

THE PSYCHOLOGICAL BULLETIN

PROCEEDINGS OF THE TWENTIETH ANNUAL MEETING
OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION
AND THE SEVENTH ANNUAL MEETING OF THE
SOUTHERN SOCIETY FOR PHILOSOPHY AND PSY-
CHOLOGY, WASHINGTON, D. C., DECEMBER 27, 28
AND 29, 1911

REPORT OF THE SECRETARY OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION

The twentieth annual meeting of the American Psychological Association was held in Washington, D. C., on Wednesday, Thursday and Friday, December 27, 28 and 29, 1911, in affiliation with the Southern Society for Philosophy and Psychology and the American Association for the Advancement of Science.

Professor Carl E. Seashore, Dean of the Graduate School of the University of Iowa, was the presiding officer. His presidential address Thursday evening pointed out the possibilities of applied psychology, using as a typical illustration the psychological measurements of a singer which the consulting psychologist of the future will make when aiding a young person to decide whether or not to devote himself to a musical career. Many papers throughout the three days' sessions made strikingly evident the fact that psychology in America is seeking to find itself in various fields of application, as well as in the realm of pure psychology.

The meetings were held, with one exception, in the main building of the George Washington Medical School. Two assembly halls were provided for the formal sessions and two rooms were devoted to a large exhibit of both new and standard forms of apparatus. About eighty members were in attendance.

The program began Wednesday morning with a symposium on the demarcation of the distinct differences between "Instinct and In-

telligence." Four formal papers provoked a lively discussion, which made evident most clearly the need and importance of much patient, detailed observation and investigation of instinctive behavior. The opening of the apparatus exhibit Wednesday afternoon was followed by a double program. In one section the papers on mental tests were presented, and in another, the experimental contributions to the study of animal behavior. Double programs were also necessary on Thursday and Friday afternoons to make possible the reading of the large number of papers submitted. Two of these programs were made up of reports of research in experimental psychology. Paralleling them were a program of general and theoretical papers, and a joint session with Section L devoted to educational psychology.

The program which attracted widest interest was that of Thursday forenoon, at which time the Associations met at the Government Hospital for the Insane. A conference had been arranged on the relations of psychology and medical education; and the interest in the papers which had been prepared showed the timeliness and importance of the subject. Several eminent psychiatrists and representatives of medical faculties were present to share in the informal discussion, and although there were extreme divergences of view regarding the type of psychology which ought to be taught and regarding the place in the curriculum where it ought to be introduced, there was marked unanimity of opinion regarding the need of psychology. It is expected that the proceedings of this meeting will be printed in full in the *Journal of the American Medical Association*.

Following this session the two societies and their guests were entertained at luncheon by Professor Franz. On that same evening Professor Franz and Professor Ruediger were the hosts at a joint smoker which proved in many ways to be one of the most delightful occasions of the week, for during the festivities the members had the privilege of hearing anecdotes and reminiscences of the early days of the Psychological Association narrated by President Stanley Hall, the first President of the Association, Professor Ladd, who coöperated with President Hall in getting the Association organized, Professor Cattell, a member of the first council, and Professor Münsterberg, who, having just come from Germany to America, was present at the first annual meeting, held in Philadelphia nineteen years ago.

At the annual business meeting of the Association Friday morning, Professor E. L. Thorndike was elected President of the Association for the ensuing year. Professor Margaret F. Washburn and Professor Max Meyer were elected to membership in the council for

three years, to succeed President Sanford and Professor Thorndike. Professor C. E. Seashore, the retiring president, was elected to represent the Association on the Council of the A. A. A. S.

The following persons, having been recommended by the Council, were elected to membership in the Association: Jasper Converse Barnes, Ph.D., Maryville College; Frederick Stephen Breed, Ph.D., University of Michigan; Lucy Hoesch-Ernst, Ph.D., Milwaukee, Wis.; Mabel Ruth Fernald, Ph.D., Chicago Teachers College; Samuel Weiller Fernberger, A.M., University of Pennsylvania; Joseph Wanton Hayes, Ph.D., University of Chicago; Mrs. Mary Holmes Stevens Hayes, Ph.D., University of Chicago; Samuel J. Holmes, Ph.D., University of Wisconsin; Herbert Sidney Langfeld, Ph.D., Harvard University; Henry C. McComas, Ph.D., Princeton University; John Moffatt Mecklin, Ph.D., Lafayette College; Ethel Chamberlain Porter, Ph.D., East Orange, N. J.; W. H. Pyle, Ph.D., University of Missouri; Carl L. Rahn, Ph.B., University of Minnesota; Christian A. Ruckmich, A.B., Cornell University; William T. Shepherd, Ph.D., Washington, D. C.; H. Douglas Singer, M.D., Illinois State Psychopathic Institute; Raymond H. Stetson, Ph.D., Oberlin College; Elmer Ernest Southard, M.D., Ph.D., Harvard University; Edward K. Strong, Ph.D., Columbia University; J. E. W. Wallin, Ph.D.; Clara Jean Weidensall, Ph.D., New York State Reformatory for Women, Bedford Hills; Harry Porter Weld, Ph.D., Clark University; Edward Moffat Weyer, Ph.D., Washington and Jefferson College; Mary T. Whitley, Ph.D., Teachers College, Columbia University.

