Odour effects on human opinion & behaviour

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Amongst all human senses, olfaction (the sense of smell) is the most prehistoric covert one, important to our survival throughout evolution. Smells often provides the first warning or reflex sign of safety (friend) or danger (foe), driving human behaviour instinctively to evoke either positive or negative state of mind and reaction to the environment in milliseconds. Olfaction is a complex poorly understood sensation, even though numerous studies indicate that odour alters perception and influences human behaviour, viz., buying actions, individually liking specific aromatic goods, visiting fragranced places, etc. Humans have the ability to recognise, remember and recollect over 10,000 different odours by a combined use of physical, chemical and mental processes to create an overall perception of smell.

While in case of our eyes, ears and touch, the message to the brain passes through the lengthy and complex nervous system, in case of the nose, the passage is through the limbic system or the rhinencephalon, also called the olfactory brain. It is present in all living animals and is responsible for basic instincts like eating, drinking, breathing and sex. In case of humans, an evolved neocortex-thinking layer gives instructions to impulses like hunger, thirst, arousal and other emotions generated by the limbic system. The aroma that arrives at the receptive region of the limbic system directs itself to the neocortex-thinking portion for understanding and assessment.

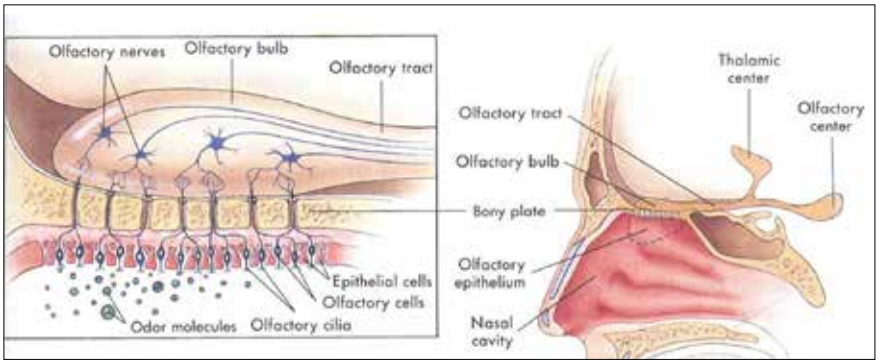
The nasal organ & mechanism of smell

The nose consists of two parts divided by the internasal bone. The upper part of the internasal bone bears on both sides a small yellowish-brown mucus membrane, about three square centimetre in surface area, called the olfactory bulb. The olfactory nerves present within the mucus membrane bear long flagella. Aromatic molecules pass through our nasal epithelium cells located high up in our nasal cavity, along with airflow, dissolve in the mucus membrane to make contact with the flagella that are about 1/1000 mm in size consisting of about 10 million olfactive cells. Very similar to a lock and key, each receptor cell contains only one type of receptor protein to detect a small number of different scent molecules. One protein deciphers into one gene and we have about 1,000 genes determining different types of receptors and sense of smell in our nose.

The odour receptor cells pass on the smell to the olfactory bulb of the brain and the structure of the odour molecule determines the kind of signal that passes from the flagella through the membrane to the olfactive nerve directly connected to the limbic system of our brain. The aromas a human nose perceives comes from a complex group of several odour molecules, which our brain simultaneously recognises into individual odour molecules. Thereafter, the complex smell signals are combined as a whole, equal to the sum of its parts, assigned an odour and deciding our likes and dislikes.

In contrast to all other nerves cells of the brain, the olfactory nerves are able to reproduce themselves. If the cells of the spinal cord are damaged you have paralysis and the nerves affected cannot be repaired. This is also the case with the nerves of the eye and ear. Nature realising the importance of the olfactory nerves, has ordained that it can repair itself when damaged. Unlike other types of neurons, olfactory neuron cells can regenerate every 60 days (approximately), due probably to the action of insulin and supplementary hormones.

Scientists Richard Axel and Linda Buck, winners of Nobel Prize for Medicine (2004) for proposing these basic principles and the genes responsible for encoding each of the proteins, further state that human perception of smell is different when breathing in and breathing out. 'Orthonasal' smell is the one we perceive when breathing in along with the air around us, while 'Retronasal' smell comes from breathing out, adding air from the mouth (with whatever it holds) and mixing the flavour sensations pre-



sent in the tongue (viz., salty, acidic, bitter, sweet and umami), hearing, texture and muscle activity. Sensory cells exists in all the moist surfaces of our sense organs viz., eyes, nose, mouth, etc. This 'common chemical sense' complements our perception of smell, enabling even people with odour aliments to still detect many types of smells.

