# A Clinical Study of Responses to Olfactory Stimuli in Aphasic Adults

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This paper is based on the author's unpublished Master's Thesis, University of Oregon, 1964. The study was born out of a desperate attempt to elicit purposeful, intelligible speech from a post CVA aphasic. The realization that standard types of stimulation had failed prompted me to take a perfume bottle out of my purse, remove the lid, and hold it under the lady's nose. After several attempts she finally said, "perfume, perfume, perfume!" When she finished crying happy tears, I pulled an orange out of my lunch sack, tore the skin, and held that under her nose. After a few tries she said "orange" clearly. The next session I returned with more things for her to smell. Once she said the correct word for the odiferous object, in response to the olfactory stimulation, she never needed to smell it again in order to name it.

At that time a review of the literature revealed no tests or theories mentioning olfactory stimuli for eliciting linguistic responses from aphasics. Schuell (29) had stated that the basic difficulty of those who did not recover from aphasia was that they could not associate a spoken word with a familiar object. They could not make associations through the visual, auditory, or tactile senses. Therefore, this study was based on the hypothesis that the olfactory sense might be therapeutically utilized to call up verbal and/or motor responses appropriate to the odors perceived.

## Methods and Procedures

Thirty aphasic adults with right hemiplegia were administered Schuell's Short Examination for Aphasia (28). Nineteen patients could be categorized into one of the five groups as shown on the Classification Chart (Appendix I).

The odorous substances used are listed in Appendix II. These substances were presented in transparent cylindrical pill containers. The hyphenated titles of the tests refer to stimulus-response.

1. Visual Substance - Oral, Written, Pantomimed: Each container was presented to the subject with the verbal request to name the contents. If he could not say the word, a written or pantomimed response was permitted. See the Response Sheet (Appendix III) for method of recording responses.

2. Printed Word - Oral Reading and Matching: All containers were lined up in front of the subject. The examiner presented words denoting the names of the substances on cards, one at a time, which the subject was asked to read aloud and then match to the appropriate container.

3. Auditory Word - Oral Repetition and Substance Identification: The subject was requested to repeat the word spoken by the examiner and then to point to the corresponding substance.

4. Recall of Substance from Memory: All stimuli were removed and the subject was asked to name as many items as he could remember.

5. Olfactory - Oral, Written, Pantomimed: The subject wore special glasses to eliminate visual stimuli while each container, the lid having been removed, was placed under his nose. His task was to tell, write, or pantomime the name or use of the substance.

6d. Olfactory - Visual and Oral Identification: The special glasses were worn while each substance was presented olfactorily and then removed so that all containers could be seen. The task was to name and find the substance he had smelled.

6s. Simultaneous Olfactory and Visual-Oral Identification: This test was given to thirteen subjects instead of Test 6d. Each container, with the lid off, was presented for the subject to see, smell and name.

7. Auditory and Olfactory - Discrimination between Substances: The glasses were worn throughout this test. The subject was instructed to tell the examiner when he smelled a certain substance. In no case did the subject receive more than four olfactory stimuli from which to choose.

As can be seen from Table 1, tests 8, 9, and 10 are a repetition of tests 4, 1, and 2 in that order. The purpose of retesting these areas was to determine whether or not the prior olfactory stimulation would aid their ability to respond.

## Results

Table 1 shows the mean scores of all subjects for each test. Mean responses to tests 1, 2 and 4 were inferior to the mean responses to the same tests (9, 10 and 8) repeated after olfactory stimulation. In test 5, correct oral responses to olfactory stimuli alone were not as numerous as correct oral responses to the next tests which utilized olfaction with vision or audition (6d, 6s, and 7).

Table 2 shows significant differences between oral responses to tests given prior to olfactory stimulation and responses to tests accompanied by or following olfactory stimulation. The last item in the table indicates the total increase in correct oral responses during or after presentation of olfactory stimuli as compared with responses preceding olfactory stimulation.