The determination of the time and place of the next meeting was left to the Council, with power to act. A cordial invitation had been received to come to Western Reserve University, Cleveland, where the American Association for the Advancement of Science will meet next December. But a meeting at this time was of course deemed inadvisable if the International Congress of Psychology is to be held in New York and Boston at Easter, in the spring of 1913.

The advisability of undertaking to hold this Congress in America as originally planned has been brought into question by certain members of the Executive Committee of the Congress, who have found a lamentable lack of interest in the Congress abroad. Other members of the committee have felt that it is important not to abandon the project in spite of the attitude of European psychologists and the difficulties in the way of holding a successful congress of really international character. On motion of Professor Cattell, the Secretary was instructed to secure by mail from the members of this

Association, the Southern Society, and the North Central Association, an informal expression of opinion regarding the desirability of having the congress in America.

(Since the above was put into type, word has been received from the officers of the Congress that the project of holding the Congress in America in 1913 has been definitely abandoned. The next meeting of the Association will, then, be held next December in Cleveland. This central location will make possible a splendid "get-together" meeting of eastern and western members on the occasion of the twentieth anniversary of the founding of the Association.)

The Council, having for some years back experienced frequent difficulty in securing adequate information regarding applicants for membership in the Association, made public the following announcement: "The Council requests that all recommendations for membership in the Association be submitted to the Secretary at least a month in advance of the time of election, and that these recommendations be accompanied by a statement of the candidate's professional position and by copies of his published researches."

On recommendation of the Council it was voted that a committee of three be appointed by the President to study and report on the relations of psychology and medical education, and to confer on behalf of this Association with other bodies interested in these problems. (Professor W. D. Scott, Professor E. E. Southard and Professor J. B. Watson were appointed.) The Council was empowered to authorize the expenditure of a sum not to exceed \$50 for the expenses of this Committee.

Professor Angell reported the completion of the investigations heretofore planned by the Committee on the Standardization of Mental Tests, and announced in a general way the plans of the Committee for the immediate future. On recommendation of the Council it was voted that the Committee be continued; that the principle of rotation of one member per year be adopted; that the order of rotation be determined by the Committee; and that the new member be chosen by the Council upon nomination of the Committee. \$250 was appropriated for the publication of reports of this Committee during the present year, the conditions of publication to be subject to the regulation of the Council. It was the general sentiment of those participating in the discussion that this appropriation should be renewed annually as needed.

It was also voted, on recommendation of the Council, that the Committee on Tests be requested to hold itself ready to examine and

report upon the relative merit of different forms of apparatus designed to serve the same general purpose. In explaining the object of this resolution, one of the speakers cited the desirability of a body which would be prepared to undertake investigations of the relative merits of the various forms of esthesiometers, tachistoscopes, etc. The committee, of which Professor Angell is Chairman, will welcome suggestions as to possible lines of usefulness.

Professor Whipple made a report of the work undertaken by the Committee on Teaching Experiments. It was voted that this committee be continued. The Association also authorized the expenditure of a sum not to exceed \$50 to meet necessary expenses of the committee.

Professor Warren presented a report for the Committee on Periodicals. It was voted that this committee be continued, with power to add to its membership. It at present consists of representatives of each of the psychological journals, but it was deemed desirable to have a representative for the readers and contributors, as well as for the editors.

A sum not exceeding \$25 was voted to meet necessary expenses in connection with the apparatus exhibit, and the expenditure of a similar sum next year was also authorized.

The following recommendation of the Council was adopted; "The Council, believing that the members of the Association should consider exercising a more direct control over the choice of its officers, recommends the appointment of a committee of three to consider this question and, in the event of their approving a change in the present arrangements, to submit to the next annual meeting the necessary amendments to the constitution." (Professor Aikins, Professor Minor, and Professor Pierce were appointed to this committee.)

The Association voted a most cordial expression of appreciation of the courtesies extended by the officers of the George Washington Medical School and the Government Hospital for the Insane, with special thanks to Professor Franz and Professor Ruediger for their generous hospitality.

REPORT OF THE TREASURER FOR THE YEAR 1911

Dr.

