The Sense of Smell – the Olfactory Sense

This is the third in the very successful series of articles that David Brown, from California Deafblind Services, is writing on the senses

The sense of smell is crucially important for the existence of almost all creatures, for finding the next meal, for avoiding many dangers, or for choosing a partner. We humans, able to distinguish thousands of different odour molecules, utilize our sense of smell for a multitude of activities from maintaining personal hygiene, to enjoying the aroma of freshly baked bread, to deciding whom not to sit next to on the bus.

We think that we smell with our noses, but this is no more true than if we say that we hear with our external ears or that we see with our corneas. The part of the nose that we can see merely collects the relevant information, so that every time we inhale, air swirls up through the nostrils to the millions of smell receptor cells that are all contained deep within the nasal cavity in an area known as the olfactory epithelium, which is about the size of a postage stamp. These cells are sensitive to chemicals produced when odours dissolve in the mucous inside the nose, and they are much more sensitive than the taste receptors, being capable of collecting and transmitting information that helps us to discriminate many thousands of different smells. Researchers have claimed that smell is 10,000 times more sensitive than taste, and the system is so complex that, unlike the five taste groups, no research has yet been able to discover basic categories of smell. In fact, we tend to pay little attention to the sense of smell, except for obvious attention paid to bad smells, and the publicity of the perfume and cosmetics industry, so that we don't even have a proper range of words to describe it. Just consider how many words we have to descibe different shades of blue for example (pale, light, dark, deep, eggshell, teal, navy, royal, Prussian, sky, aquamarine, and so on), and how few words we have to describe the various different smells of roses or dogs. So it is very hard to use words to explain exactly how something smells to somebody who hasn't smelled it.

The sense of smell is unique in that, unlike all other sensory systems, it sends information directly to higher centers of the brain and completely bypasses the thalamus, which is the area of the brain where all other incoming sensory information is sorted into the two basic categories of what needs our attention and what does not need our attention. Because it doesn't have to pass through this preliminary sorting and analyzing process, smell is the sense that puts our brains into direct contact with the environment in a way that none of the other senses can. So the sense of smell has quick, direct, and powerful connections to the limbic system, the part of the brain concerned with primitive instincts and drives, the part that processes emotions and memories. In 'Understanding Deafblindness' Geegee Larrington refers to smell information traveling '...on short, large, fast fibers to deep within the brain'. This is why particular smells can evoke such very strong emotions and memories,

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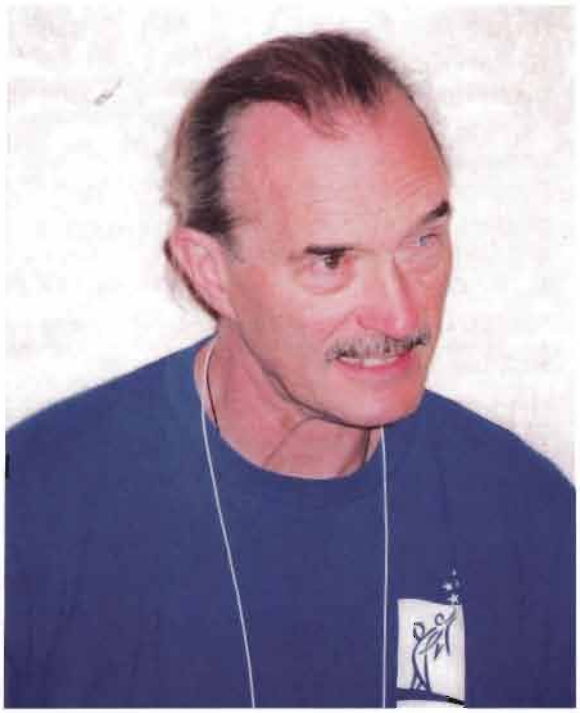

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all based upon associations made through previous experiences, and do it so quickly and so vividly.

The sense of smell depends on the functioning of not only the first cranial nerve (the olfactory nerve) but also parts of the fifth cranial nerve (the trigeminal nerve). Qualitative smell sensations (for example the distinctive and unique identifying smell of a lily, or an orange, or freshly cut grass) are transmitted by the first cranial nerve, whereas other aspects of smells (for example the heat, coldness, sharpness, spiciness, and irritating qualities of a particular smell) are transmitted by parts of the fifth cranial nerve. It is helpful to know that more than the 'smell nerve' is involved in our perception of smell. In the population of children with CHARGE Syndrome, for example, which is one of the leading causes of congenital deafblindness in children, we know that about 42% have damage to the first cranial nerve and 43% have damage to the fifth cranial nerve, so that there is a high incidence of missing or reduced sense of smell.