Perceiving odour becomes more complex when our brain transmits signals to its responsible parts: the piriform cortex (responsible for perception of odour); the entorhinal cortex (accountable for pairing specific scents to specific memories); the olfactory tubercle (liable for reward behaviours associated with smell); and the amygdala (involved in emotional and non-conscious/autonomic responses to smell).

Knowledge before birth – Proustian memory effect

Humans learn about smell even before birth when aromatic foods eaten by the mother passes into the amniotic fluid, which the developing foetus ingests. Scientific studies by Marcel Proust show that when mothers consume garlic, alcohol or smoke cigarettes during pregnancy, their infants due to early experiences too prefer these smells later in life confirming that associations, tradition and culture all influence different perception of valuable and desirable scents. According to Proust, childhood memories of smells stored in memory come back into consciousness with their original intensity when a person encounters a near-similar situation. Odour memories that stay with people throughout life have a power to evoke personal emotions, influencing and charming potential consumers about a specific product.

Predicting human lifespan

US National Social Life, Health and Aging Project, a University of Chicago study of older people, finds that losing the ability to identify scents can predict human mortality better than a diagnosis of ailments in heart, lungs or cancer. Although losing the ability to smell does not directly increase mortality, it could predict impending body ailments as exposing the olfactory nerve to the environment also exposes the central nervous system to airborne toxins and pathogens. In ancient medical practice, body odour was a means to diagnose illnesses. Ironically, among all our human senses, olfaction is the most unappreciated and undervalued one – until lost.

Understanding the complex sense of smell and its effects on human behaviour requires combined effort of experts from diverse disciplines: anthropologists, aromachologists, behavioural psychologists, biochemists, cognitive neuroscientists, food scientists, molecular biologists, neuropharmacologists, physiologists, radiologists, surgeons and others. Current understanding show that odour can affect emotions and behaviour and one can use it to elicit positive responses like better customer ratings for products and services, intent to purchase, good time memories, feelings of being relaxed and comfortable – all powerful tools for businesses and brand elevation.

How odours affect thinking and behaviour – physiological theory

According to the pharmacological hypothesis, fragrances directly affect human system (nervous & endocrine systems), acting like drugs and interfering with various hormones and neurotransmitters, producing change.

If we accept this hypothesis, then these fragrance chemicals should enter into the bloodstream through either the nasal mucosa (mucus membranes in nose) or lung mucosa (mucus membranes in lungs) or olfactory nerves (directly into the brain through the nerves in our nose, bypassing the bloodstream). Lavender directly influences certain chemicals in the brain; animal studies show that even if the olfactory system is non-functional, it still has effects, suggesting it is not the 'smell' but the absorbed chemicals into the body that are responsible for its effects.

However, there is no concrete evidence to show that fragrances enter the bloodstream. Simple inhalation of essential oils, does not really contain enough chemicals to affect the human body (even though some effects are seen in rats having smaller body weight and greater sense of smell).

Only by injecting large doses of chemicals directly into the body, can we physiologically influence a person. A caffeinated beverage takes about 20 minutes, on average, to influence behaviour and this is true for most chemicals. However, fragrances affect humans almost immediately without taking the time to metabolize and influence human body systems.

Furthermore, odour molecules that are chemically very similar, in fact smell and behave differently.

1. L (-)-carvone, which smells like spearmint leaves, increases pulse rate, diastolic blood pressure and restlessness, while D (+)-carvone has a spicy aroma like caraway seeds, and increases diastolic and systolic blood pressure. (*Reference: Huenberger et al.*)
2. Inhaling D (+)-limonene increases systolic blood pressure, changing alertness and restlessness of users, however, inhaling L (-)-limonene affects only the blood pressure of users. (*Reference: Huenberger et al.*)
3. D (+)-rose oxide confers relaxing physiological effects whereas L (-)-rose oxide is stimulative. (*Reference: Traynor.*)

These show that only the odour, not the molecule, makes the difference in humans.