To Balance from previous year.....	\$3,077.69
Dues received from members.....	243.35
Interest from July 1, 1910, to July 1, 1911.....	99.72
Receipts from sales of Psychological Monographs No. 51 and No. 53..	95.89
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	\$3,516.65

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Stationery and printing	\$75.25	
Traveling expenses (1910 meeting)	86.16	
Clerical assistance	15.75	
Postage	56.51	
Express and telegrams	6.91	
Printing and distribution of Proceedings	8.37	
Appropriation toward printing and distribution of report of Committee on Standardization of Tests	150.00	
Appropriation toward printing and distribution of report of sub-committee on Standardization of Methods of Studying Color-vision	200.00	
Miscellaneous	3.83	
Unexpended petty cash	10.65	613.43
Balance in Union Dime Savings Institution	\$2,772.99	
Balance in Fifth Avenue Bank	130.23	2,903.22
		\$3,516.65

W. V. BINGHAM,
Secretary and Treasurer

HANOVER, N. H.,
December 20, 1911.

Audited by the Council

REPORT OF THE SECRETARY OF THE SOUTHERN SOCIETY FOR PHILOSOPHY AND PSYCHOLOGY

The Seventh Annual Meeting of the Southern Society for Philosophy and Psychology was held at Washington, D. C., on Wednesday, Thursday, and Friday, December 27, 28, and 29, 1911, in conjunction with the American Psychological Association and the American Association for the Advancement of Science. The meetings were held in the George Washington University Medical School, President Shepherd Ivory Franz presiding. The programs for December 27 and 28 were arranged jointly with the American Psychological Association. Following the joint meeting on Thursday afternoon came the president's address on "New Phrenology." On Thursday evening the members of both societies were entertained at a smoker held at the New Fredonia Hotel by Professors Franz and Ruediger.

The following items were passed upon at the business meeting held on Friday morning, December 29.

1. The proposed amendment to Art. II., Sec. 3, of the constitution was adopted.

2. It was resolved that the existing arrangement with the Psy-

chological Review Publishing Company be continued as optional to the members of the Southern Society and be handled as hitherto by the secretary of the society. In the future, however, this option is available only to members residing in the southern territory, but it is no longer restricted to those who are new subscribers. Notice of the above arrangement is to be printed after the constitution on the membership list.

3. The secretary was authorized to drop the names of members after one year of delinquency.

4. The determination of the time and place of the next meeting was left in the hands of the Council.

5. The treasurer's report was audited by the Council and showed a balance on hand, December 23, 1911, of \$65.64.

6. The following officers were elected for the year 1912: *President*, Robert Morris Ogden, University of Tennessee; *Vice-President*, H. J. Pearce, Brenau College, Gainesville, Ga.; *Secretary-Treasurer*, William Carl Ruediger, The George Washington University; Council for 3 years, Shepherd Ivory Franz and John Brodus Watson; Council for 1 year, W. B. Lane.

7. The following persons were elected to membership: Samuel Claman, Howard University; H. E. Cunningham, Lookout Mt., Tenn.; Gardner C. Basset, Johns Hopkins University; Williston S. Hough, George Washington University; Edmund B. Huey, Johns Hopkins University; Herbert Charles Sanborn, Vanderbilt University.

8. Votes of thanks were extended to Dean W. C. Borden for the use of the George Washington University Medical School and to Professors Franz and Ruediger for the smoker.

W. C. RÜEDIGER, *Secretary*

THE GEORGE WASHINGTON UNIVERSITY,
WASHINGTON, D. C.

ABSTRACTS OF PAPERS

The Measure of a Singer. Address of the President of the American Psychological Association. CARL E. SEASHORE, University of Iowa.

(This address is published in full in *Science*, Feb. 9, 1912, Vol. XXXV, p. 201.)

New Phrenology. Address of the President of the Southern Society for Philosophy and Psychology. SHEPHERD IVORY FRANZ, Government Hospital for the Insane.

An examination of the system of Gall shows that the basis for his conclusions was an artificial division of the mind into elements which differ from one another in degree or in kind. Gall attempted to correlate these divisions with divisions of the brain, assuming that the mental processes were localized in certain areas of that organ.

Although this view has been attacked from time to time, it has left its impress upon anatomists and clinicians. Broca had a view of mental and brain relations somewhat similar to that of Gall, and this view was amplified by Wernicke and others.

The schematic subdivisions of the mind were combated, but numerous attempts from the clinical and anatomical standpoints have been made to uphold the doctrine. In this class belong the studies of Flechsig, and the more recent studies of the histological localization of function.

Histologically the cerebral cortex can be divided into a number of areas, which have the same fundamental characteristics of cells and fibers arranged in more or less definite layers, but which differ from one another in the special arrangements of these elements. Because of these differences it has been assumed that the areas have different mental functions.

The direct relation of the so-called sensory and perceptive areas to mental states has not been proven. The histologists have not been able to give any good explanation for the differences in the so-called motor areas, of which, clinically and physiologically, we have more information than of other parts of the cerebrum.

Many clinicians refer to the localization of aphasias as evidence for the localization of mental processes, but even as clinical manifestations the disorders of speech cannot be said to be associated with definite parts of the brain.

Another principle of histological localization is that of definite functions for the different layers of the cortex, but there are no facts which warrant a localization of definite mental states in the individual layers.