Table 3 shows the mean correct responses of the subjects classified in accordance with Schuell's groupings for types of aphasia. Although the average mean response for all groups to tests involving olfactory stimuli was higher than for the other types of responses, Group I (severe damage) and Group IV (specific sensorimotor findings) were more successful in their responses to tests involving olfactory stimuli than in any other type of response.

## Discussion

The data suggest that olfaction can be used effectively to stimulate language in some aphasic adults. Eleven out of the thirty studied produced

TABLE 1

TOTAL MEAN RESPONSES FOR EACH TEST GIVEN IN ORDER OF PRESENTATION TO THIRTY ADULT APHASICS

| Test Sequence | Stimuli | Responses | N | Mean |
|---|---|---|---|---|
| 1 | Visual Substances | Oral, Written, and Pantomimed | 30 | 8.83 |
| 2 | Printed Word | Oral Reading | 21 | 8.1 |
| | | Match Word to Substance | 21 | 10.2 |
| 3 | Auditory Word | Oral Repetition | 20 | 11.8 |
| | | Visual Identification | 20 | 13.2 |
| 4 | Recall of Substances from Memory | Oral, Written, and Pantomimed | 19 | 3.78 |
| 5 | Olfactory | Oral, Written, and Pantomimed | 30 | 6.80 |
| 6.d | Olfactory | Visual and Oral Identification | 16 | 10.81 |
| 6.s | Olfactory and Visual | Oral Identification | 13 | 11.00 |
| 7 | Auditory and Olfactory | Discrimination Between Substances (Oral) | 18 | 12.11 |
| 8 | Recall of Substances from Memory | Oral, Written, and Pantomimed | 16 | 7.50 |
| 9 | Visual Substance | Oral, Written, and Pantomimed | 28 | 11.53 |
| 10 | Printed Word | Oral Reading | 7 | 11.00 |
| | | Match Word to Substance | 14 | 13.07 |

TABLE 2

A COMPARISON OF ORAL RESPONSES TO TESTS GIVEN PRIOR TO PRESENTATION OF OLFACTORY STIMULI (I) WITH RESPONSES TO TESTS ACCOMPANIED BY OR FOLLOWING OLFACTORY STIMULI (II)

| | I | | II | | | |
|---|---|---|---|---|---|---|
| N | Types of Stimuli | Types of Responses | Types of Stimuli | Types of Responses | Mean Differences | Levels of Significance |
| 28 | 1) Visual Substance | Oral | 9) Visual Substance | Oral | 3.7 | .01 |
| 16 | 1) Visual Substance | Oral | 6.d) Olfactory | Visual and Oral Identification | 1.8 | .01 |
| 13 | 1) Visual Substance | Oral | 6.s) Olfactory and Visual | Oral | 3.2 | .01 |
| 12 | 2) Printed Word | Oral Reading | 10) Printed Word | Oral Reading | 1.25 | .02 |
| 16 | 4) Oral Recall of Substances from Memory | | 8) Oral Recall of Substances from Memory | | 3.0 | .01 |
| 30 | Total Number of Correct Oral Responses | | Total Number of Correct Oral Responses | | 3.16 | .02 |

TABLE 3

MEAN CORRECT RESPONSES OF THIRTY APHASIC SUBJECTS CLASSIFIED ACCORDING TO SCHUELL'S GROUPINGS FOR TYPES OF APHASIA

| Types of Responses | Schuell Groupings | | | | | | |
|---|---|---|---|---|---|---|---|
| | I N=2 | II N=6 | III N=0 | IV N=7 | V N=4 | Unclassifiable N=11 | Average Mean Response for all Subjects |
| Responses to Tests Involving Olfactory Stimuli | 11.08 | 9.03 | | 10.67 | 9.25 | 9.26 | 9.84 |
| Oral Responses to all Stimuli | 4.95 | 9.30 | | 6.92 | 6.83 | 8.96 | 7.39 |
| Oral, Pantomimed, and Written Responses to all Stimuli | 9.82 | 9.16 | | 7.88 | 7.10 | 7.78 | 8.34 |
| Matching Responses to Auditory, Olfactory, and Visual Stimuli | 8.80 | 7.13 | | 9.28 | 9.42 | 9.88 | 8.30 |
| Mean Total of all Types of Responses to all Types of Stimuli | 9.59 | 6.39 | | 7.28 | 8.10 | 9.52 | 8.17 |