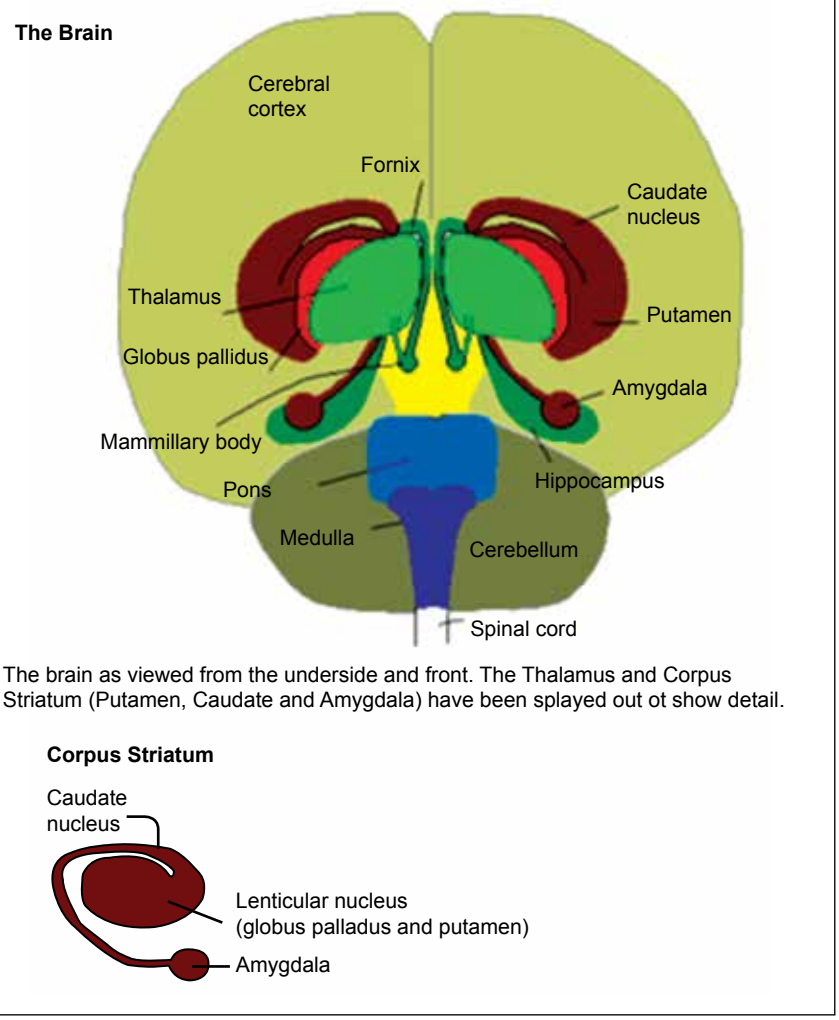
How odours affect thinking and behaviour – Psychological theory

According to this theory, odour effects on humans are due to learning, familiarity due to experience, beliefs, memories, conscious perception and expectations.

To illustrate: the smell of dogs can be quite different for persons having a pet dog and to those bitten by a dog. We can see here that odour likes and dislikes are due to emotional memories – either good or bad. Scientific studies show a connect between the effect of smell and the part of the brain related with memories and emotions. The olfactory nerve (odour) moves signals up to the amygdala and hippocampus – organs involved with strong emotions, memories and learning. A person liking a smell directly relates to its effects on mood, i.e., if an odour scientifically demonstrates a definite effect, it will not work with persons who do not like the smell!

Research shows that the main factors influencing the effect odours have on humans are:

- Hedonic characteristics (whether the smell is simply pleasant to you);
- Cultural (every culture has a different significance on the use of different odours);
- Experiences (past & present);
- Sex (male or female); and
- Personality (explicit temperament traits increase a person's sensitivity to smells).



The brain as viewed from the underside and front. The Thalamus and Corpus Striatum (Putamen, Caudate and Amygdala) have been splayed out ot show detail.

Odours probably affect persons just like music; at times, a person is in a 'mood' for loud western music and sometimes for a soothing classical one. Similarly, a song could remind one of cheerful instances or unpleasant memories. In a 1966 study among American and British citizens, the British rated wintergreen smell as unpleasant whereas Americans rated it as pleasant. Researchers believe this selection was largely due to associated memories: in Britain starting from World War II to 1960, wintergreen fragrance was common in medicines and analgesics, reminding them of injuries, doctors, and hospitals; while in the United States, wintergreen was a flavouring agent in popular candies.

Likes and dislikes to specific smells vary widely among persons. The odour of an orchard in full bloom could recall childhood picnic memories; a person hailing from a village loves the smell of natural manure, while most people brought up in a city would rate the smell as disgusting. Cultural and geographic variations, prior learning and personal history all determine the peculiarities of smell-related perception. Europeans and North Americans perceive the smell of lavender flowers as calming and citrus smells as bright and happy. Japanese associate rose water as an energizing, happy smell and jasmine as relaxing. Indians consider sandal fragrance to calm the mind, bringing it closer to the divine.