It has been assumed that the principle of localization has been settled, but this cannot be accepted, because there is dispute whether mental states, clinical phenomena or cells are localized. There is some doubt about the exact localizations of cell groups in the cerebrum; there is more doubt regarding the relation of clinical manifestations to the injury of certain areas, and there is no evidence to warrant a psychic localization.

All that can be concluded at the present time is that the mind

is associated with brain activity. We are unable to say that the activity of the cerebrum alone is the concomitant of mental processes.

Instinct and Intelligence. HENRY RUTGERS MARSHALL, New York City.

We avoid confusion by considering activities from the subjective and objective standpoints separately.

Objective View.—Activities increase in variety *pari passu* with increase of complexity of animals' structure.

The most striking characteristics of activities of animals of lowest and highest complexity are as follows:

Class A. Activities in simplest animals display (1) Evident biologic value. (2) Directness. (3) Immediacy. (4) "Perfect very first time." (5) Non-modifiable. (6) Innate.

Class B. Activities in complex animals display (1) Often no evident biologic value. (2) Indirectness. (3) Hesitancy. (4) Not "perfect very first time." (5) Highly modifiable. (6) Not evidently innate.

But in complex animals we discover certain activities of class *A*. These we call "instinct-actions." The nearer an animal approaches to simplicity of organization the closer do its activities approach the ideal of "instinct-action." The "instinct-action" of the simple cell may be assumed to reach this ideal. The characteristics of varied activities of complex animals may then be conceived of as due to the "instinct-actions" of cells, or minor systems of cells, in a highly complex system. Hence the varied activities of complex animals may be stated in terms of cell "instinct-action," which may be looked upon as the biologic unit.

Subjective View.—But these varied activities (class *B*) are what we ourselves know as intelligent activities; hence we may argue that intelligence is statable in terms of "instinct-feelings," the psychic correspondents of "instinct-actions," "instinct-feeling" being the psychic unit.

This view is corroborated by introspection, the distinguishing marks of intelligent acts appearing to be due to the emphasis of the correlated "instinct-feelings" involved. If we could grasp the full psychic significance of an "instinct-feeling," by slowing down the process, we should find in it all the essentials of intelligence; and if intelligent acts could be made immediate they would appear objectively as "instinct-actions," and subjectively as "instinct-feelings."

Instinct and Intelligence. C. JUDSON HERRICK, University of Chicago.

The term instinct as popularly used is incapable of accurate scientific definition for it is commonly applied to behavior complexes including variable proportions of structurally predetermined innate action and intelligent action. I would replace the terms instinct action and intelligent action of Marshall by innate action and individually variable action, and I maintain that these two types of action are separate biological functions, both of which are exhibited in some measure by all animals, and that they are independently variable.

Innate action includes the fundamental physiological properties, tropisms, taxes, reflexes, compound and chain reflexes and the inherited elements of all higher behavior complexes. These actions are common, within narrow limits of variation, to all members of a race or species. And they are developed in accordance with the same evolutionary laws (natural selection, etc.) as are the other stable elements in the action-system which is typical for each species. Individually variable action includes all non-heritable acquired behavior from simple physiological modifications resulting from practice, at the lower extreme, to learning by experience and the higher intelligent adaptations, at the other extreme. Individually acquired automatisms are derivatives of individually variable actions.

A special mechanism has been differentiated for the higher forms of individually variable action, viz., the association centers of the brain, whose highly developed mnemonic functions are derived from the simple "physiological memory" of ordinary protoplasm, and whose connections are such as to facilitate functional associations independently of immediate sense stimulation.

Instinct and Intelligence. ROBERT M. YERKES, Harvard University.

Instinct and intelligence, physiologically considered, are two functional capacities or tendencies of organisms. Neither has developed from the other: each is a fundamental organic capacity. Now the one, now the other tendency predominates in the life of the individual or of the species.

Instinctive activities are practically serviceable on first appearance; strikingly perfect in important respects; predictable; heritable in definite form; and suggestive of experiences, and results thereof, which the organism has not had. Intelligent activities, by contrast, are serviceable as the result of trial; practically unpredictable; not

definitely heritable; and suggestive of experiences which the organism has had.

No organism lacks either the instinct capacity or the intelligence capacity. Instinct means, first of all, conservation—the holding to that which has been tested and found good by previous generations. Intelligence means progress—the blazing of new paths.

It is through the study of the behavior of activities in inheritance that we may hope for the solution of our most important questions concerning the relations of instinct to intelligence.

Intelligence as Distinguished from Instinct. CHARLES H. JUDD,
University of Chicago.

The discussions of the relation between instinct and intelligence are very much clearer in their definitions of instincts than they are in their definitions of intelligence. Intelligence is commonly defined by saying that it is merely the outgrowth of instinct, and is like instinct in form; or, if a discrimination is made, intelligence is described in negative terms. It is that which is not inherited. It is not a fixed type of behavior.

