Object Identification and Naming in Cleft Palate Children

DONALD G. BRENNAN, M.A.
WALTER L. CULLINAN, Ph.D.
Oklahoma City, Oklahoma 73190

The results of recent studies have suggested that the communication disabilities which are generally observed in children with cleft palate may be greater than can be explained on the basis of the anatomical defect alone. While defective articulation and resonance inbalance can be related directly to structural and functional deficiencies, there is evidence of general language deficits in cleft palate subjects (e.g., *8, 9, 13*). The areas of deficit include verbal and gestural output, vocabulary usage, and recognition vocabulary. In addition, many studies (e.g., *4, 5*) have found lower IQs for cleft palate children than for noncleft palate children, and lower IQs for verbal than for nonverbal tasks.

The language deficits possibly could be explained on the basis of medical, environmental, and social problems related to the palatal condition (*10*). Lamb, Wilson, and Leeper (*6*), however, found evidence of visual-perceptual-motor involvement for cleft palate children which might be familial in nature. They concluded that the cleft palate condition may be, in some cases, only one manifestation of a broad range of involvements, including visual-perceptual-motor deficits, which may result from the same overall genetic abnormality. Smith and McWilliams (*14*) also found evidence of a general visual-motor deficit and they point out the need for further investigation of the perceptual-motor capabilities of cleft palate children.

Two aspects of visual-perceptual-motor performance which have been investigated recently, although not with cleft palate subjects, are the visual duration threshold and the object-naming latency. The visual duration threshold refers to the duration of stimulus-picture exposure necessary for a subject to detect enough information to identify the pictured object. The object-naming latency (verbal reaction time) refers to the time from the onset of a stimulus-picture to the onset of the spoken naming-response. Thresholds and latencies have been studied by several investigators (*2, 7, 11, 12, 16*) as a means to a better understanding of the perceptual and coding processes involved in seeing an object and naming

The authors are affiliated with the University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma.

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it. Interest has also been in the manner in which the brain organizes the word-store and in the retrieval system for words.

The purpose of the present study was to determine whether possible visual-perceptual-motor deficits in children with cleft palate include higher thresholds and longer latencies than are evidenced in noncleft children.

Procedure

SUBJECTS. Subjects were 14 cleft palate and 14 noncleft palate children. The two groups of children were matched for sex (8 males and 6 females) and chronological age (±4 months). The cleft palate group ranged in age from 7 years, 0 months to 11 years, 3 months with a mean age of 8 years, 10 months and the noncleft group ranged in age from 7 years, 0 months to 11 years, 6 months with a mean age of 8 years, 11 months. Four cleft palate subjects had isolated clefts of the palate, 4 had bilateral clefts of the lip and palate, and 6 had unilateral clefts of the lip and palate. Cleft lip only subjects were not included in this study. The subjects were administered the Peabody Picture Vocabulary Test (PPVT), Form B, and an IQ of 80 was established as a minimal criterion for subject selection. The mean IQ of the cleft group was 95 (range: 80–112) while the mean IQ of the noncleft group was 95 (range: 80–110). All subject pairs were matched within 10 PPVT IQ points and 9 subject pairs were matched within 5 points. All subjects in the noncleft group and 10 of the children in the cleft group passed a hearing screening test (20 dB re: ANSI, 1969, for speech frequencies). The remaining 4 cleft children had hearing losses which did not exceed 35 dB in the poorer ear. Due to difficulty in obtaining subjects to fit the other criteria, children who usually wore glasses were accepted as subjects and were required to wear their glasses during the experimental tasks. It was assumed that for these children, three cleft palate and two noncleft, the defects for which glasses were prescribed were corrected by the glasses; none of these children expressed any difficulty in seeing the pictures. The children in the noncleft group had normal voice and articulation and all children in both groups were enrolled in the appropriate grades for their ages in normally graded schools.

TEST STIMULI. The test stimuli consisted of 36 pictures of simple objects considered easily recognizable by children. Black line-drawn tracings of commerical picture cards were prepared to a uniform size of 3¾ inches. The names of the pictured objects represented a wide range of frequency of occurrence according to the Thorndike-Lorge frequency distributions (*15*).

INSTRUMENTATION. The experimental condition and equipment were similar to those previously described by Milianti (*7*). A Harvard four-channel digital timer (Model 300-4T), lamp driver (Model 402), and the experimenter were in the control room of a two-room sound-treated suite.

The subject, the experimenter's assistant, and the exposure cabinet of a two-field Harvard tachistoscope (Model T-2B) were in the experimental room. A two-way intercom system allowed the experimenter to communicate with the subject.

