribed the total draping of the female body with the result that the uncovering even of the female ankle was experienced as highly erotic.

We know for a fact today that infants just a few days old are aware of the odor of their mother's body and breast and even recognize their mother by her specific odor (Schaal, 1988). We also know that odor memories may linger for a lifetime. Is it not feasible that the first, most important odor sensation of our lives remains alive in us, even if unconsciously, for the remainder of our days? Would such an odor not signal protection and human warmth rather than sexual adventure? In American perfume briefing today there is often mention of the 'nuzzle factor' that a fragrance should possess (Benaim, 1991). This factor spells security rather than sexuality, unless, of course, we consider, with Freud, even the mother–child bond as fundamentally erotic.

Perhaps we should qualify the erogenous effect of human body-like odors as follows. Odors reminiscent of the urogenital and anal regions are distinctly erotic in tendency. In odors from the other body regions this tendency, if it exists at all, is only faint.

26.4 Modern perfumery seeks to create or enhance sexual attraction

It is revealing that Jellinek expressed his central thesis in this way in the first chapter of his book (p. 3). Today we would be more inclined to say: 'People today seek in perfumes a way to enhance their sexual attractiveness.' The consumer-centered marketing mode of thought, so typical of our epoch, was

foreign to Europe in the 1940s. To be fair we should have to test Jellinek's claim on its own ground and ask perfumers and the marketing directors of perfume houses whether they really seek to create and offer the consumer perfumes which enhance sexual attractiveness. Perhaps we would find a surprising measure of agreement, especially among the marketing directors.

The general thesis which was Jellinek's starting point and according to which all human activity is motivated either by the survival or the sexual drive (p. 3) is no longer considered tenable today. Moreover, in the closing decade of the twentieth century we cannot consider the question of the purpose of perfumes without thinking of the consumer. We must ask him or her. This has been done, although, as Dollase indicates in Chapter 24, more rarely than might be expected. In Chapter 25 of this book Bain summarizes his insights from several decades of consumer research. Dollase's and Bain's arguments may be supplemented by the results of a survey conducted in 1992 among 317 female college students in the US (Mademoiselle, 1993). Seventy-three per cent of the respondents gave as the reason for using perfume 'to feel good about myself'. The reply 'part of my beauty routine' also found 73% agreement. 'Attractiveness to others' (of both sexes) was chosen by only 48% of the students as a reason for fragrance use and only 35% considered 'to attract the opposite sex' as appropriate to themselves.

Undoubtedly there are difficulties with this kind of direct questioning regarding reasons for doing things. For one thing, the consumer is often not aware of his or her own motives. This is particularly likely to be the case with products such as perfume about which there is little reflection, and where feelings and thoughts are hard to verbalize. Moreover, when people feel that their motives might not be in line with current morality they tend to substitute other motives which they consider more acceptable. Consciously or subconsciously, they avoid placing themselves in a bad light. In the case of perfumes this means that surveys rarely inform us about irrational motives even though such motives may in fact operate. This problem can be circumnavigated by posing questions not verbally but, for example, by asking the respondents to express their notions and feelings by drawing pictures or pasting collages. Then, however, there is always the possibility that the experimenter's interpretation of the findings is colored by his or her preconceptions.

In a study of this kind (Contest-Census Institut, 1989) conducted in Germany with three respondent groups (women aged 18–25 years, women aged 30–40 years and men aged 20–27 years), the main motives uncovered were as follows. The women in the 30–40 age group used perfume to enhance 'a positive feeling' in such a way that they could 'influence others as well as themselves in this direction of feeling' in an 'unobtrusive manner, without revealing their purpose'. To the extent that the 'positive feeling' is erotic in tonality, this motive is certainly in line with Jellinek's thesis.

The women of around 20 years old, however, used fragrance 'to feel good in a social sense'. By her scent aura the young woman can 'express her personal-

ity', 'define her social position' and 'demonstrate how she wants to be seen'. Here we are reminded of Dollase's thesis of the symbolic and self-referent value of fragrance. At the same time this aura can serve to 'keep her at a desirable distance from the urban crowds surrounding her', an interesting motive that has repeatedly appeared in recent surveys and found literal verification in observations by Nesbitt and Steven (1974). The French cultural historian Marylène Delbourgh-Delphis (1983) said: 'Like fashion, fragrance is the art of gentle escape. In the midst of ordinary life, it creates a privileged space'.

For the young men in the study, fragrance was 'the domain of mature women' and its effect was seen as 'so powerful that it might make them a slave to female desires' – an echo of Baron's findings in the US, cited by Dollase (p. 223).

Thus, this study shows the erotic aura to be certainly an important motive for fragrance use but not the only one. In Chapter 24 of this book Dollase outmaneuvers the respondents' rationalizing tendencies in a different way, by a naive-psychological re-interpretation of the findings of consumer studies. He arrives at the insight that the perfume user (following Jellinek we shall limit our attention to the female user), seeking with her fragrance an effect on others, can rarely verify whether such an effect was actually achieved. In most cases she does not know what effect her fragrance has on the other person, she does not even know whether it has any effect at all. In her actions she must therefore rely largely on her own expectations. These, however, are shaped by the fragrance's effect *on herself*. Thus, her perfume becomes the expression of her own feelings. If her feelings about fragrance change with her mood or with the situation, her fragrance becomes an expression of her state of feeling at that moment.

