THE PSYCHOLOGICAL BULLETIN

THE PSYCHOLOGY OF LANGUAGE¹

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I. THE RELATION OF PSYCHOLOGY TO LINGUISTICS

The psychology of language seems related most nearly to the branch of linguistics termed general grammar. Collitz, (8) in his address at the founding of the Linguistic Society of America, described general grammar as that part of linguistic science concerned with the relation between grammatical forms and mental categories. Weiss (111) delineated the broader psychological significance of language. The possession of language distinguishes man most strikingly from lower animal forms. Language enables us to use words as proxies for all objects. As language evolves we tend toward the control of all the objects of the universe through the manipulation of substituted words. Language operates to unite all the individuals of a community into a single sensori-motor organism. Language makes repeatable the best responses of previous generations. The social nature of language emphasized by Weiss is also stressed by Meillet. (50)

II. THE RELATION OF LANGUAGE TO THOUGHT

The problem of the relation of language to thought has been of all the problems of the general psychology of language, most widely discussed among American and British psychologists. Watson (105) early raised the problem in his *Behavior: An Introduction to Comparative Psychology*. He attracted most attention in

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his *Psychology from the Standpoint of the Behaviorist* in 1919.(106) In the *British Journal of Psychology* for 1920, there appeared a series of four articles by prominent British psychologists, together with an article by Watson.(107) Each of these contributions attempted an answer to the question, "Is thinking merely the action of language mechanisms?" asked in reference to Watson's position. Watson had said that language is the most striking behavior difference between man and the lower types of animal life. From the physical standpoint, articulate language consists of a series of special sounds produced by the oral cavities. Laryngeal activity is unnecessary for articulate speech. The question of the identity or non-identity of thought and language would not be at all easy of solution by the means of observing speech defects. This is because the destruction of the bodily mechanisms sufficient to make thought impossible would be followed by the organism's death. The difficulty of learning to speak a new language late in life probably comes from the structural changes in the larynx following upon maturity. It is popularly believed that the vocalizations of infants are associated with emotional states. Language habit is the connecting of vocal activity with bodily states, while vocal habit is the sounding of new words. Imitation operates to a much greater extent in bringing about language learning than it does in the furtherance of manual learning. The child, lacking implicit thought, uses explicit thought almost entirely. With maturity, implicit thought responses appear. Adults have types of thought which are intermediate between explicit and implicit. Explicit thought is not more common among adults because the sound of the voice, which stimulates the adult when he talks to himself, becomes a distracting stimulus for the thought activity. Since the form of implicit speech is abbreviated, it will serve for individual but not for social adjustment. It is unnecessary to assume that all thought is laryngeal. Other implicit bodily processes, some manual, may serve to bring about a silent word, a spoken word, or an act. The psychologists have commonly failed to show the relation between thought and other bodily processes. These people have believed that thought is either of unknown relation to the body, or that it is primarily associated with cortical activity. Thought is a muscular activity, complex as a whole, and extremely abbreviated as to its parts. Thinking includes all implicit language activity and such other activity as is substitutable for language activity.

Thought activity may be divided into three classes; invariable word sequences, such as rote memory, together with day dreaming,

both these behaviors being characterized by the absence of trial movements; recalling responses which involve the giving of old but infrequent responses; and novel problems, characterized by their abundance of trial reactions.

Titchener, says Watson, raised the issue of the inconsistency of the use of introspection by the behaviorists. Watson says that the behaviorist, in the present development of psychology, arrives at a knowledge of thinking through logical inference, without the use of introspection. Since thinking behavior leads to the same results as certain sorts of overt behavior, it seems most reasonable to assume that the thinking behavior is like these explicit responses. The study of the thought processes by instrumentation is to be hoped for.

The behaviorists, says Watson, have been attacked for failing to give an account of the meaning of meaning. This is not a scientific problem, according to Watson's view. The experimental determination of an individual's responses to an object would give an account of the meanings of the object to that individual. Bartlett and Smith (3) held that Watson had failed to make a clear distinction between the substitution of language responses for manual responses and the mere replacement of the one by the other. To Bartlett and Smith, a substitute response is characterized by its functioning as a sign. A sign, to them, is any mode of response which is succeeded by specific modes of reaction in the total adjustment to the situation at hand. Bartlett and Smith believe that many non-speech responses are capable of acting as signs. However, to them, the use of signs does not always involve thought; consequently there is some likelihood of there being an implicit language accompaniment to all thought. The mere abbreviation of a response is not a thinking reaction. The very subtlety of thought causes us to confuse it with speech. Watson fails to distinguish between thought and thinking. Thinking is defined by Smith and Bartlett as a response to a universal quality. As to the practical possibilities of a theory identifying thought and speech, they believe that if a study of thought without the study of the expression of thought be possible, it is extremely limited, and that the method of Watson, though inadequately developed as to detail, is on the whole correct.

