A CORRELATION BETWEEN THE LOCATION & SENSITIVITY OF HUMAN SENSE ORGANS

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Abstract

A curve is plotted with the average gross physical positions of sense organs on the human face against their "sensitivity" or domains of operation. The points are shown to lie on a smooth curve. The upper portion on the curve is shown to predict the correct domain of perception for the sense of touch. The lower portion of the curve shows no limiting value in the perception of small masses. It is speculated that we may be capable of perceiving particles and particle fluxes very much smaller than the currently accepted thresholds.

Human perception of reality is entirely dependent on the five senses. The organs corresponding to four of these senses, namely the tongue, nose, ears and eyes are located on the face, while the fifth — the sense of touch — is through sensors distributed all over the body. This distribution of sense organs is, in fact, the same for nearly all higher forms of life on earth. The sensations produced by our organs are often qualitatively described as "coarse" or "fine", the sensation of touch being usually considered the coarsest, while sensations such as the perception of colour or music are considered among the finest. With this qualitative distinction in mind, it is interesting to note that the sense organs on the human face seem to be arranged in an ascending order of "fineness", culminating in the eyes which are usually considered the most sensitive and useful of our organs. It is possible that the sequence of organs on the human face is an accidental one. However, such a possibility is unlikely, since the evolutionary process seems to have ensured that every part of a human body is in its present location for some specific reason. In the present article, we describe an attempt to determine whether the locations of sense organs on the human face are in any way related to their sensitivity and domain of response.

The sense of taste is activated by solids, or more exactly, by aqueous solutions or suspensions. The sense of smell on the other hand is activated by gases or vapours. Hence, although both organs operate at the molecular level, there is a distinct difference in the amount of matter required to activate these senses. The nose operates, literally, at a finer level than the tongue. A little above the nose, ears operate on the energy of longitudinal waves in air, while still higher are the eyes, which respond to a part of the spectrum of electromagnetic radiation. This progression, namely gross matter, gas, vibrational

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energy and radiational quanta, is clearly in sequence. However, the sequence must be quantified in terms of a common unit before one can attempt to correlate it with the positions of sense organs on the face. Taste and odour are properties of material particles, while sound and light are manifestations of waves, that is, characterised by quanta of energy. Fortunately, energy and mass are interconvertible and a common unit can be found. We have chosen a unit of mass as this common unit, rather than a unit of energy, since the representation of a photon or a phonon as a particle of a certain mass seems conceptually easier than the representation of matter as de Broglie waves. We have, therefore, characterised each of the sense organs on the human face by a threshold, or "activation" range of mass at which the organs operate. These values and the forms in which these masses are perceived are given in Table 1 on the opposite page.

One would now like to know where exactly the four sense organs are located on the average human face. Since the length, breadth, size and shape of human faces vary over a fairly large range, we have preferred to use average ratios to indicate the locations of sense organs on the human face rather than the average absolute dimensions. We have considered the length of a face to be the perpendicular distance between planes tangential to the top of the scalp and the chin, respectively. The ratio of the distance between a horizontal plane passing through a given organ and that tangential to the scalp, to the total length of the face is then taken as the vertical location of that organ. We have measured several Indian faces as well as photographs of faces from other parts of the world. The location ratios show very little racial variation. The average values obtained are shown in Figure 1 (below) and Table 1.

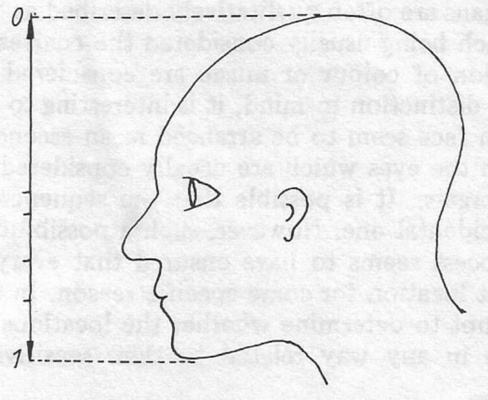

Figure 1. The location of sense organs on the human face.

Figure 2 (below) shows a plot of the common logarithm of equivalent activation mass against location ratio for the four sense organs on human faces. The points appear to lie on a smooth curve.

The $\log_{10}$ m versus r curve of Fig. 2 seems to indicate a strong correlation between the sensitivity and location of sense organs. The reason for such a correlation is not obvious. Perhaps it indicates the order in which the organs evolved. However an extrapolation of the curve in Fig. 2 leads to certain interesting suggestions. In the direction of increasing r, the curve appears to

Table 1

Location ratios of sense organs on the human face, their operational thresholds expressed in order of magnitude units of mass, and the velocities of propagation of these particles. Note that the velocities are also in sequence.