The importance of intelligence in human life justifies the demand that we give a positive definition of its characteristics. In the process of organic adaptation there is evolved in the individual the power of initiating activities from inner motives. This is shown by the delay which appears when one of the higher animals is stimulated, and reacts only after a long series of internal processes. The internal processes in this case are more significant in determining action than is the external stimulus. Furthermore, the sequences of external stimuli do not determine the sequences of activities. Within the complex individual new types of relationship are established between the impressions that come from the outer world. Thus the individual, instead of reacting upon objects which stand near to each other in nature, is able to bring together objects that in nature are remote from each other. This bringing together of remote objects is the result of inner processes of comparison or association. The power of making independent associations or comparisons is the highest outgrowth of the evolutionary process. It is superior to memory, which merely retains external impressions. It gives to the individual a power over his environment which he could not have if he merely followed the dictates of the environment.

Such statements as the foregoing make it clear that intelligence is that characteristic whereby an individual becomes superior to his

environment, and capable of modifying what he finds in the environment. In man this ability to modify environment is the characteristic power which differentiates him from the lower organisms. Man has gone so far as to evolve certain forms of activity which are employed chiefly in planning and preparing for changes in his environment. Language is a form of behavior of this indirect type which man works out as a means by which he can ultimately react upon his environment. Language is first involved as a means of reacting to the social environment, as distinguished from the physical environment. After language is produced through social intercourse, it becomes an instrument of inner planning and comparison, and as such promotes the further evolution of a higher form of reaction, namely, intelligent reaction.

Any organism which is characterized by a type of behavior so remote from the lower forms of behavior must be described as having reached a higher stage of evolution. This statement should not be interpreted to mean that there is any breach in evolutionary continuity, but it certainly does call attention to the fact that evolution has progressed to such a point that continuity is not the most important phase of the matter.

Imitation and Animal Behavior. M. E. HAGGERTY, University of Indiana.

Advance in the experimental analysis of behavior tends to make psychological concepts inadequate. Many of the concepts of comparative psychology are of the relative unanalyzed sort, which indicates that in this field we have not pushed our experimental analysis to the end. Imitation is a case in point. One reason why we have not made more progress in our study of imitative behavior is that the concept of imitation has been hampered by its classification into instinctive and voluntary. These adjectives when used with imitation are intended, not as descriptive of objectively observed behavior but as explanatory, *i. e.*, they are intended to indicate the non-observed processes antecedent to such behavior. Yet instinct and volition when taken concretely in the behavior of mammals have the most uncertain significance, and instead of being explanatory they really obscure the great variety of imitative behavior. If we are not to give up the category of imitation in comparative psychology and to withdraw from the experimental study of imitative behavior we must have a reworking of the concept itself. This reëxamination of the concept must be made independently of the ideas of instinct

and volition and be based on objectively observed facts, *i. e.*, upon facts which have been experimentally determined. There are not enough such experimentally determined data for an adequate reorganization of the concept, but the recent work on rats, cats, birds, monkeys and apes gives some basis upon which to work. Such a reorganization must take account of all the factors that determine attention and also of the various levels of accuracy and complexity in the imitative behavior. We may for a time be compelled to have a different grouping for different species of animals.

The Discrimination of Articulate Sounds by Cats. W. T. SHEPHERD, Washington, D. C.

The paper is a report of experiments which were made with cats to determine their ability to discriminate articulate sounds. The major part of the work of the experiments was done by the writer's wife, Mrs. Barbara Shepherd.

One of the animals used in the experiments was seven months old, the other about three years old. The younger cat had not previously been given any name, and had no training in the discrimination of words. The other animal had previously been given a name, different from that given it in the experiments. Both were gray house-cats, and both were females.

The experimenter called the name given the animal and also other words in conjunction. The cat was to show its discrimination of the name given it from the other words used by appropriate motor reactions to its name, such as rearing up in the cage and looking for food to be given it when its name was called, and by not so responding when the other words were called. Suitable control tests were employed.

The younger cat began to show indications of forming the proper association on the third day. On the thirteenth day it had perfected the association. The older cat first showed indications of discrimination on the tenth day. On the twenty-fifth day of the experiments it properly responded nineteen times in twenty trials.

The writer concludes from the experiments that cats are able to discriminate articulate sounds. The younger animal took 150 trials of each auditory stimulus to perfect the association, the older cat 490 trials, the younger of the two individuals learning much more rapidly. In rapidity in forming the association, these two cats showed a rough correspondence to ability in raccoons, in similar tests, to discriminate words.

Some Experiments on the Brightness Value of Red for the Light-Adapted Eye of the Rabbit. M. F. WASHBURN, Vassar College.

