Perfumery Top, Middle & Bottom Notes: The End of the Road for an Outdated Theory?

……Every so often an idea or an article comes along which challenges the way we have traditionally looked at things. Such an article is described below; it is to do with the assessment of odours, which is a complex area, and now subject to a number of newer techniques. Although we may improve and refine our approaches in the art of odour description, we still fall back on some basic concepts……..

The Ancient Greeks.

To the Greek civilization, odour vocabulary was a problem and Aristotle explored the close relationship between smelling and emotion, and because the olfactory apparatus could be grounded in emotions like pleasure and pain, it was deemed incapable of transcending its physical matrix. Further, this emotional grounding was perceived to be responsible for the lack of odour vocabulary. We have come a long way since those times, but odour vocabulary is still a problem to the lay-person, who often has few words to describe smells in a way which will convey an accurate impression from one person to another. Perfumers have had to find words, and ways and means of describing their endeavours, and the system that has endured is based on the evaporative profile (see below).

Classical Top, Middle & Bottom Notes.

Much of the way we consider, describe and even design perfumes over the last several decades has been derived from the concept of top, middle and bottom notes. This concept is derives from the idea that a perfume will have layers of fragrance which can be progressively stripped away by normal evaporative processes. Thus when a perfume is freshly dipped onto a perfumer's strip (or daubed on the skin) the top note is initially perceived which progressively gives way to the top and bottom notes. We can say:

Top Note

The more volatile materials in the perfume give the first impression of the odour.

Middle Note

Bears the main theme of the fragrance

End Note

Traditionally regarded as fixing the perfume, consists of the long lasting notes.

Obviously the basis of this hinges on the fact the raw materials employed in perfumery differ in their relative volatility: the sharp fresh impression made by ethyl formate for example may flash off from a perfumer's strip within seconds or minutes, but the creamy precious wood notes of sandalwood oil may still be discernible on a dry-out 6 weeks later.

Returning to the performance of our perfume on the strip, ideally, the perfume should evaporate smoothly from top note to end note, with the fragrance theme apparent at every stage. This is more likely to happen in a fine alcoholic fragrance of course than in a household fragrance, which are less sophisticated/subtle. The concept of top, middle and bottom notes is deeply embedded in the philosophy of perfumery, and is unlikely to ever completely die, whatever new theory comes along. Whilst the ideas here are useful for the newcomer to fragrance creation, it is probably not the case that experienced working perfumers really worry too much about ratios of top: middle: bottom notes in their creative and matching work - certainly not in my experience. It has to be said that Cares, for example, describes this analytical approach in detail in a translation of a 1961 article in French which subsequently appeared in *Soap Perfumery & Cosmetics* **35**: 328-335 (1962) which he dramatically applies to Air du Temps. Paraphrasing his words however, he concludes that eventually the student perfumer will impose his own classification himself. The term (or concept) of "fixative" also seems somewhat out of favour now; it is not used so much anymore. It represents the idea that somehow by incorporating a suitably harmonious high-boiling, low volatility material in the fragrance formulation somehow the evaporation of the more volatile components is slowed. In fact we still see this described as late as 1978: see Jellineck J.S. (1978) "Fixation in perfumery - what we understand" *Perfumer & Flavourist* **3(4)**: 27-31.

The concept of the evaporative profile can particularly be successfully applied to the evaluation of essential oils. Dry-outs can give information which may be difficult to ascertain from and initial impression: information such as the character changes on dry-down, the revelation of underlying notes, the presence "dirty-notes", persistence on the strip, soapiness, readiness to oxidise and so on. Some ideas on potential usefulness in application are thereby gained. Some idea of quality, commercial value, naturalness etc. is also gleaned from this procedure, and it is perhaps one of the most vital exercises carried out by a quality control department, or a single assessor/trader. Special techniques may have to be applied when dealing with specific items i.e. absolutes, which may have to be diluted to 1% in alcohol and stored for several prior to comparative assessment against standards.

Mookerjee *et al*. come up with a new slant on fragrance perception.
In an article, which first appeared in *Perfumer & Flavourist* Jan/Feb 1998, and subsequently reappeared in *Cosmetics & Toiletries* **113** pp 53-60 July 1998, B.D. Mookerjee, *et al*., described a different theory of fragrance perception. This was based on the fact that the diffusion of individual molecules from a perfume was not based on molecular weight or boiling point or odour value. This means that when a perfume is freshly dipped on a strip on daubed on the skin, all molecules are present in the evaporative area above the perfume to form an "aura", not just the most volatile ones as the former theory described.

Mookerjee explained the phenomenon of "aura" composition by considering the diffusivity of the fragrance molecules present, which he defined as the inherent property of a substance to emit its molecules into the air. He further applied the theory not only to perfumes but also to living flowers by considering the emission of fragrant molecules from above the petal surface. By absorbing these molecules into a (high boiling) liquid absorbent in a glass fibre positioned above the petal surface (a piece of diffusion technology patented by IFF and trademarked Aura of Aroma) Mookerjee *et al*., were able to compare the composition of liquid extracts of orchid fragrance (from *Dendrobium superbum* - oh what a memorable name!) with the classic liquid extraction technology against the aura. They found that by reconstituting the results above for the composition of the aura, they were able to obtain a much more diffusive (and presumably lifelike) impression of the *Dendrobium superbum* fragrance. Much of the remainder of the paper is devoted to looking at the effect of applying fragrances to the skin and considering the ratios of the concentrations of the substances present in the perfume oil to that found in the aura, and obtaining factors for increase or decrease of concentration. The conclusion of the paper is that assessment of initial fragrance impressions is not solely explained by individual materials with high volatility values, but by consideration of the diffusivities of all substances present.

A Conundrum Explained? As complete aside, in a small way, this theory has explained something which always puzzled me. I used to work in a laboratory years ago, which had some areas of exposed wooden working tops. The laboratory used to assess finished raw materials including capsicum oleoresin: the murderously hot principle of red peppers (*Capsicum annum*) obtained by solvent extraction. Inevitably some of this material would end up on the bench and soak into the woodwork. Many people that work with capsicum eventually become sensitised to it, and my red-haired assistant and I eventually got to the state where just walking into the laboratory on a Monday morning (and touching nothing) would start to bring us out in a rash. In spite of the relatively high molecular weight of capsaicin and its related compounds (the pungent principles) I mentally argued that the vapour of capsaicin was being emitted from the benches and causing the problem. I can now reflect that capsaicin probably has a relatively high diffusivity, and I don't need to trouble myself about the molecular weight undermining my little theory!