pupillary changes with a like or dislike of the material, nor with the degree of complexity of the stimulus or the information contained in abstract and geometrical drawings. This perhaps conflicts with previous pupillary[2] and other autonomic[4,5] findings.

More important, it was found that a peak in the dilation of the pupil was followed by a sharp post-solution drop, when single-solution anagrams and mental-arithmetic division sums were solved. That this drop was associated with a reduction in arousal at the end of a job was demonstrated by the presence of the drop, if not the peak, when the subject was instructed to answer and halt his attention on multi-solution anagram-type word-game problems on receiving a signal. Otherwise, there was no such pupillary drop with the multi-solution problems. Unsolved material, on the other hand, both arithmetic and single-solution anagrams, was found to produce a high plateau of maintained dilation, usually just below the peak attained at solution.

Similarly, difficult arithmetic problems, solved or unsolved, were found to produce an overall higher level of dilation than easy ones. Moreover, the same phenomenon occurred when the same kind of arithmetic material (with answers consisting of two digits) was to be answered by two different techniques, one easier than the other. Thus the cognitively easier response, of giving each of the two digits of the answer as attained, was found to result in a lower level of dilation than when the first digit had to be remembered while the second was being found, and then both being answered verbally together.

The absence of solution peaks with the multi-solution word-game material, the overall relatively low levels even when many responses were made, the lack of differences noted here between material found easy or difficult, or when many or few responses were made, suggested one of two things. Either verbal answering did not account solely for the solution peak (some other factor such as success was perhaps responsible), or the potentially easier multi-solution problem was different in its effect from the single-solution one.

The importance, however, of the contribution of verbalization to the response peak of the pupil was demonstrated in several ways. Verbalization of a stored response, either at a pre-arranged moment, or after receiving a signal, resulted in an increase in the dilation of the pupil during those periods, as compared with control situations when verbalization occurred elsewhere. The moment of actual as opposed to verbalized solution of a problem was still marked by a peak, although often of a somewhat lower level. Other motor activities, however, such as pressing a button on solving the problem, proved sufficient to bring the solution peak up to the same level as when concomitant verbalization occurred. Nevertheless, while pressing a button proved equivalent to verbalization in forming the peak, it did not replace it. Thus subsequent additional verbal answering of the response resulted in a dilation level equal to that which occurred in a similar condition where there had been no such pressing of a button. It has already been noted here, however, that verbalization was not an inevitable inducer of relative dilation of the pupil, as with the multi-solution word-game material.

There were a number of subsidiary findings. There was a tendency for an overall "down-drift" in the pupillary baselines during the course of the experimental runs, possibly associated with a decline in arousal. These would usually be reset to earlier levels by switching stimuli or response types, or when a number of successive difficulties or failures were encountered. Similarly, overall baselines appeared to be pre-set to blocks or runs of similar stimuli. Thus, during inter-stimulus or inter-task intervals within such blocks of similar material, a baseline pupillary diameter would be found which differed from that encountered with blocks of different material.

Our intention now is to add measurements of blink-rate to the studies of the pupil in information processing tasks. The latter will include reaction time and vigilance situations, and comparisons of performance under established sets such as speed and accuracy. The effects of drugs, stress and fatigue could also be studied, as well as situations using auditory material such as the Wittenborn[6] tests of attention, with a button pressing response and a variable rate of presentation.

This work was carried out while I was at the Department of Psychology, University of Sheffield.

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GENERAL

Gymnoplasts instead of "Protoplasts"

MICROBIOLOGISTS call yeast cells and bacteria devoid of their cell wall "protoplasts"[1]. According to a 100 yr old definition the protoplast represents the totality of the living cell constituents quite independent of whether the cell is coated by a wall or not. The general cytological term has therefore unfortunately been narrowed by considering the "protoplast" as the result of the removal of the cell wall. In seminars and symposia on "protoplasts", the term is used for a cytological speciality which covers only a small sector of the wide classical concept, as represented by the publications in the journal *Protoplasma* and the monographs of *Plasmatologia* which are concerned with all aspects of living matter, and not only with the problem of whether and how the lost cell wall can be regenerated.

The first cytologist to report naked protoplasts of higher plants was Küster[2], who called them gymnoplasts, in contrast to the dermatoplasts, the normal plant cells with their cell wall. These are clear and logical terms which tell us that there are cells with walls, the dermatoplasts, from which naked protoplasts, the gymnoplasts, can be prepared.

Another scientific misnomer is "spheroplast"[3] for a gymnoplast the cell wall of which is incompletely removed. Most gymnoplasts are perfect spheres as well, and so it is illogical to give to a neutral morphological term such a special meaning. A term ought to express what it means. An incompletely naked gymnoplast could, for example, be called a semi-gymnoplast. Morphological terms are necessary for the description of observed objects, and they should not be used for the characterization of their ontogenetic or functional features. For example, spherosomes which contain hydrolytic enzymes are lysosomes[4], but probably not all spherosomes belong to that category, and, of course, not all spherical cells are "spheroplasts", that is, cells with incompletely removed cell walls.

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