Like the taste receptors, the smell receptors develop very early in a foetus, stimulated by chemicals in the amniotic fluid that they inhale and exhale while still in the womb, so that babies are born with an already well developed sense of smell. Babies also appear to be born with an innate ability to detect bad, aversive smells, since it is reported that one-day old babies give facial expressions that indicate rejection when they are exposed to fish or rotten egg smells. But the fact that we experience so much smell sensation before birth complicates this whole area, just as it does with early taste preferences and aversions. Since babies are exposed to a selection of 'smells' over a long period in the womb this seems likely to exert a powerful influence on their smell preferences immediately after birth. There is clearly experience-dependent learning in the smell sense, but whether the response to certain smells (in particular what we consider to be bad smells) is innate or not has still not been settled.

As with taste, so our sense of smell declines as we get older, so there is a double impact on the loss of flavour from food and drink, as well as on more generalized aspects of environmental awareness. By 80 years of age 80% of people are reported to have some major smell dysfunction, and 50% are functionally anosmic (the word used to describe someone who has lost some or all of their sense of smell). Not only is there a loss of the sense of smell, but also a loss of the ability to discriminate between smells. Disturbance of the sense of smell has many possible causes. In most instances, loss of smell is caused by nasal and sinus disease, upper respiratory tract infection, or head trauma. Patients with neurodegenerative diseases, such as Alzheimer's disease, experience significant loss of smell perception. In fact, one of the common very early stages of Alzheimer's is a loss of smell sensitivity. Medications, especially those that increase dehydration and limit mucous production, are also an important and frequently overlooked cause of smell impairment.

Smell and taste are the two chemical senses, so called because they detect chemicals, and smells and tastes are, of course, chemicals. With both of these senses we sample our environment for information. Unlike taste, of course, smell can signal over long distances and so form part of our early warning alarm system. With our sense of smell we are continuously testing the quality of the air we breathe, which will alert us to potential dangers

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like smoke or leaking gas, as well as informing us of other relevant information, such as the presence of food, or cooking, or of another person. The sense of smell also serves a recognition function, in that we all have our own unique smell and we can recognise and be recognised by our smell. Some children with deafblindness very clearly sniff other people because this is a help to them in identifying familiar individuals. Research has shown that children can distinguish between the smell of their siblings and other children of the same age, and also that babies recognise their own mothers' smell and mothers recognise their own babies' smell. Emotion can be communicated by smell, as when dogs are said to pick up and respond to the smell of fear in humans. Research in the 1990s showed that people can discriminate between the smell of people watching "happy" and "sad" films, which suggests that the emotions of others, for example fear, contentment, and excitement, may therefore be transmitted and recognized by smell. How we smell, why we smell, and the impact of smell on our everyday life are poorly understood, and we certainly underestimate the importance of smell to our functioning and to our general well-being. Research suggests a close correlation between missing sense of smell and depression, for example. Physiologically, the two chemical senses of taste and smell aid in normal digestion by triggering gastrointestinal secretions. There are also suggestions that smell can influence arousal levels, mood, emotions, the immune system, and the endocrine system that produces and controls hormones. So a great deal can be communicated and controlled by smell without us even knowing it.

The sense of smell is intimately linked with memory, smell evokes memories. Damage to the temporal cortical region of the brain, the site of memory, doesn't affect the ability to detect smell, but, rather, prevents the identification of the smell, because we must first remember a smell before we can identify it. Smell memory falls off less rapidly than other sensory memory, in fact smell memory normally lasts a long time. Like the stimuli we receive through other senses, a smell can become associated with a particular experience and the same smell can recall whole complex memories, complete with all associated emotions; smell is better at this memory cue effect than other senses, and it does it very quickly and powerfully. French novelist Marcel Proust claims that:

'When nothing else subsists from the past, after the people are dead, after the things are broken and scattered...the smell and taste of things remain poised a long time, like souls... bearing resiliently, on tiny and almost impalpable drops of their essence, the immense edifice of memory.'

This is entirely unconscious, although countless studies have shown that recall of specific factual information can be enhanced if the original learning was done in the presence of a smell and that same smell is presented at the time of recall. But research has also shown that smell memory is context dependent and can be modified in the light of new experience, which implies that our smell sense is continuously dynamic, updating as we live and experience new things.

