

Humans and the Olfactory Environment

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The sense of smell is underappreciated. Though less crucial than sight or hearing, it tells about what people neither see nor hear. It also enriches sight and hearing with biochemical data on objects of interest. Finally, by producing disgust or pleasure, it helps decide whether such objects should be avoided or approached. Humans have remade their olfactory environment, typically by making it more pleasant-smelling, just as they have remade their visual environment to make it more pleasant-looking. But the process has not been one-way. By remaking the environment, people have ended up remaking ourselves. On the one hand, humans have been creating more and more of their world; on the other hand, this human-created world has been modifying their genomes via natural selection.

Keywords: gene-culture coevolution ; odor ; olfaction ; human evolution

1. Introduction

The sense of smell is underappreciated. Though less crucial than sight or hearing, it tells about what people neither see nor hear. It also enriches sight and hearing with biochemical data on objects of interest. Finally, by producing disgust or pleasure, it helps them decide whether such objects should be avoided or approached.

The act of smelling can indeed be pleasurable. This psychological reward has led people to remake their olfactory environment in ever more appealing ways, just as people have remade their visual environment with pure bright colors that are rare in nature. The process began with the human body, which they learned to deodorize by bathing in water and then reodorize by perfuming with aromatic compounds. Reodorization would eventually spread to the entire home, with the result that they now spend much, if not most, of the time in an olfactory environment of their making.

2. Odor Emission and Detection: Culturally or Genetically Influenced?

How much of people's sense of smell is learned? How much innate? There is no easy answer, partly because genetic and cultural influences interact with each other, and partly because a genetic influence can vary from one stage of mental processing to another, from one odor to another, and from one individual to another.

First, even when odor detection is under tight genetic control, it still takes place within a broader cultural context that influences how the odor is evaluated. Evaluation may be positive in one context but negative in another ^[1].

Second, culture can change the genetic makeup of a population. Some people are a better “fit” for their culture because they can readily learn its rules and exploit the opportunities it creates. They thus enjoy reproductive success. As their behavioral traits spread through the gene pool, the culture will meet with less resistance from the average individual and will shift further in the same direction as the behavioral shift. Cultural evolution is therefore difficult to separate from genetic evolution. The two support each other, forming, in fact, a single trajectory of gene-culture coevolution.

Third, a genetic influence can vary from one stage of mental processing to another. In some cases, as with the odor of a mother's breast or close kin, people learn to recognize a specific smell, but that learned information is fed into an innate algorithm that allows recognition of only one smell or a limited number ^{[2][3]}. The algorithm “expects” information from the environment. Once that information has been supplied, it loses superfluous neural units and becomes fully hardwired ^[4]. For instance, prenatal exposure to an odor can produce permanent recognition of that odor ^[5]. In other cases, the researchers recognize a specific smell without any learning; the algorithm is fully hardwired from the outset ^[6]. The rule seems to be that natural selection tends to hardwire any mental task that is both frequent and predictable. In such cases, the advantages of learning do not offset the disadvantages, notably the time required for learning and the mistakes that will inevitably occur during that time.

Fourth, a genetic influence can vary from one odor to another ^{[7][8][9][10]}. A twin study found that sensitivity to two odors is 78% and 73% heritable ^[8]. In the case of another odor, a single gene explains over 96% of the observed variation in sensitivity ^[1]. Yet there may be little or no heritable variation in sensitivity to other odors ^[11].

Finally, in addition to varying by sex and age, a genetic influence can vary from one individual to another ^{[9][12]}. For some people, androstenone smells like sweat or urine. For others, it has a pleasant sweet or floral smell. For still others, it is odorless ^[9]. An American study found that 63% of odorant receptors are functionally polymorphic and that, on average, over 30% differ between any two individuals. African Americans were found to be the most genetically diverse group in this respect, although much of that genetic diversity does not translate into functional differences with real effects ^[13].

3. Coevolution between the Olfactory Environment and the Sense of Smell

In this case, as in others, gene-culture coevolution explains much of recent human evolution. More than any other animal, people make the world they live in, and it is often the human-made portion of the environment that decides who lives to reproduce. By remaking the surroundings, people have ended up directing the evolution ^{[14][15][16]}.

With respect to the olfactory environment, gene-culture coevolution can be divided into three historical stages: hunting and gathering, farming, and reodorization of bodies and homes.