a greater number of correct oral responses to olfactory stimuli than to visual stimuli. Nine out of the thirteen who received tests 1 and 6s demonstrated superior performance to simultaneous visual and olfactory input than by visual alone.

In the pilot study, only tests 1, 5, 6s and 9 were administered with approximately the same results. The fact that the pilot subjects did not receive the tests which included seeing or hearing the names of the substances tends to negate the possibility of those tests improving responses to olfactory stimuli.

It is interesting to note that Brown (5) found that discriminatory ability of monkeys on simultaneous visual and olfactory stimuli was not impaired by temporal lobe lesions. It is conceivable that the same ability in aphasic humans with temporal lobe lesions might be related. Since the olfactory bulb, or perception area, is located on the underside of the temporal lobe, it is likely to escape damage incurred by auditory and visual systems requiring thalamus to cortex pathways. Herrick (10) reported that the olfactory cortex serves as a nonspecific activator for all cortical activities as well as participating in cortical associations. This may be why substances in visibly recognizable form bearing characteristic odors offer the patient an additional means by which he can perceive the stimulus and build associations which in turn may lead to improved verbal expression.

As a means of comparing the aphasiologist to the aphasic, consider those of us who awaken in the morning feeling decerebrate. The aroma of coffee brewing arouses some cerebration and the aphasiologist begins to make enough associations so that he can get ready for work.

## Discussion

Q: Have you tried using taste as a stimulus?
A: No.

Q: Do different types of odors elicit better responses than others?
A: Pungent odors elicited more oral responses albeit not always the name of the substance. (Included here for the questioner's convenience is a rank-order list of the test substances based on the frequency with which they were identified by olfaction by normal and aphasic subjects--Appendix II.)
Additional information pertaining to types of odors is found in Amore, et al. (2) and Ruch, et al. (27). Five of the test substances, mothballs (camphoraceous), perfume (floral), peppermint candy and toothpaste (pepperminty), and dill pickles (pungent) had primary odors. Licorice and cloves are pure olfactory stimuli. Mothballs stimulate trigeminal nerve endings resulting in cutaneous sensations. Thus, even an anosmic person reacts to mothballs.

Q: Did you establish a smell reception threshold, range of acuity or normalcy?
A: No. A few patients were not tested because their families indicated that they had always been anosmic.

Q: The author was referred to Geschwind,Norman."Disconnexion Syndromes in Animals and Man." Brain, 88 (1965), Part I, pp. 237-294 and Part II, pp. 585-644.

A: Wouldn't it be interesting to "round-table" with Doctor Geschwind? His articles are difficult to summarize, by his own admission, but I am very intrigued by the concept he explores. He interprets human syndromes independently from animals but he uses the evolution theory of the brain to explain the neocortex, its functions and dysfunctions. Consider his statement on page 274.

> "In subhuman forms, the only readily established sensory associations are those between a non-limbic (visual, tactile, auditory) stimulus and a limbic (olfactory, gustatory) stimulus. It is only in man that associations between two non-limbic stimuli are readily formed, and it is this ability which underlies the learning of names of objects."

Perhaps he would agree that pairing a limbic stimulus with a non-limbic stimulus, and then fading the limbic would be a possible way of revitalizing associations between non-limbic stimuli for the aphasic patient who has lost the ability to name objects on the basis of non-limbic stimulation alone.