Comparing the two hypotheses, the psychological hypothesis seems right. Odour chemicals actually do not enter human bloodstream and even if they did, are not strong enough to make a

change or influence body chemicals directly. The human sense of smell is far more fluid and psychological without having any straight 'universal' smell responses, affecting people differently largely due to their cultural beliefs, personal histories, memories, expectations, likes and dislikes.

Human thoughts and fragrance liking

Human thoughts can influence the sense of smell and this 'halo effect' is popular with consumer product manufacturers. If a consumer product has one 'virtuous' or good trait, it automatically extends itself to everything else about the product with people generally liking it better. Promoting a product as '100% natural' makes users like, enjoy and use it better than not telling them. Sensory experiences do not appear in a vacuum; one has to interpret them with full knowledge of the interactions between what we smell and what we think we smell under diverse context of evaluation.

Olfaction and performance

A close link exists between olfaction and physical performance. Every individual identifies with smells that evoke positive psychology and athletic outlook. Odours help create a sense of familiarity and safety.

A fragrance associated with spring or summer when exercising on a treadmill on a depressing rainy day can evoke positive emotions connected with summertime. Fragrances can work as a tool to create an 'on demand' associated positive state of mind.

Olfactory process & its effect on human behaviour

The sense of smell powerfully commands many behaviours including memory. Insects, birds and even mammals predominately rely on their olfactory abilities for survival. In case of humans, olfaction is a primeval sense. Let us suppose a bear approaches to attack a human; the person will come to know of it within seconds after attack, whereas a dog accompanying the person would have caught the smell of bears much before. In this respect olfaction is a vital survival tactic in most animals to sense a predator, although it is a less prominent feature in humans.

Although smell seems far less meaningful to humans, there is an important link between olfaction and human behaviour. Neuroscientists at Tufts Medical School and New England Medical Centre say that a salamander's perception of a particular odour evokes a change in its skin potential. Aromachology, a newly developing science, scientifically studies the interrelationship of fragrance and human psychology by analysing emotions produced when odours activate olfactory pathways leading to the human limbic system in our brain.

Odours initiate release of neurotransmitters affecting the brain and an individual's mental state. Serotonin release produces a tranquil, soothing effect, while endorphins impede pain, increasing sexual excitement. Studies show that the use of certain aromas releases neurotransmitters determining mood, behaviour and productivity. For example, peppermint is a mental stimulant that increases a traveller's alertness on a long journey, while vanilla mentally relaxes and relieves stress.

Olfaction also plays an important role in comparison to other senses like vision and hearing in triggering a more emotional memory. Isn't encountering the unique scent of a lost love far more poignant than seeing a timeworn photograph?

Olfaction thus plays an important part in human psychological make-up, being one among the five different ways a person connects with the world around. These links between smell and feelings have a profound impact only when a person loses the ability to smell (medical ailment or anosmia), miss their emotional enthusiasm and suffer from clinical depression. Anosmia sufferers feel isolated or cut-off from the environment experiencing 'blunting' of their emotions, directly affecting their ability to make and maintain intimate personal relationships confirming the strong association between smell and memory. Scientific studies show that the loss of olfactory function might be an indicator to serious ailments like Parkinson's and Alzheimer's, several years before motor skill problems actually develop.

Traditional healing practices in India and modern day aromatherapy claim that the use of specific aromas can help people with both physical and emotional problems, viz., burning aromatic sandalwood (*Chandan*), agarwood (*Oudh*), frankincense (*Luban*) etc.

Historically, society has treated fragrance as a luxury item and a social enhancer, perceiving a person wearing a fragrance as more elegant than one who does not. Fragrance users mention they wear fragrances because it makes them smell good, get noticed, evokes memories associated with their pleasant experiences, creates a feeling of well-being, increases their sexual attraction, and enhances their social status.

Classification of odorants

Dr. P. Jellinek's in his book 'Psychology in Perfumery' proposes that we can classify all odorants – natural, synthetic or semi-synthetic – by the effect they produce on the user. This classification, however, is not sharply differentiating as boundaries overlap and one odorant can produce more than one effect, depending on the combinations used in creating the fragrance.

- Erogenic effects: produced by aromatics of natural origin like musk, civet, ambergris, orange oils, indole and indole-containing essential oils like jasmine etc.
- Narcotic effects: produced by resins, essential oils containing rose components, geranium oil, tuberose flowers, violet blossoms, balsams and other flowers pomades etc.
- Anti-erogenic effects: produced by citrus & cologne odours, lavender and pine odour, etc.
- Stimulating effects: produced by mosses like oak moss, vanilla & tonka beans, spice oils, patchouli oil & vetiver oil etc.