PROCEDURE AND RESPONSE RECORDING: VISUAL DURATION THRESHOLD. Each subject was seated before the exposure cabinet and instructed to look into the viewing aperture which was surrounded by a rubber hood to eliminate visual distraction. The experimenter's assistant monitored the subject's position, encouraged the subject's attention, and assisted in the tachistoscopic presentations. The subject was instructed that he was to name pictures which would appear very briefly on the screen. Three practice pictures (*dog, cow, baby*) were presented to each subject to familiarize him with the task. Twelve test pictures were then presented in random order to each subject. The experimenter said "Ready" before showing each picture and the picture was immediately followed by a one-second masking stimulus in order to avoid the effects of visual after-image. Each picture was presented at a duration below the subjects' threshold of recognition. The time of exposure was then increased in 5 millisecond steps up to 100 milliseconds and then, due to limitations in the instrumentation, in 10 millisecond steps until the pictured object was correctly identified. Exposure time was recorded directly by the digital timer. The length of the task varied from 20 to 35 minutes.

PROCEDURE AND RESPONSE RECORDING: OBJECT-NAMING LATENCY. After a short rest, the object-naming task was presented to each subject. The subject was instructed to name more pictures but, unlike the previous task, he was told that the pictures would be exposed long enough to be recognized. The children were encouraged to name the pictures as rapidly as possible. Three practice pictures (*cup, cat, finger*) were presented prior to the presentation of the 24 test pictures. Prior to each exposure the experimenter gave a "Ready" signal followed by a 2- to 3-second interval before the 5-second tachistoscopic presentation of the stimulus picture. The subject was repeatedly encouraged to respond as quickly as possible. The verbal response was picked up by an Electro-Voice cardioid microphone (Model 664) and recorded on channel 1 of an Ampex two-channel tape recorder (Model 440). The start control of the digital timer which initiated the tachistoscopic presentation was wired in such a way as to simultaneously produce a stimulus voltage on channel 2 of the same recorder. The recorded samples were transferred to a Sanborn oscillographic chart recorder (Model 7702A) for the latency measurements. The stimulus voltage was recorded on one channel of the Sanborn and the verbal response was recorded on the second channel at a paper speed of 100 millimeters per second.

All chart recordings were carefully monitored both visually and auditorally. In some instances the onset of the speech signals could not be differentiated from noise signals, e.g., sighing or physical movement, and these responses were excluded from analysis. Since Milianti (7) noted that signal-noise differentiation was especially difficult for words beginning with fricatives, few initial continuant sounds were used in this investigation.

Stimulus onset was defined as the point at which the stylus moved from baseline in an extended upward direction. The onset of verbal response was defined in the following ways: (1) sudden movement of the stylus consisting of a wide excursion or sharp peaking from baseline; (2) the point of onset of gradual rise from baseline; (3) the point of minute fluctuations from baseline prior to sharp vertical movements; (4) fluctuations due to sounds of the articulators contacting or separating, respirations or subvocalizations which connect with or immediately precede the verbal response by 50 milliseconds or less; and, (5) sudden movement of the stylus due to vocalization of vowel sounds connected with or preceding the verbal response signal by 50 milliseconds or less. The latency was measured to the nearest one-half millimeter or 5 milliseconds.

To establish the reliability of the principal investigator, a second experimenter familiar with the criteria of measurement, measured two latencies chosen at random from each of the 28 subjects. The judges agreed perfectly on 31 (55%) of the 56 measurements. For 19 (34%) responses the measures differed by 5 milliseconds and for 6 (11%) responses the measures differed by 10 milliseconds.

Results

VISUAL DURATION THRESHOLDS. The stimulus words, word frequencies and the average obtained thresholds for both groups are presented in

TABLE 1. Stimulus words, Thorndike-Lorge frequency distribution, number of responses included in analysis and mean and median visual duration thresholds (in milliseconds).

stimulus words	*word frequency**	*N*	*means*		*medians*	
			clefts	*nonclefts*	*clefts*	*nonclefts*
1. shoe	100+	14	95	76	70	72
2. chair	100+	14	90	64	82	65
3. fish	100+	14	98	66	82	68
4. cake	50–100	14	136	110	130	110
5. pencil	40	14	90	69	82	68
6. snake	28	14	97	84	90	80
7. sandwich	23	14	145	101	120	100
8. comb	19	14	169	92	145	92
9. pumpkin	13	11	85	75	70	76
10. broom	13	14	92	64	62	60
11. scissors	8	14	109	79	90	60
12. bathtub	1	13	179	161	140	159

* Word frequency per 1,000,000 words of text.

Table 1. The word *pumpkin* was not named after 500 milliseconds exposure by 3 cleft subjects and the word *bathtub* was missed by one cleft subject. These data and the corresponding responses for each matching noncleft subject were not analyzed. The mean threshold across subjects and stimuli was 115 milliseconds for the cleft group and 87 milliseconds for the noncleft group with standard deviations of 33 milliseconds and 27 milliseconds, respectively. The difference between the means was significant (paired-$t = 5.64$; $p < 0.001$) and the noncleft group evidenced lower thresholds than the cleft group on all stimulus items. When medians were used rather than means, the noncleft group evidenced lower thresholds than the cleft group on 9 of the 12 stimulus items.