In order to eliminate the brightness error in experiments on color vision in animals it is not sufficient to show that the animal tested can distinguish a color from the gray that a color-blind human being would see in place of the color, but the animal must be proved capable of discriminating the color from all grays. The present experiments attempted to find whether any one of a series of gray papers was indistinguishable from the Bradley saturated red paper to the light-adapted eye of the gray rabbit. An error mentioned by Watson as incidental to the use of colored papers, namely, that when pasted on surfaces they show irregularities that would serve to distinguish them was eliminated by pinning the papers on the two doors of a food box, and pinning them on freshly for each experiment. Food was in both compartments of the box. The doors could be pushed open by the rabbit, but the door carrying the gray paper was always bolted on the inside. The gray paper was sometimes on one door and sometimes on the other. Fresh red papers were used in each test, to eliminate a smell error. To avoid the possibility that the rabbit might distinguish the red paper from the gray by smell, in many of the tests gray paper was put under the red and red under the gray, a narrow slit being cut in the upper paper at about the level of the rabbit's nose. This mixture of the two smells never had any effect on the discrimination. To show that the animals were not guided by differences in the surfaces of the two papers, red and gray velvet were substituted occasionally for the papers, without at all interfering with the discrimination.

The five rabbits tested were all able to discriminate the red papers from Hering grays number 6, 7, 15, and 24; but all failed to discriminate red from the very dark gray number 46, and from the black paper supplied by the Stoelting Company. Red would thus appear to have a low stimulating power for the light-adapted eye of the rabbit. The experiments were performed in collaboration with Miss E. Abbott.

Modifiability of Behavior in the Earthworm Allolobophora fœtida.

ROBERT M. YERKES, Harvard University.

By means of a T-shaped glass labyrinth, in one arm of which were placed a strip of sandpaper and a strip of blotting paper moistened with NaCl(8N) earthworms have been tested for modifications of behavior.

The following results are presented, subject to revision in the light of further observations:

1. The worms have not acquired a definite habit of turning directly to the open arm of the T and thus escaping to a moist dark tube.
2. Certain modifications have appeared during daily series of trials.
3. There are indications of tracking.
4. The animals rapidly fatigue. Five trials per day prove more satisfactory than ten, fifteen, or twenty.
5. In so far as the worms learn to follow a direct path through the T, they do so apparently by the use of certain cutaneous sense data rather than by inner kinesthetic data.
6. The first trial each day almost invariably presents numerous mistakes.
7. There are some indications that the sandpaper becomes a "warning" against the salt which lies beyond it in the arm of the T.

The Nervous and Non-Nervous Reactions of Actinians. G. H. PARKER, Harvard University.

When the column of a sea-anemone (*Metridium marginatum*) is touched gently or otherwise stimulated, the animal responds in a few seconds by contracting the longitudinal muscles of its mesenteries whereby the oral disk is withdrawn. This reaction is better elicited from the oral or aboral edge of the column than from the middle of the column. If a crystal of magnesium sulphate is allowed to dissolve on a spot on the aboral margin of the column, that spot in a few minutes becomes insensitive to stimulation though the adjacent margin may retain to the full its sensitiveness. Since the mesenteric muscles are situated far from the point of stimulation, the reaction in question is undoubtedly nervous in character.

When the equatorial region of the column of the sea-anemone is stimulated mechanically, there follows in the course of half a minute or so a circular constriction of the column due to the contraction of the circular muscles. This constriction occurs with regularity even after this region has been anesthetized with magnesium sulphate. It is therefore probably non-nervous in character and dependent upon the direct stimulation of the circular muscles.

Thus sea-anemones possess not only muscles controlled by nerves such as are seen in the higher animals, but probably also muscles that are directly stimulated, such as have been observed in the more primitive metazoans, the sponges.

Seventeen Different Definitions of the Term "Tropism" as Applied to Reactions in Organisms. S. O. MAST, Johns Hopkins University.

The term "tropism" was first used by Decandolle (1832) in the study of reactions of plants to light. He prefixed "helio," thus making "heliotropism" and used this term in a very definite sense, indicating merely the fact that plants bend toward the light. But the term "tropism" soon came to signify not only bending toward but also the processes involved in bending, both real and imaginary, and since then it has been applied to almost every conceivable sort of reaction. I have collected seventeen different definitions of this term, varying in meaning from the practically all-inclusive one of Willey (1910)—"The word tropism means the tendency to react in a definite manner towards external stimuli"—to the all-exclusive one of Torrey (1907),—"In heliotropism as well as in galvanotropism, the oriented organism is in a condition of physiological stimulation, and . . . the response to stimulation is local."

In nearly all of the definitions orientation is implied as one of the distinguishing characteristics of "tropisms," and some use the term merely to indicate orientation, but if nothing more than this is implied it would certainly be much less confusing to use "orientation," which has a definite meaning.