In one scientific study, musk in concentrations below the threshold of conscious detection was present in a fragrance and male participants had to pick out and rate the physical appeal between unknown females either wearing or not wearing the subliminal fragrance. The male participants generally rated the fragranced woman as more attractive than her unscented colleague even though the comparing subject partners were identical twins. Probably the virtually imperceptible fragrance (subliminal smell) appears to do the trick and influence human responses. Is it then not apt to say, "Beauty is in the nose and eye of the beholder?"

Another comparative study shows that department store customers stay for 20% longer time in the store (so tend to purchase more) when the store is fragranced with a subliminal fragrance than a store having an odourless environment, indicating that even odours we are not aware of can powerfully shape behaviour. The perfumery industry actually bases itself around this linking of fragrances to memory and emotions, and perfumers keep creating fragrances attempting to convey a vast array of feelings, from longing to vitality to relaxation.

Smell is also enormously significant in case of attraction between humans. Research shows that genes, making up the human immune system, produce body odour and subconsciously helps one choose partners with some scientists even believing that sniffing is a precursor to the primal behaviour of kissing.

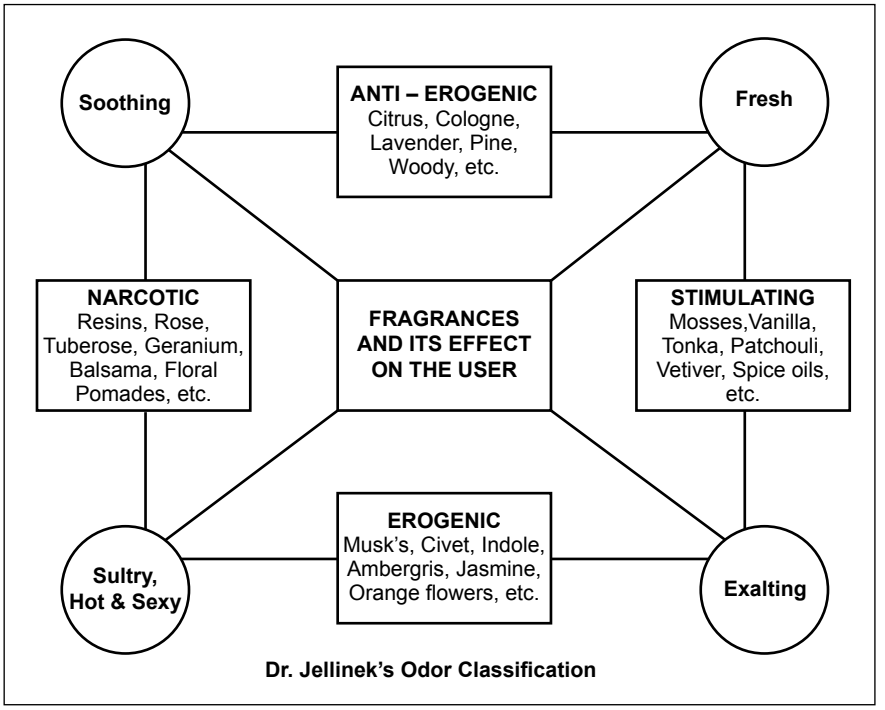
Associations primarily govern emotional response to smell, as different people can have diverse perceptions of the same smell. One individual may find a particular brand of fragrance as 'powerful aromatic' and 'heady', while another person will describe it as 'overpowering' and 'sickly nauseating'. Regardless of this, most people will find certain smells as obnoxious, viz., smell of smoke, rotten food, urine and excreta, smelly socks, etc.

Odour effect on hormones

Plenty of researches in the past have shown that different odours can influence people. A study by Japanese researchers from Nara University of Education strongly indicate that one can actually modulate the potential effect of various odours on hormone levels in males and females.

- Rose oil: Reduces stress and lowers cortisol (high stress results in high cortisol).
- Floral smells: Reduces stress in men, and significantly increases testosterone levels. In women, it significantly decreased testosterone levels and sexual aggression.
- Musk: (A traditional aphrodisiac) significantly decreased testosterone in males, whereas it significantly increased sexual excitement in women.
- Lavender: Increase blood flow to the penis in almost 30-40% of male subjects.

Just smelling musk or floral (rose) odours decrease cortisol in both sexes reducing stress. If men want to increase their "manly hormone" (testosterone), they could consider flowery, floral scents! Likewise, if men want to woo women, the old use of musk might actually do the trick. Does this not very easily explain the logic behind using male and female fragrances? Happily continue sniffing!



Dr. Jellinek's Odor Classification