For the user herself, her perfume is not simply a scent, an impression of her senses. By the associations which it calls forth in her and by the suggestive force of associated elements such as packaging, name and advertising, the fragrance becomes, to her, a symbol. Since the specific brand is rarely recognized by others, the effect of the symbol is even harder to transmit to others than is the effect of the scent as such. In Dollase's words (p. 229), the perfume becomes 'self-anointment' and the satisfaction that comes with its use stems from a 'strong internalization of symbolic values'. A similar view is expressed by the statement 'in our unconscious representation, perfume is the embodiment of hidden powers – the scent is their sign – and, using it, we transmit these powers to ourselves' (Jellinek, 1992a).

'Creating distance' and 'symbolic self-anointment' are quite different from 'creating or enhancing sexual attraction'. There is no more objective, statistically significant proof for motives such as 'protective aura' or 'self-anointment' than there is for the sexual one. The evidence for all of them consists only in responses of consumers to questions and from patterns of observations. However, the recognition alone that they are, along with enhancing sexual

attraction, plausible motives for perfume use breaks the monocausality of Jellinek's theory.

The picture that emerges from surveying current psychological literature and consumer studies with a mind as free as possible from preconceived theories shows a multitude of objectives and motives aiming in part at the user herself, in part at specific other persons and in part at the people around in general.

26.4.1 *Every perfume for women contains erogenous components*

This thesis leads us directly to a paradox of modern perfumery that has led to widespread misunderstanding: the musk paradox.

Natural musk is the extract of a scent gland of the sexually mature male of a deer species native to the foothills of the Himalayas. The material has been known since antiquity. It is said to have been one of the prophet Mohammed's favorite scents. A thousand years later Josephine, Napoleon's Haiti-born wife, loved it and used it lavishly. Erotic powers have often been attributed to it (Ellis, 1936). Because of the kinship of its 'pungent–ammonia-like, sweet–nutty and bitter–animalic' odor, Paul Jellinek (p. 40) classified it among the erogenous odors. All of this refers to infusions of musk tonquin, to natural musk.

Ever since the days, around 1970, when the so-called 'Musk Oil' appeared in the hippie stores of San Francisco, starting a triumphant fashion trend that was soon to sweep the East Coast of the USA and then the entire western world, everyone, young and not-so-young, has known what musk is. He or she knows the mysteriously erotic aura of Musk Oil and the countless similar products that appeared in its wake – an aura that was and has remained the central theme, first by word-of-mouth propaganda and then of more or less subtle magazine adverts and television commercials.

Since about the same time, however, natural musk has hardly been used any more in perfumery. The native hunters were so effective in their quest for the rare and precious prey that the musk deer was threatened with extinction. For many years now it has been a protected species and hunting it is prohibited. All attempts to raise the animal in captivity having failed, the price of natural musk has risen to dizzy heights. A recent quotation for musk absolute was at close to US$ 700 000 per kilo.

Fortunately, the perfumer has had a number of synthetic replacements available for the past 100 years. The palette of synthetic musks has steadily been expanded, most notably in the 1950s and 1960s. None of these substances, however, exhibits the complex odor of natural musk. Their odor centers primarily around the nuance described by Jellinek as 'nutty–sweet'. Consequently, Jellinek (p. 75f) classified the synthetic musks as primarily narcotic, not erogenous. In a consumer test designed to encourage the detection of animal nuances only 10% of the odor descriptions provided for a typical

synthetic musk (cyclopentadecanolid or Exaltolid) referred to animal aspects. With androstenol, in the same test, the rate was 45% (Jellinek, 1987). In another study (Köster *et al.*, 1986), a significant positive correlation between concentration and acceptance was found for cyclopentadecanolid, indicating that this synthetic musk was the more positively accepted the higher its concentration. With androstenol there was a highly significant correlation in the opposite direction. This is what one would expect with materials reminiscent of human body odor: if too strong, they become unpleasant, even obnoxious, Hence, here is clear experimental evidence that at least one of the synthetic musks is not usually perceived as being reminiscent of human body odor.

The musk note in modern perfumes, including the so-called 'musks', comes exclusively from synthetic materials. Additional evidence that these materials do not contribute erogenous qualities is furnished by the fact that they are very widely used, at high levels, in the fragrances used in laundry detergents and fabric softeners – applications where animal odor notes reminiscent of human body odor would be the very last thing one would want. Synthetic musks were also used, at very high levels, in the 'green apple' shampoos that were the rage of the early 1980s. There exist 'musk bases' created by perfumers that closely approximate the complex odor of natural musk tincture with its distinct animal nuances, but these are not by any means used in all perfumes.