About one half of the definitions, including three different ones by Loeb, contain the idea that "tropisms" are orienting reactions caused by the *continuous* action of the stimulating agent, *i. e.*, that the stimuli resulting in orientation are not due to change of intensity but to "constant intensity." As Loeb puts it, "they are a function of the *constant intensity*" (ital. mine). The only trouble with definitions implying this is that there is no conclusive evidence indicating that orientation in any organism is ever due to continuous action of the external agent, while it has been demonstrated to be due to change of intensity in a number of cases. There is not the slightest evidence that "tropisms" as defined by Loeb form a class of specific reactions essentially different from other reactions as he, Bohn and others maintain.

As matters now stand it is utterly impossible to know what is meant by "tropisms" unless it is first definitely stated according to which of the 17 or more definitions the term is used.

Behavior of Fire-flies (Photinus ardens ?) with Special Reference to the Problem of Orientation. S. O. MAST, Johns Hopkins University.

The fire-flies studied are found in dark crevices or under ground

during the day. In the evening when it is still light enough to read they come out; the females crawl to the tips of grass or other objects and remain quiet; the males fly about and glow fairly regularly at intervals of about five seconds. The females do not glow unless light from the males or from some other source is flashed on them.

When a female glows in response to the glow of a male, the male ordinarily turns directly toward her. This is repeated until the two come together, after which copulation takes place. If a female is held near a male he pays no attention to her unless there is actual contact, showing that neither objective vision nor smell is functional in mating.

The males do not orient when exposed to continuous illumination. They respond only to flashes of light and do not react until after the light has disappeared. Thus orientation may take place in total darkness, and it is surprising how accurately these animals turn through the proper angle in the total absence of the stimulating agent that caused the response. Here we have a case in which it is clearly demonstrated that light does not act continuously in the process of orientation as demanded by Loeb's theories, a case in which it is also clearly demonstrated that continuous stimulation is not necessary to keep the organism oriented.

No difference could be detected between the glow of females and that of males either in quality or quantity of light emitted and yet males rarely if ever respond to the glow of other males, showing that in some way they distinguish between the flashes of light produced by opposite sexes. It was demonstrated that this is not due to possible minute differences in color, form or intensity of the glow. The glow of a female in response to a male, occurs shortly after that of the male, while among the flashes of different males there is no such time relation. The sequence in the time of glowing is undoubtedly an important factor in the process in question, but many observations indicate that it is not the only factor, although no others were discovered.

A Critique of the Discrimination Test: a Study in Animal Behavior.

JEAN WEIDENSALL, State Reformatory, Bedford Hills, N. Y.

Taking the black-white discrimination test as typical of the discrimination method, we proposed to investigate the relative efficiency of the black and the white after and during learning in such a test. We suspected that of the two or more stimuli presumably involved in learning the ordinary test of this kind only one, as a matter of

fact, might be used. This suspicion was based upon the fact that previous experiments have proceeded as though but one discrimination were necessary—that of the two stimuli from each other—whereas three discriminations are essential. Until each quality is first discriminable from its background, the two cannot be discriminated from each other. Any conclusions, therefore, stated in terms of the discriminability of the two qualities are unfounded so long as we continue to display the stimuli against the unknown background of our various problem boxes over against which one or both of the stimuli may be inefficient throughout the entire test, or unequally efficient at different stages of the learning process.

Our conclusions based upon a series of five carefully controlled experiments with 36 rats were:

1. Black and white are both visible against the background of our box; but they are not equally so. Their effectiveness varies as 1 : 2 :: white : black. That is, it takes twice as long to learn the problem of following black alone as it does to follow white alone. Wherefore,

2. When the two stimuli are supposedly involved only the white is used because the black is so much more difficult to perceive. And after learning the typical discrimination test, only the white is efficient. Thus the standard discrimination method in a typical instance has reduced itself to one of simple recognition.

Since the standard discrimination test is one whereby the existence of differing sensory qualities are determined in terms of *their efficiency in conduct*, since, that is, we say that two qualities are discriminated because they call out different reactions, it is a serious criticism if the conditions of our experiments have not been such that both the stimuli are inevitably involved and that the chances for their efficiency are equal.

The second half of the paper concerned itself with an investigation of the relative efficiency of *quality* and *position*. Previous tests have isolated each in turn, series, form, intensity, and extensity, but so far as we know quality and position have not been isolated. Yet in all these tests the quality of the stimulus and its “thereness” are independent variables; for the position of the quality and the position of the food bear a fixed relationship or set of relationships. There is nothing, accordingly, to prevent the animal from learning in terms of the “thereness” of the stimulus rather than in terms of its specific quality. Had the two been varied independently either one or the other might have proved to be of relative or absolute efficiency. The results on this point will be published later in detail. We found

that the variation of position was a confusing factor and that though the complete abstraction of quality from position is entirely possible for us it is extremely difficult, if at all possible, for the rat.

Some Experiments on Pitch-discrimination in Dogs. H. M. JOHNSON,
Johns Hopkins University.

A preliminary report was presented of work begun in April, 1910, on two blind dogs, in an attempt to test by a better method the work of Kalischer, Rothmann and others on pitch-discrimination in the dog, and localization of the center for pitch.