APPENDIX I

CLASSIFICATION CHART FOR SCHUELL'S SHORT EXAMINATION FOR APHASIA

| | Group I Severe Damage | Group II Auditory Retention Span & Recall | Group III Specific Visual Findings | Group IV Specific Sensorimotor Findings | Group V Auditory Visual & Motor Findings | Unclassifiable | # of Errors |
|---|---|---|---|---|---|---|---|
| SECTION A | | | | | | | |
| Auditory disturbances | | | | | | | |
| 1. Auditory recognition | Def. | Intact | Intact | Intact | | | |
| 2. Auditory retention span | Def. | Def. | Def. | Def. | Def. | | |
| 3. Auditory comprehension | Def. | | | Def. | Def. | | |
| a. Directions | | | | | | | |
| b. Paragraph | | | | | | | |
| SECTION B | | | | | | | |
| Reading disturbances | | | | | | | |
| 1. Word recognition (vis.) | | | Sig. | | | | |
| 2. Word recognition (aud.) | Def. | | | Sig. | | | |
| 3. Reading comprehension | | Def. | Def. | Def. | Def. | | |
| a. Sentences | Def. | | | | | | |
| b. Paragraphs | No P. | | | | | | |
| SECTION C | | | | | | | |
| Speech & language disturbances | | | | | | | |
| 1. Cranial nerve | | Intact | Intact | Intact | Def. on | | |
| 2. Sensorimotor | Def. | Intact | Intact | Def. | 1 or 2 | | |
| 3. Naming | No P. | Sig. | Sig. | Sig. | | | |
| 4. Functional speech | No P. | Def. | Def. | Def. | Def. | | |
| a. Definitions | | | | | | | |
| b. Proverbs | | | | | | | |
| SECTION D | | | | | | | |
| Visual & writing disturbances | | | | | | | |
| 1. Revisualization | | Intact | Sig. | Intact | Def. | | |
| a. Man | | | | | | | |
| b. Symbols | | | | | | | |
| 2. Spelling | No P. | Sig. | | | | | |
| a. Written | No P. | | Sig. | Sig. | | | |
| b. Oral | | | | Def. | | | |
| 3. Functional writing | No P. | Def. | Def. | Def. | | | |
| a. Dictation | | | | | | | |
| b. Spontaneous | | | | | | | |
| c. Reversals, distortions, confusions of symbols | | Intact | Def. | Intact | Def. | | |

Def: Defective No P: No performance Sig.: Errors significant if present

Blank spaces indicate performance not significant for classification.

# APPENDIX II

## LIST OF SUBSTANCES IN RANK-ORDER BASED ON THE EASE WITH WHICH THEY WERE RECOGNIZED BY TWELVE NORMAL ADULTS AND THIRTY APHASIC ADULTS

| Normals | Aphasics |
|---|---|
| 1. Peppermint (candy & toothpaste)<br>Onion<br>Perfume<br>Nail Polish<br>Coffee | 1. Peppermint (candy)<br>Mothball |
| 2. Licorice<br>Cloves<br>Tobacco ( and cigarettes)<br>Peanuts | 2. Lemon<br>Onion<br>Coffee |
| 3. Lemon<br>Pickle<br>Mothball | 3. Perfume<br>Peanuts |
| 4. Soap | 4. Tobacco (and cigarettes)<br>Nail Polish<br>Licorice |
| | 5. Pickle<br>Soap |
| | 6. Toothpaste<br>Cloves |

APPENDIX III

RESPONSE SHEET FOR EXPERIMENTAL TESTS

Test Number_____

Name_____
Number_____
Place_____
Date_____

| SUBSTANCES | RESPONSES | | | | | |
|---|---|---|---|---|---|---|
| | VERBAL | WRITTEN | PANTOMIME | MATCH | CORRECT | INCORRECT |
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |
| 5. | | | | | | |
| 6. | | | | | | |
| 7. | | | | | | |
| 8. | | | | | | |
| 9. | | | | | | |
| 10. | | | | | | |
| 11. | | | | | | |
| 12. | | | | | | |
| 13. | | | | | | |
| 14. | | | | | | |

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