Pear (60) gives an analysis of thought which makes speech but a part of thought. Thought may be divided into recall, abstraction, comparison, recomparison with aim, combination into a conclusion, and finally, the expression of this conclusion in speech. Thinking is not a habit, as Watson believes a part of it to be. Pear objects to

Watson's neglect of the place of imagery in thinking, and to Watson's account of imagery. He cites experimental evidence against Watson's identification of the tracing of objects by the eye with imagery. He also cites experimental work on the study of meanings, which he believes shows that meanings differ from words in that their relations are governed by laws other than those which control the relations of words. This was written to controvert Watson's assertion of the identity of meaning and response, and the non-importance of the problem of meanings to psychology.

Robinson (72) believes that the behaviorists reject introspection, together with other parts of the classical psychology, on practical grounds. He holds that such rejection is permissible, but does not think it justifiable in the substitution of speech responses for consciousness. Robinson further contends that it is necessary for science to consider all parts of the universe, whether such be readily accessible or not; also, he believes, consciousness is of practical efficiency, since Freud has shown that imagery influences conduct. The behaviorist leaves consciousness "an isolated and gratuitous miracle." On strictly behavioristic grounds, it would be necessary to determine meaning by the accompaniment of a word in time or space with the object that the word means. Such accompaniment is not sufficient to account for meaning. Thinking to the behaviorist cannot be trial and error language responses, because error implies the evaluation of responses, which is outside the field of a behavioristic psychology.

Thomson (90) believes that the use of the word "substitute" by Watson agrees substantially with Bartlett and Smith's term "substitute sign." He differs, however, from Smith and Bartlett in regard to their treatment of thinking as the response to a general quality. To Thomson, thought is a shortened form of trial and error. Thought, then, cannot be identified with response to an abstract quality, because when such a quality is discovered in a situation, trial and error responses cease. In Thomson's opinion, the behaviorist accepts the existence of conscious states, but chooses not to consider them. However, a denial of the interaction of mental states is a denial of their existence, and the behaviorist's absence of mystery is in truth absence of familiarity. Thomson would disagree with Watson in defining thought by extension, since Thomson does not believe that habitual responses are thought at all. Thought rather refers to a trial and error response in quest of a general quality. The answer to the question "Is thinking merely the action of language mechanisms?" cannot be given in the affirmative, according to

Thomson, if the common understanding of this expression be accepted. However, Thomson agrees that thinking is largely the action of language mechanisms; that thought can be studied through its physical manifestations; and that substitution, which must by definition be relevant substitution, is true criterion of thought.

Watson replied to all of the four articles cited, with the exception of the one written by Robinson. This was not available to him at the time of his writing. Watson answered the question "Is thinking merely the action of language mechanisms?" in the negative. He defended his earlier assertions in the greater part, however. He believed that there is a strong tendency for thought responses to be localized in the larynx. He argues for the extension of the definition of thinking to include all sub-vocal language, and other substitutable activity of whatever kind. In research programs, he believes that overt vocalization could be successfully substituted for introspection. He denied Thomson's statement that the behaviorist admits the existence of conscious states. While granting that verbal reports of experience are possible, Watson states that such reports are quite unreliable. He attacks non-behaviorists who hold that the unobserved portions of thought processes are unlike the observed parts. He defends the position that holds to the identity of thought and its expression. Taking issue with Smith and Bartlett, Watson contends that it is not possible to respond to universal qualities. He believes that responses to universal qualities are responses to words treated as objects.

The controversy as to the identity or non-identity of thought and language was entered by Otis (58). To Otis, thinking is the recombining of the mental elements. These mental elements are images of various sorts; kinesthetic, visual, tactual. Words constitute one, but only one, type of the material of thought. He believes that behaviorism is adequate for a limited field, which to him is smaller than the field of psychology.

Head (27) also discusses the question of the identity of thought and speech. From a study of certain unilateral lesions of the brain, he concludes that there are psychic processes involving language which cannot be classified as speech, reading, writing, motor, or sensory activities. These processes Head calls symbolic thought.