Smell and children with deafblindness

Most of us have heard stories about the surprising

(Left) Nick feels and smells the ice cream ball

(Right) Nick enjoys the heavy weight and string smell of the ice cream ball

effects of smell sensations on some children with deafblindness. A young child with significant visual and hearing impairments who always became very upset when being taken into the hospital building even though he could not possibly have seen and recognized the building nor understood from spoken conversations that he was being taken to a hospital. Another child would become excited and begin to salivate as lunch was being cooked in the room next door, even though he had not seen or heard the food being prepared. An older child would routinely search for the hand of every new person who entered her classroom and lift it to her nose very deliberately and sniff it; then she would either drop the hand and walk away, or she would smile and embrace the other person. When a girl with profound disabilities was allowed time to smell the dish of lavender-scented oil that was always used in her weekly massage session her eyes would open wider, she would become gradually more animated, and she would break her customary silence with quiet vocalizations. All of these are examples of ways in which the sense of smell can offer vital and meaningful information to children with deafblindness and enable them to connect with their environment and to recognize and anticipate what is coming correctly.

Some children with deafblindness are anosmic, they have no sense of smell (we think that this is the case with many children with CHARGE Syndrome, for example, because of the cranial nerve damage already mentioned and because of blocked nasal passages), and others don't appear to show any awareness of the sense even though it may be intact and working. In other cases children give very clear evidence that smell is an important sensory input for them, as in the examples mentioned above, and many children show levels of environmental and social awareness that are surprising and perplexing to us (like the boy upset by hospital visits), until we realize that their sense of smell must have given them the essential information they needed for this awareness and recognition. Indeed, if we think of the sensory deprivation inherent in the term 'deafblindness' it seems obvious that the relative importance of other intact sensory channels like smell and taste might be enhanced as long as the inputs coming through those sensory channels are meaningful for the child.

Sometimes people involved with a child with deafblindness think of using smells in a deliberate way to help the child know what is going on, and in these cases the following guidelines might be helpful.

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1. First it is helpful to observe for, and discuss, the ways the child already responds to smells. How do they show that they have perceived a smell, and which smell? Can they locate its source in the room? Do they seek out smells? Do they recognize smells, and how do they show that they do? These are all important questions to be asking and discussing before any work is done

on enhancing smells or adding new smells to the child's environment.

2. Helping the child to become more aware of smells that are already present in their existing environments and in their regular routines might be a useful thing to do, and there are usually many more of these routine smells around than we realize. This idea might involve strengthening these existing smells if this is possible, or it might mean investigating ways to draw the child's attention to the smells in a way that helps them connect the smell with the upcoming activity. These activities might also help the child to learn to seek out smells more consciously and deliberately. Time spent exploring and thinking about this, and discussing your ideas with others, should be helpful.

3. Any ideas about introducing new smells artificially should be treated with caution. If the new smell is not already an integral part of the activity or of the environment it might, in fact, be a distraction and create confusion for the child. Since the smell is being introduced artificially it might also be difficult for everybody involved with the child to remember always to introduce it consistently and appropriately, and to remember exactly which smell is to be used with which activity or in which location.

4. Many smells released into the atmosphere remain perceptible for a very considerable period of time, and they can't be 'put away' like we would switch off a light or a radio, or remove a toy from a child and put it away in a drawer. If too many different and strong smells are deliberately introduced in one place they will blend together, which could cause confusion and distraction, and might even be a potential health hazard (depending upon the type of chemicals being used). Everybody in the room will be exposed to these smells, not just the child for whom they are intended. It is reported that the sense of smell 'tires' and the nose begins to lose its sensitivity after exposure to three or four different smells in succession.

5. All of us have hypersensitivities to certain smells and to certain intensities of smell, and, while some children with deafblindness may demonstrate these hypersensitivities with obvious aversive responses, others might not be able to let us know that they are suffering. Because of that unique nerve pathway from the inside of the nose directly into the brain it is particularly important to use caution, discretion, and close observation when exposing a child to a range of enhanced smell experiences. (For more information on these kinds of hypersensitivities see www.handle.org/miscinfo/environ.html).

6. Hypersensitivity might be reduced if essential oils are used to provide certain smells rather than an impure source like an aerosol spray or some other type of air freshener. Essential oils are powerful chemical substances, however, so should only ever be used after consultation with an aromatherapist. Essential oils can be used in massage sessions, and this is one activity where it seems like a very good idea to introduce a consistent smell in the massage lotion to help to 'label' the activity for the child with deaf-blindness. If used in a massage lotion these oils will be absorbed both through the nose and through the skin so it is particularly important to consult an aromatherapist and to follow all safety guidelines. For massage purposes any essential oil should always be greatly diluted in a bland carrier oil, and the dilution needs to be greater for young children than for adults. Many specialists recommend that no essential oil be used in massage lotion for the very youngest infants, and then only essential oil of lavender or chamomile be used with older children (both of these oils are said to have calming, soothing properties).

With thanks to CDBS

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