3.1. Stage 1: Hunting and Gathering

Early humans did not live in a world of their making. They lived in a natural environment where their sense of smell helped them hunt and gather within a large foraging area. For instance, the odor of a lake or a forest could mark their way to a destination and the way back. Among present-day hunter-gatherers, such as the Umeda of New Guinea, smell is as good as sight for spatial orientation. It is often better for some tasks, such as detecting a distant campfire ^[17] (p. 98).

Smell also enables hunter-gatherers to identify people by age, gender, and social dominance. Among the Suyu of central Brazil, men are expected to have a bland smell, which is considered to be a condition for living in society. A strong smell is normal for some Suyu: for children, because they have not yet been socialized; for the elderly, because they are no longer subject to social restrictions; and for women, because they are seen as living outside society. Tribal leaders, too, are said to have a strong smell, which indicates their power not only to rise above the social order but also to inflict social disorder ^[18] (pp. 106–120, 202–203). Finally, smell may indicate membership in a tribal group. According to the hunter-gatherers of northwest Amazonia, each group has its own odor and can mark its territory with an “odor-thread” ^[19] (pp. 125–126).

The importance of smell is shown by the vocabulary of hunter-gatherers, such as the Jahai of peninsular Malaysia. Their language has a dozen stative verbs for specific odors: “to be fragrant,” “to be musty,” “to have a stinging smell,” “to have a urine-like smell,” etc. “These verbs are common parlance, known and used by all. Everyday conversation is peppered with them and they are not limited to religious, mythical, or otherwise specialist genres” ^[20] (pp. 356–357), ^[21] (pp. 24–25), ^[22].

The literature on hunter-gatherers occasionally refers to adults removing body odors through bathing, which is usually confined to special occasions. Among hunter-gatherers of the northwest coast of North America, such occasions include preparing for a bear hunt, searching for a guardian spirit, ending a period of mourning, or being initiated into a secret society ^[23] (pp. 12–13), ^[24] (pp. 892, 899). Sweat lodges have been similarly used by North American indigenous peoples to cleanse themselves for healing or ceremonies ^[25]. In Amazonia, bathing is a pre-hunting ritual that men perform to hide their odor from their prey ^[26] (p. 19). In other groups, such as the Hadza of Tanzania, bathing is rare because suitable water is scarce ^[27] (p. 428). In central Africa, frequency of bathing is seen as a distinction between the Efe hunter-gatherers and the neighboring Lese, a farming people: “Lese women noted that whereas Lese men wash their hands and bodies frequently, sometimes once a day, the Efe may bathe only once a week and do not use soap” ^[28] (p. 79). Whenever non-ritual adult bathing has been reported among hunter-gatherers, there is evidence of outside influence, such as the use of soap or shampoo ^[29] (p. 142).

In sum, body odor is considered most problematic during hunting when it can alert game animals to the presence of humans. This is the stated reason why women should not hunt: the scent of menstrual blood is said to drive animals away ^[30]. Body odor is also problematic during encounters with the spirit world. The least problematic encounters happen in the course of normal social relations, which are not seen as a reason for deodorizing the body.

3.2. Stage 2: Farming

Beginning some 10,000 years ago, hunting and gathering gave way to farming, which, in turn, led to sedentism, population growth, and increasing social complexity ^{[14][15][16][31]}. People no longer needed their sense of smell to find elusive food sources or to orient themselves within a large area. Their senses of sight or hearing were usually enough. Moreover, with the replacement of wild foods with crops and livestock, they now encountered a narrower range of plant and animal odors.

3.3. Stage 3: Reodorization of Bodies and Homes

A third stage began when people not only removed their natural odors but also added new ones by means of perfumes, incenses, scented balms, and aromatic bath oils. The new scents often served to increase sexual attractiveness, perhaps by interacting with some of the body's natural odors ^{[32][33]}. In a compendium that included descriptions of perfumes, written in India in the 6th century, the section on perfumery was sandwiched between sections on aphrodisiacs and sexual intercourse ^[34] (pp. 72–73). For whatever reason, the practice became widespread. By the time of the Greek historian Herodotus, in the 5th century BC, the men of Babylon were said to be “anointed over the whole of their body with perfumes” ^[35] (*Histories* I: 195). Around the same time, the inhabitants of the Indian city of Ayodhya were described in similar terms: “There was no one who was dirty or whose body lacked for ointments or perfumes” ^[34] (p. 57). As body odors became less noticeable, not only through regular bathing but also through regular perfuming, the capacity to emit them further atrophied.