Kantor (39) asserted that language should not be regarded as the expression of any inner thing, but as a response in its own right. He divides the material of the study of language into anthropological, philological and psychological data. Language responses are distin-

guishable from other reactions by their being indirect adaptive response. Language is always indirect adaptation; thinking is always direct.

Melrose (51) reviewed the controversy between Watson and the British psychologists. He attempts to evaluate the various definitions of thinking proposed during this discussion. He deplores the failure of previous writers to tell how thought may be studied other than through its expression. He believes that the view which holds thinking to be a response is the only proper way of regarding the problem. In a later paper, Melrose (52) says that thinking is a process of handling concepts by means of judgments, and that these concepts and judgments are language responses. This linguistic thinking is of higher type and is more efficient than is the motor solution of problems.

Lashley (44) believes that experience has no content that may not be designated by language. Hunter (30) believes consciousness to be describable as a one-way relationship composed of sensory process and language response. Reiser (67) holds that the behaviorists, in emphasizing speech and other muscular responses, have neglected the part played by the brain in thought process. The complication of the brain's structure makes a consideration of its part in thought of the greatest importance. Watson (108) identifies the unconscious of the Freudians with un verbalized responses. He attacked the Freudian notion of the hangover of infantile behavior in adult life. As evidence against the psychoanalysts, he cited the case of a child who showed no evidence of having retained infantile habits after the lapse of a comparatively short time. Watson says that sex life is the concern of much of Freudian literature and practice because sex organization, being in great part un verbalized, becomes a part of the psychoanalytic unconscious.

Markey (48) treats of the way in which words function in the place of objects. In thought behavior, the body stimulates itself in the way in which another object stimulates it. A language habit thus becomes the substitute for an absent stimulus. Language habits contain responses other than speech responses. Markey believes meaning to be activity.

Dashiell (10) attempts to describe thinking behavioristically. He holds that the emphasis of behaviorism is upon the biological rather than the physiological situation. The behaviorist's emphasis upon speech as a part of thought need not be construed as an attack upon introspection, but rather as the substitution of one physiological

theory of thought for another. Behavioristically, thinking is describable as a series of interrelated motor acts and motor sets; physiologically, it is the interaction of reaction circuits.

Davies (11) believes that contradictions exist in Watson's treatment of the rôle of imitation in language learning. In treating of the psychology of language, behaviorism fails to take account of the complication of the brain. Evidence from speech pathology makes it necessary to take cognizance of this complication.

Tolman (97) believes the verbal reports of introspection a type of social behavior; Langfeld (43) calls attention to Malinowski's identification of the meaning of a word with the action for which it stands.

De Laguna (42) believes that speech has developed from the animal cry. Since this is true the earliest speech must have been a sentence embodied in a single word. Speech is distinguished from the cry in that it is a response to a perceived, rather than to a felt, situation. De Laguna objects to the older treatment of speech as a form of activity paralleling thought processes. Objectively regarded, speech is the greatest mechanism for bringing about human coöperation.

Fischer (14) studied the way in which names are attached to nonsense figures presented visually and the way in which these names are subsequently altered. Pick (62) cited Stumpf in support of Fischer's contention for an unanalyzable correspondence between the form of a figure and the name which attaches to it. Rogge (73) discusses the mechanism of speech change. He believes that word creation is dependent upon the speaker rather than upon the hearer. In another article, Rogge (74) treats of the alteration of meaning in a compound word after the compounding has been effected. Stumpf (86) discusses the phenomenal qualities of speaking as compared with singing.

White (113) believes that language has developed from an undifferentiated to a highly differentiated state. The use of abstract language distinguishes the civilized adult from the child and the savage. Some of our language habits are acquired through training; some are inherited and come from the training of previous generations. Callet (7) believes that there is a tendency throughout all language for certain combinations of sounds always to designate objects or ideas of a certain class. He also believes that certain speech sounds designate particular moods of the speaker. Hayworth (26) believes that laughter was developed as a language response.

III. FACTORS IN LANGUAGE ABILITIES

Piéron (63) gives an account of the relation between brain injuries and speech defects. The loss of meaning accompanying certain types of brain injuries is treated. Travis (100) argues for a psychoanalytic approach to the problems of disabilities in written and oral language. He emphasizes the importance of mental conflicts as against the law of exercise in explaining the forgetting of language responses. The successful treatment of a case of spelling disability is recorded.