OBJECT-NAMING LATENCIES. The results of the object-naming task are presented in Table 2. A total of 21 responses by the cleft group and 10 responses by the noncleft group involved either misnamings or failure to name the object during the 5-second stimulus presentation. None of the

TABLE 2. Stimulus words, Thorndike-Lorge frequency distributions, number of responses included in analysis and mean and median object-naming latencies (in milliseconds).

stimulus words	*word frequency**	*N*	*means*		*medians*	
			clefts	*noncletfs*	*clefts*	*noncleft*
1. ring	100+	14	931	826	885	815
2. bed	100+	14	855	759	855	765
3. house	100+	14	821	816	792	810
4. door	100+	12	1180	1200	1085	1002
5. horse	100+	12	1143	1042	1158	1038
6. boy	100+	13	1000	946	960	930
7. nail	50–100	14	935	874	885	842
8. bell	50–100	14	804	814	830	812
9. elephant	35	14	1159	885	1022	872
10. deer	35	12	1081	1090	1042	1020
11. fork	31	14	963	915	855	935
12. leaf	27	14	1003	911	932	905
13. witch	24	14	1237	999	1252	1000
14. butterfly	22	14	961	880	948	875
15. ladder	19	13	1196	993	985	926
16. camel	18	14	1528	1024	1220	1045
17. shovel	14	14	1101	984	892	962
18. rake	13	12	1195	1222	1025	1062
19. umbrella	13	13	1061	1017	1080	885
20. turtle	13	14	881	939	890	858
21. magnet**						
22. carrot	9	14	1119	940	1102	902
23. hanger	1	13	965	1283	885	980
24. toaster	1	11	1772	1205	1705	1000

* Word frequency per 1,000,000 words of text.
** Test word eliminated from analyses.

responses involving misnaming or failure to respond were used in the data analysis. Since a total of 16 of 28 subjects in the study did not name *magnet* appropriately, none of the latencies for this word were included in any analysis. The mean across subjects for all words was 1082 milliseconds (S.D. = 222) for the cleft group and 981 milliseconds (S.D. = 141) for the noncleft group. The difference between the means was significant (paired-$t = 2.68$; $p < 0.01$). The noncleft group demonstrated shorter latencies than the cleft group on 17 of 23 stimulus items when using mean latency and on 18 of 23 when using median latency.

Discussion

The two tasks, identifying an object and giving the name of an object, are more complex processes than they might seem at first. Wingfield (*17*) has suggested that in the object-naming latency there is a confounding of the time required for the perceptual identification of the object and for the search for the name of the object. The perceptual identification of the object was described by Wingfield as a two-stage sequential process involving the visual analysis of the stimulus and the processing of the detected information to complete the perceptual identification. The time required for the visual analysis of the stimulus is presumably what we are calling the visual duration threshold. In addition to the times according to Wingfield which are confounded in the latency, we would have to add, at least, the time which it takes to initiate speech once the name of the object has been located. Thus, we see, in an admittedly oversimplified manner, a four-stage process involved in naming an object: (1) the visual analysis of the object, (2) the processing of the detected information in completing the perceptual identification, (3) the search for the name of the object, and (4) the initiation of the spoken response once the name has been located.

These four steps may well be overlapping in time. From the errors observed prior to reaching threshold in the threshold task, it certainly appears that the subjects are processing some of the information included in the stimulus. For example, *bathtub* frequently was miscalled "box" below threshold exposures, indicating that the subject had detected some information relative to the shape of the object. It has been suggested that the distinction between perceptive processes and verbal coding in the picture naming task may be artificial and that the verbal processing of the visual stimulus may not simply follow the perceptual one but may interact with it from the beginning (*1*). It is conceivable, further, that the subject begins to get prepared, at least to initiate speech prior to the final location of the name.

The finding in this study that the cleft palate children have higher thresholds than the noncleft children suggests that there may be some deficit in the visual-perceptual abilities of the cleft palate children. This seems to add support for the speculations of Smith and McWilliams (*14*) and Lamb, Wilson and Leeper (*6*). that there may be visual-perceptual-motor deficits in cleft palate children.

The difference in average latency for the two groups, however, may not be the result of perceptual difficulty but rather of difficulty for the cleft subjects in locating the names of the objects or in initiating the spoken responses or both. Since the threshold times are included in the latencies, at least part of the difference in latencies may be due to the difference in thresholds. The average difference in threshold between the two groups, 28 milliseconds, however, is small compared to the average difference in latency, 101 milliseconds, so it would appear that the difference in latency is due primarily to factors other than differences in threshold.

It is generally accepted that impaired central nervous system functioning results in slowed simple (motor) reaction times and it has been suggested that a simple reaction time test might have merit as a diagnostic tool in detecting brain damage (*3*). It is not evident however, that the longer verbal reaction times for the cleft subjects compared to the noncleft subjects indicate impaired central nervous system functioning, but further study of the object-naming response seems warranted. In addition to those implied above, there are still many questions to be answered, including the manner in which high thresholds or long latencies affect linguistic performance and the differences in performance on these tasks among children with different types of cleft.

Summary

Cleft palate and noncleft palate children were compared on their performance on a visual recognition task and on an object-naming task. Analysis of the data indicated that cleft palate children performed significantly poorer on both tasks than did the noncleft children. Additional research on the language and visual-perceptual-motor abilities of cleft palate children seems indicated.

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