Organ	Location ratio, r	Approximate domain of activation	Equivalent particle mass for activation m (kg)	Approximate velocity of propagation v (m.sec^{-1})	Nature of propagation
Tongue	0.783	0.1 mg to 1 gm of substance	$10^{-5\pm2}$	10^{-7}	Diffusion of solids in liquids
Nose	0.691	10^{-8} mg to 1 mg of gas	$10^{-10\pm4}$	10^{-3}	Diffusion of gases in air
Ear	0.629	10^{-5} mW.sec to 100 W.sec acoustic energy	$10^{-20\pm5}$	$3.5 \times 10^{+3}$	Velocity of sound in air
Eye	0.580	1 photon to 10^{10} photons	$10^{-35\pm5}$	$3 \times 10^{+8}$	Velocity of light in vacuum

asymptotically approach the line $\log_{10}$ m = +5. Moreover, the average human body would be contained approximately within the distance r = 6. In the framework of the present work, this can be interpreted as an indication that the range of perception below the tongue would be restricted to particle masses between 10^{-5} and 10^{+5} kg (i.e. 100 milligrams to 100 metric tons). This is in good agreement with our "grossest" sense — the sense of touch. The lower limit in the range of milligrams is reasonable. Whether the upper limit is meaningful is difficult to decide (one may do well to remember the story about the three blind men and the elephant — the man feeling the trunk thought the elephant was a long pipe, etc.). Certainly the middle of the predicted range, 10^0 kg, gives the correct sizes (for usual densities) which can be perceived by touch alone. What is important is that an upper limit does seem to exist in the perception of large masses by touch.

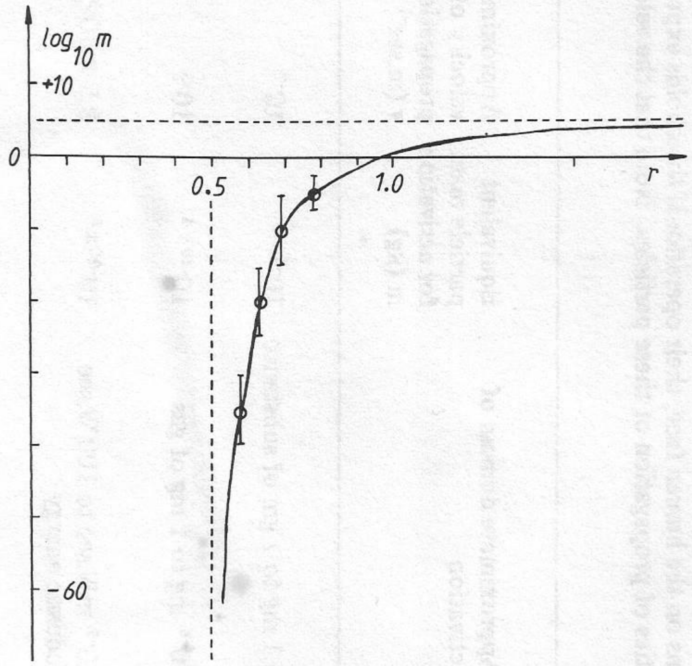

Figure 2. A plot of the common logarithm of activation masses for sense organs against their location on the face.

The curve in Fig. 2, when extrapolated to the low mass side, however, does not show a limiting value in M but tends to asymptotically approach the line r = 0.5. Fig. 2 predicts therefore that a sense organ located just above the level of the eyes should, if it exists, be able to operate at particle masses between 10^{-45} and 10^{-55} kg. The form in which this mass range may be perceived, whether as mass, as radiation or any other form of energy, is beyond the scope of Fig. 2. Converted, for instance, to electromagnetic radiation, this would correspond to a frequency of between 10^{-4} and 10^{+6} Hz, with a central frequency of about 10 Hz. It is interesting to note that brain rhythms are of this order of frequency and that stroboscopic excitation at frequencies close to 10 Hz can initiate convulsions in epileptic patients or cause transitions into the hypnotic state. It is also interesting that the frontal areas of the brain are usually connected with conceptual or intellectual activity. One could consider the human ability to recognise patterns as a "sixth sense" and an information scientist could possibly allocate an energy quanta at which this sense operates. Fig. 2 would then indicate a location. The steep slope of the curve near $r = 0.5$ also indicates an ability to detect a very large range of small particles, i.e. a large number of phenomena. Indeed, persons of exceptional intellectual ability such as geniuses or prodigies have often described a sudden transition into an "illuminated" state where entire ranges of physical or conceptual phenomena have fallen into place. A perceptual transition one may well describe as that from knowledge to wisdom. However a connection between these phenomena and the nature of Fig. 2 is purely speculative and only indicates a direction for research.

The numbers used in this article are very approximate and there is much scope for improving the curve in Fig. 2 to a more exact one. We conclude merely that the sensitivity of human sense organs are correlated to their physical locations in the body. If this correlation is not spurious, then the human organism may be capable of evolving (may even have already evolved) sense organs to detect fluxes of particles and quanta of masses which are presently considered infinitesimally small.

References

1. Brown, R.A., Science and the creative imagination, *Spec. Sci. Techn.*, 3, 563 (1980).
2. Simon and Schuster, The way of the scientist, in *Int. Science and Technology*, New York, p.82 (1966).
3. Platt, W. and Baker, R.A., The relationship of the scientific hunch to research, *J. Chemical Education*, 8, 1969 (1931).