Gates (17) emphasizes the fact that the language abilities of reading and spelling are not unitary, but depend on the working together of a number of activities. Over three hundred children were studied; correlations were found between reading and spelling ability and thirteen mental tests of various types. Word-perception was found to have the highest correlation with reading and spelling ability; general intelligence came next. Tinker (94) studied the relation between the character of eye-movements during reading and the nature of the reading. He found that the ratio between time of eye-movement and reading time grew smaller during careful reading. Tinker (95) also studied factors involved in reading formulæ. He believes that his experiments show a tendency toward the formation of configurations in the reading of formulæ. Tinker (93) also studied the problem of the ease of reading numerals as against that of reading the same material expressed in words. Numerals, he found, were the more easily read. Tinker and Paterson (96) studied the ability of 640 subjects to read material printed in capitals, lower case roman letters and italics. Lower case was read somewhat more easily than were the italics; both were more easily read than were the capitals.

Sapir (78) attempted to point out the things that needed consideration in arriving at a psychologically sound prosody. The factors which make verse different from prose are considered. Foremost, believes Sapir, are those elements that tend to excite the rhythmic apperception of a series of words. He believes that the choice of words is the most important of these variables. A somewhat unusual diction causes the blocking of stereotyped responses, thereby bringing about heightened attention. Periodicity in the sectioning of written or spoken material also brings about the desired rhythmic response.

Symonds (88) studied the effect of foreign language school training on ability in English. He tested 513 Chinese children attending

a Chinese language school in Hawaii. He found a very slight correspondence between attendance at such schools and deficiency in English. Tomb (98) comments on the great ease with which children learn a foreign language, as compared with the slow learning of adults. Tomb concludes that this ability is intuitive in children. He bases his belief on observations of the learning of the native tongues by the children of British residents in India.

IV. THE MEASUREMENT OF LANGUAGE CAPACITY

Boyd (4) describes the grammatical development of children at various age levels. He believes that grammatical development is essentially complete at about the age of eight. He notes the special idioms of early childhood, together with the increase in sentence length during growth. Nice (57) also discusses the length of sentences at different stages of the child's growth. She treats of the relation between vocabulary size and sentence length. She feels a need for observations of the appearance of sentence types in English-speaking children. In another article, Nice (56) discusses early opinions upon vocabulary size, while reviewing early studies of vocabulary. The opinions reviewed extend from British writers of the middle of the last century to present day American psychologists. The vocabulary studies of Gregory (24), Pelsma (61), Whipple (112), and others, are reviewed and criticized. Nice points out that early opinions as to the meager vocabularies of adults, opinions which are very much alive to-day, have been overthrown by vocabulary studies of both adults and children. However, these studies, while showing decisively that individual vocabularies are much larger than was at one time supposed, disagree as to the number of words possessed by both children and adults. For instance, Terman (89) gives the eighth grader a vocabulary of 9,000 words; Vasey (102) gives him a word list of 40,000. Nice believes that the size of the dictionary on which the vocabulary test is based accounts for such differences in reported vocabulary size. On the basis of unabridged dictionary studies of adults, Nice concludes that the figures of Terman are too low; and that those of Vasey are too high.

Weeks (110) correlated the scores on Terman Vocabulary Test with a number of achievement and mental tests. She found the Terman test usable as a group test, and found that, for pupils above the fifth grade, the test was as reliable when given as a group test as when it was given as an individual examination. Weeks (109) also

describes the Berkshire Word Test, based on Webster's Collegiate Dictionary. This test was compared with eight other vocabulary tests.

The Presseys (65) criticize tests of silent reading ability. They believe that such tests are in truth tests of attention.

V. THE INFLUENCE OF LANGUAGE ABILITIES UPON OTHER PERFORMANCES

Walters (104) tested 165 school children divided into two groups, one of which used a foreign language in the home, the other of which used English as a home language. He concludes that the foreign language handicap amounts to six to eight months of mental age in testing thirteen year old children with the Binet-Simon test. Smith (84) tested Welsh children with five language tests. Classifications of home language usage and social position of the children tested was made by the teachers of the schools in which the research was carried out. The results showed a superiority of the children who used English only in the home, as against those who used both English and Welsh. This superiority was observable in both school achievement and mental test score.

Saer (76) investigated bilingualism in three Welsh counties. He tested fourteen hundred school children and about three hundred university students. The Binet-Simon intelligence test was given, together with tests of dextrality, rhythm, vocabulary, and composition. The monoglots were found to have a greater range of vocabulary than the bilinguals, as well as greater proficiency in dextrality tests and higher intelligence test scores. Since these differences were found to persist in Saer's university group, he concludes that the distinctive performances of the bilinguals and monoglots are hard to modify by training.