By perfuming themselves, women reoriented sexual interest toward their upper body, particularly the face. This point is made by Havelock Ellis in his writings on the psychology of sex: “The odor of the body, like its beauty, in so far as it can be regarded as a possible sexual allurements, has in the course of development been transferred to the upper parts. The careful concealment of the sexual region has doubtless favored this transfer” ^[36]. Reorientation toward the face was further assisted by romantic kissing, a practice unknown to most hunter-gatherers ^[37]. As an expression of erotic desire, kissing seems to have first gained broad acceptance in the ancient civilizations of the Mediterranean, the Middle East, and South Asia ^{[36][38][39]}.

In time, perfumes were used to reodorize not only the body but also the home environment. People came to control not only the temperature and lighting of their homes but also the smell. In 1843, while traveling through Hadramaut, a European observer noted that rooms were fumigated five or six times a day with frankincense ^[40]. Homes are still regularly fumigated with frankincense and myrrh in northeast Africa and south Arabia ^[41]. In the United Arab Emirates, a research team found that 86% of all households burn incense indoors at least once a week ^[42]. The same researchers found no consistent associations between incense use and wheezing, coughing, or shortness of breath, perhaps because the Emiri population has adapted to this practice ^[42].

At an early date, reodorization was extended to spaces outside the home through the planting of aromatic flowers and shrubs. The Persians were pioneers in this respect, as attested by the Greek historian Xenophon when describing a Persian garden: “Lysander was astonished at the beauty of the trees within, all planted at equal intervals, the long straight rows of waving branches, the perfect regularity, the rectangular symmetry of the whole, and the many sweet scents which hung about them as they paced the park” ^[43] (*Oeconomicus* 1:4.16–18). Throughout the Middle East and the Mediterranean, “pleasure gardens” were planted with aromatic shrubs, such as jasmines ^[44].

4. A Second Coevolution: The Olfactory Environment and the Ability to Represent Odors in the Mind

The new olfactory environment coevolved not only with the sense of smell but also with the ability to represent odors in the mind. Individuals had to become better at:

- representing certain odors in their minds;
- exchanging these mental representations with other people via speech and, later, writing;
- storing these representations in memory;
- recalling them at a later date in full detail.

In this case, as in others, the coevolution was at first non-genetic: people made better use of their existing abilities, in particular the ability to develop thoughts collectively. This is a corollary of the Sapir–Whorf hypothesis: language is not

merely a passive medium of thought; it is a means to express thought in a more organized, coherent, and systematic manner through the very process of transforming mental representations into words, including the effort of making one's thoughts understandable to people who think differently and who assist by offering comments, corrections, or additional information.

Thus, as language developed, so did thought, including the mental representation of odors. Once an odor was named, it became a concept that could be manipulated in speech and mind, notably through comparison with other concepts: "a named odor has more chances of being categorized and these chances increase when the naming is precise" ^[45] (p. 52). An odor could also be re-experienced simply upon seeing or hearing its name; this vicarious experience could then become a thing to be savored, enjoyed, and shared with other people, including those who had never known it in real life. The odor experience could now circulate within a larger space—not only the internal memory of each person's mind but also the external memory of oral and written tradition ^[46].

In addition to a purely cultural coevolution, was there also gene-culture coevolution? Just as natural selection improved the ability to discriminate between certain odors, did it also improve the ability to represent them in one's mind, speech, and writing? There may, for instance, have been selection for individuals who could more readily name an odor, recall it later in full detail, and, thus, re-experience it vicariously. Indeed, according to several studies, a named odor is more strongly remembered than a nameless one ^{[47][48][49][50][51]}. One study, however, failed to replicate this finding ^[52]. It has been suggested that the replication failure might have a methodological cause, particularly the use of forced choices ^[53]. Another possibility is that these different studies used subjects from populations with different trajectories of gene-culture coevolution.

The mental representation of an odor thus has an existence that is distinct from that of the odor itself. It can take on a life of its own. The decoupling between signifier and signified seems to have begun early in cultural evolution. In an essay on totemism, the anthropologist Claude Lévi-Strauss argued that animal totems are "good to think," just as delicacies are good to eat. Whenever a hunter-gatherer thought about a particular animal, the thought could, in itself, arouse an emotional response, either positive or negative. Certain animals thus became totems because of their positive emotional value ^[54] (p. 89). Similarly, when people think about a pleasant-smelling odor, they are motivated to increase its presence in their environment, thereby increasing their encounters with it. A process of positive feedback thus begins. As the odor becomes more often encountered and the pleasurable response increasingly accessible through memory, the stimulus-response sequence becomes more predictable, even automatic. The advantages of learning no longer outweigh the disadvantages. Hardwiring is now the better option.

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