What has been said here about musk holds also for another legendary perfume material, the tincture of ambergris obtained from a substance excreted by the pot whale. The natural material is very hard to find today and its synthetic substitutes are far less animal in character. Two additional animal materials, civet and castoreum, are still available today in their natural form but they were never nor are they today used universally in perfumes.

Along with the perfume materials of animal origin, Jellinek cites a number of materials obtained from plants that possess odor nuances reminiscent of the odor of certain regions of the human body. Some of these (such as ambrette seed oil, costus root oil and orris oil) are, for various reasons, rarely used today, others (jasmine absolute is the outstanding example) are often replaced by artificial bases in which the animal principle is only faintly represented.

All in all, we must conclude that Jellinek's dictum that 'true perfumes... always require at their core a base with erotic effect' (p. 8) is today no longer necessarily true.

26.4.2 *The effect of a perfume on sexual attraction is the result of the interplay of its erogenous, anti-erogenous, stimulating and narcotic component effects*

This thesis (pp. 72, 74, 95) plays a central role in Jellinek's theory, explaining as it does the absolutely essential contribution of the non-erogenic materials to

a perfume's overall effect. Jellinek has never claimed that a perfume is the more sexually alluring the higher its content of erogenous components nor has he ever been a proponent of the 'musk' fragrances.

26.4.3 *The optimal balance of the four component effects differs from one person to another and results from a combination of the factors: hair color/skin type, mother vs. mistress, feminine vs. masculine, naive vs. artful, age and activity*

This thesis is echoed in the consumers' statements quoted by Bain in this book, to the effect that in the selection of a fragrance the user's desired role and the situation in which the fragrance is to be worn are essential criteria. At the same time, we find a characteristic difference in the tone of Jellinek's and Bain's arguments. Jellinek's assumes a strong identification of a woman with 'her' perfume. In our century, it has been the norm until the early 1970s that a woman used one perfume on nearly all occasions, 'her' perfume, and that she stayed faithful to this fragrance over a period of many years or even a lifetime. In the past two decades this attitude has undergone dramatic change. In recent surveys it has been found time and again that normal fragrance users, both female and male, at any one time have several fragrances, often four or more, on their dressing table, switching between these according to mood and circumstance. Perfume has become a woman's more outward attribute, a change strikingly reflected in the phrase 'wardrobe of fragrances' coined in the 1970s by the Fragrance Foundation in the US. Jellinek observed the one-perfume attitude of the women of his time, he did not advocate it. In fact, he remarked (p. 119) that using 'not just one favorite perfume, but... different perfumes according to... changing clothing or varying activities... is far more appropriate to a refined taste.'

In yet another way, Jellinek was ahead of his time. There is in his book a point which is, in truth, embarrassing. It occurs towards the end of Chapter 14. Having explained how the Odor Effects Diagram can be used to determine, for the first time ever in a systematic manner, what type of perfume is most suitable for each individual woman, he lists the perfumes corresponding to the various 'focal points' that may characterize a woman (p. 121). In this listing, 'most fashion perfumes, types such as Chypre, Mitsouko, Fougère, aldehydic perfumes', i.e. nearly all perfumes available in the perfumery stores of the time, correspond to the 'exalting' focal point, leaving for the countless women whose focal point lay elsewhere little choice beyond perfumes that were outdated at the time the book was written. Today, the situation has radically changed. The perfumes offered now, ranging from sultry florientals to fresh unisex perfumes, from calming light florals to stimulating men's fragrances – freely worn by today's women – really provide ample choice at all points and sides of the diagram.

26.4.4 *In men's fragrances erogenous components are to be avoided*

The cultural revolution that started in 1968 has also had a strong impact on this thesis. It has today largely lost its validity. The marked increase of animal and of floral notes in men's fragrances has meant that the dividing line between masculine and feminine perfumery has become less distinct and more flexible than Jellinek had anticipated. This thesis, incidentally, demonstrates the circumscribed cultural context to which Jellinek's theory referred. There has never been a clear demarcation between feminine and masculine scents in the Islamic or in the Pacific cultures.

26.5 Closing remarks

Our critical re-evaluation of Jellinek's book leads us to a conclusion that may at first glance appear paradoxical. The thesis of the sexual drive as the motive force and basis of explanation for all of perfumery can no longer be maintained. In spite of the abandonment of this central thesis, major parts of Jellinek's arguments have not lost their validity, for Jellinek was an excellent observer who did not permit his observations to be clouded by his theories. Having abandoned the arguments' biological underpinnings, we recognize, however, that his observations do not have the universal validity which Jellinek ascribed to them. They are valid only for the culture and the epoch in which they were conceived.

Any attempt to replace Jellinek's theory by a new one, based on the current state of knowledge, would be confronted by great difficulties. In Dollase's words, advances in knowledge have led to an exponential increase in unanswered questions. However, this should not be cause for resignation. Many questions related to the psychology of perfumery are today the subject of scientific investigations around the world. The hope that we shall soon know more about many of today's unanswered questions seems warranted. Perhaps, hopefully, this new edition of Jellinek's book will prove to have been some 10 years hence an interim report.

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