Rexroad (69), while performing an experiment on manual learning, discovered that his subjects always directed their manual activities by sub-vocal speech. This led Rexroad (70) to perform an experiment with the same apparatus for the purpose of further learning the relation of verbal and manual response. The subjects were instructed to repeat a word sub-vocally while striking a key. The word, on being presented to the subject after such training, called out the manual response.

Michael and Crawford (53) rated 56 students on nine speaking voice qualities, and correlated these ratings with scores on the Thurstone Intelligence Test. The voice qualities were also correlated with scholarship. The correlations of these abilities were positive,

and ranged from .30 to .65. Jersild (33) studied the effect of a number of factors influencing the presentation of oral material in an attempt to learn the effect of these factors on the learning of the presented material. The effect of temporal position of the material on learning was studied, and also the effect of speakers' gestures and intonations.

Gilliland (22) studied 115 college freshmen, divided into groups on the basis of the amount of Latin they had studied. He had these students define a list of English words which were of Anglo-Saxon, Greek, and Latin origin. The definitions of the students were rated on a point scale. The Latin students were found to be better able to define words of Greek and Anglo-Saxon origin than were non-Latin students. A correspondence was found between the amount of Latin studied and intelligence test score. The writer discusses the possibility of the defining ability of the Latin students having been influenced by their higher intelligence. He concludes that the study of Latin has an influence on defining ability independent of the higher intelligence of the classical students.

Colvin and Allen (9) found evidence that linguistic ability influences mental test score. They studied Italian and American children in Rhode Island schools. School achievement corresponded less well with intelligence test score in the case of the Italians than it did for the Americans. Also, Italian children did proportionately better in the sections of intelligence tests devoted to arithmetic than they did in sections which were apparently more dependent upon language ability. Mann (47) gives an account of clinic cases showing the influence of language ability on school work. She points out that one factor in the low school achievement of children with a foreign language handicap is the loss of time that should be given to the actual teaching of school subjects through the necessity of incidental language training by the teacher.

Ide (31) believes that a child's language ability should be brought to a point at which the child will not be set off from his fellows by language deficiency. She cites clinical cases in support of this contention.

Lester (45) studied the correspondence between vocabulary test score and scholastic ability, together with the correlation between spelling ability and vocabulary. These correlations ranged from .25 to .68 for vocabulary with school subjects; and from .28 to .64 for spelling ability with school subjects. Barlow (2) in a study of

327 subjects, found that full articulation in learning verbal material was more economical than was restricted articulation.

VI. DIFFERENCES IN LANGUAGE RESPONSES FOR GROUPS AND INDIVIDUALS

Garth (16) studied the word categories of 56 blooded Indians and 141 whites. The categories used were those originated by Jastrow (32) in his studies of the nature of the vocabularies of men and women. Garth obtained his word lists by three minute free association tests. The whites were divided into two groups, to check the differences between whites and Indians. The Indians were not found to differ significantly from the whites in the types of words found in vocabularies. Shen (82) studied the eye movements involved in reading Chinese as compared with the eye responses found in the reading of English. The number of pauses to a line is greater in Chinese than in English, a difference in accord with the systems of writing of the two languages. He suggests that there are physiological differences in the mechanisms of eye movement for English and Chinese readers.

Sapir (77) tries to analyze the cues by which speech may indicate personality. He believes that there are five levels of speech behavior; the voice as such; speech dynamics (rhythm, intonation) pronunciation, vocabulary, and style of connected utterance. Personality may be judged on each of these levels. Language behavior is a suggestive field for personality research.

Murphy (55) studied the word associations of 82 manic depressive cases, 120 dementia precox cases, and 250 normal people. A modification of the Kent-Rosanoff word list was used in this study. Associations were classified according to the logical relationship between stimulus and response. The normal group gave fewer "coordinates" (pairs in which stimulus-word and response-word are both the same part of speech) and more words in an adjective-noun relation than did the abnormal groups. There were no significant differences between the abnormal groups. Busemann (5) studied the literary productivity of German writers at different ages.

Schwesinger (80) studied the correspondence between delinquency and the knowledge of slang. She devised a slang battery test, which was given to adolescents in a New Jersey reform school. No correspondence was found between knowledge of slang and degree of delinquency. She suggested the use of slang tests for the comparative study of social levels.

Raspe (66) studied children's explanations for optical illusions, the working of the electric light, and the operation of the metronome. Kollarits (41) noted analogic errors in children's speech. Prandtl (64) using nonsense material, studies the persistence of perseveration in the learning of successive series. He also recorded individual differences in tendency to perseveration. Travis (99) found that the output of stutterers was inhibited by the presence of a group, and that stutterers show greater variability in output while working alone. This shows that a difference exists between the speech defectives and normal groups, whose performance under Travis' conditions was tested by Floyd Allport (1).

VII. TECHNIQUE IN LANGUAGE INVESTIGATION

Holmes (29) describes the use of phonetic symbols in recording the language responses of a child. A record was kept for 18 months during the child's first and second years. The stressing of syllables by the child was also recorded. Robbins (71) devised a test for verbal imagery, involving the presentation of nonsense syllables in pairs. Schmitz (79) studied the effect of inserting pauses of varying lengths in series of verbal material to be learned. Pauses were also made between the presentation and reproduction of the syllable. Stein (85) presented printed words tachistoscopically. The alteration in ease of reading was noted when the word was changed from its normal direction on the paper, or when the word was printed brokenly across the background. Fuchs (15) used the journals of 52 school children as materials for an investigation. Gault (18, 19, 20) describes a technique for the communication of speech sounds to the hand of deaf subjects. Audiometer tests were obtained for the subjects tested, as a part of the controls used. Other precautions consisted of isolating the subject from the source of the speech sounds used in making the test. After a training series, a sound or word could be recognized with more than chance frequency. The sound presented was one of a list given visually to the subject. Gault and Crane (21) describe the order of difficulty of discrimination for vowel sounds presented through the finger tips. Knudsen (40) also investigated the receptivity of the sense of touch to various sounds. Sherman (83) investigated the recognition of emotional states by the singing voice. A trained vocalist sang notes of constant pitch and intensity, after having been instructed to express one of five emotions by the sung note. Listeners recorded the emotion they believed to be indicated by the singer's voice. In spite of their not

knowing the names of the list of emotions being expressed, the judges showed a high degree of accuracy in picking the emotion intended by the singer.

Esper (13) describes the apparatus used by him in repeating the pioneer linguistic experiments of Thumb and Marbe (92) on analogic change. The experiment resulted in the verification of Thumb and Marbe's results for American materials. Esper (12) later describes the Bradyscope, a device by means of which visual material is carried on a continuously moving chain, and presented at regular intervals and variable speeds. Exposure of the materials was effected by the automatic opening and closing of shutters.

Gray (23) describes apparatus used by Buswell (6) in the latter's study of the relation between eye-movements and voice in reading. Eye movements were recorded photographically, while a record of the voice was kept by a dictaphone. Buswell found that with increased reading ability the temporal span between the response of the eye and that of the voice increased. Ruschel (75) compared the learning of numbers and syllables when rehearsed by writing from sight, with the learning of spoken syllables.

Thorson (91) criticized apparatus used to record tongue movements in early investigations of subvocal speech problems. She describes a modification of Sommer's movement analyzer, together with controls adopted to eliminate the most conspicuous errors of earlier work. These are: the recording of movements other than tongue movements as speech responses, suggestion to the subject arising from the use of the apparatus. She concludes that tongue movements are not the invariable accompaniments of internal speech. Rexroad (68) describes the apparatus later used by him in his study of the relation of subvocal speech to manual activity. Miles and Shen (54) describe apparatus for the study of visual movement. This apparatus was later used by Tinker (94) in his study of eye movements during silent reading. Handrick (25) describes a device for recording time intervals in complicated word association problems. Pauli (59) describes an improvement on the Lippmann and Marx memory apparatus.

VIII. MISCELLANEOUS AND GENERAL ARTICLES

Tsai and Abernethy (101) investigated the recognition and recall of Chinese characters by American students. They found difficulty of recognition to be independent of the complexity of the character. Lotspeich (46) gives a Freudian interpretation to the characters of

the Chinese written language. Wilkins (114) shows the effect of change of material to do formal syllogistic reasoning.

Jespersen (34, 35, 36) discusses the causes of language changes. He believes that the approach to the factors operating in language evolution may best be learned through a study of the language of the child. He believes that a great many changes are to be accounted for by the great difference in speech between parent and adolescent. From a linguistic standpoint, Vendryes (103) treats speech sounds, vocabulary, grammar; as also do Marouzeau (49) and Scott (81). Hoffman (28) gives a general historical account of the problems of the psychology of reading. Judd (37, 38) gave early attention to the scientific study of language. He has called attention to the lack of an adequate consideration of the problems of language by psychologists.

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