The dogs were taught to react in one way to middle C and in another to the G above sounded on tuning forks, and learned the problem in 285 and 405 trials (19 and 27 days) respectively. When Stern variators were substituted for the forks, the number of trials necessary to complete recovery from disturbance was respectively 120 and 90. When forks and variators were used indifferently in a given series the number of trials required was respectively 150 and 600. (An accident producing considerable emotional disturbance accounts for the longer learning time of the second animal.) When the problem of discriminating between chords containing one or the other stimulus tones was set, the learning time was respectively 615 and 660 trials, but the daily percentage of error seldom exceeded 20.

When last summer the same dogs were given the problem of discriminating between middle C and the E above and made to work at the problem with the operator removed from the room, the problem was yet unlearned after 505 trials each. On suspicion that the mode of reaction chosen was not sufficiently definite, and that enough attention had not been given to the factor of "delayed reaction," a special stimulus box was constructed, forcing the animal to turn at right angles right or left toward the food box chosen, and permitting punishment to be given in case of incorrect choice. The stimulus was given by the Helmholtz method of "tandem-driven" forks equipped with König resonators, giving practically pure tones with widely variable intensity. Two normal dogs were introduced as a control. After 300 trials punishment was introduced for incorrect choice. The problem is yet unlearned after about 1,000 trials each.

These results indicate that neither in Kalischer and Rothmann's work nor in the former part of this experiment, were the animals certainly reacting to tone at all; and that our anatomical conclusions to be reliable must be supported by better behavior results than have yet been obtained.

The Use of the Maze in Comparative Psychology. EDWIN G. BORING
and LUCY M. DAY, Cornell University.

In the study of the animal mind comparative psychology must always make reference, either implicitly or explicitly, to human consciousness under similar conditions. It is this reference that distinguishes comparative psychology from the study of animal behavior. In such a complex experience as the learning of the maze the reference must be fully explicit. Hence, as a preliminary to the use of the maze with animals, there should be made a thorough analysis of human consciousness under as similar conditions as possible.

Such an analysis has been undertaken by Miss Lucy M. Day and the writer at Cornell University. We present herewith a preliminary report on the work.

The Watson circular maze was duplicated on a large scale. Sixteen observers, most of them trained in introspection, learned the maze, giving full introspective reports. The reports were independently analyzed by the two experimenters to obtain a numerical estimate of the processes involved in making the turns. The two estimates showed an agreement of 85 per cent.

The analysis shows that the maze-learning consciousness consists of three phases: (1) Determination of direction after making the turns, (2) guidance within the passages, and (3) location of the turns.

The determination of direction after the turns involves five factors—attitudinal, verbal, visual, kinesthetic, and automatic. Each of these follows a definite course throughout the learning process, although the course varies somewhat with the ideational type of the observer. The attitudinal factor is of importance in only the first two or three trials. The verbal factor reaches its maximum very early, the visual slightly later. They both give place to kinesthesia, which in turn is resolved into a somatic automatism.

Moreover, the course of learning, with regard to the first phase, naturally falls into three periods. In the first period, attitudes and verbal and visual imagery are advantageous to learning, while the introduction of motor imagery is disadvantageous. In the second period, kinesthesia becomes favorable, while attitudes and verbal and visual imagery become unfavorable. In the third period, automatism predominates, and learning is retarded by the introduction of any form of imagery.

With respect to the other two phases of the learning process, our

analysis is not yet complete. So far as our results go, however, they indicate that vision is most important for guidance within the passages, and that both motor and visual factors are involved in the location of turns.

An Experimental and Introspective Study of the Human Learning Process in the Maze. F. A. C. PERRIN, University of Chicago.

Two types of maze were employed in this experiment — the pencil maze, and a maze through which the subject walked. In either case the subject was blind-folded, and learned the route by trials. The time and error curves obtained were quite comparable with the curves based upon the records of the white rat in the maze. (1) The introspections, however, brought out the fact that it was essentially a human, and not an animal, learning process, inasmuch as it was conscious learning and, as such, had involved in it the rudiments of the higher cognitive activities. The various subjects built up and employed ideational controls for the maze. In doing so, they employed in a rudimentary way at least the processes of attending, discriminating, judging, inferring, reasoning. It was the human mind at work, not the animal mind. (2) While the rational element was necessarily present, the actual method was distinctly that of trial and error. Some special mazes, designed to give the maximum opportunity for reasoning, failed to call forth any other method.

The rational element was necessarily present. It was not only present but it was effective, and not merely accessory. This fact suggests the question of its relative efficacy. The adult human, in learning a maze, does not improve upon the time and error records of the white rat in any pronounced way, but he is decidedly at an advantage in tests that call for an application of the learning experience to modified conditions, such as is represented when the maze is altered in size, or rotated.

Memory versus Imagination—an Experimental Critique. LILLIEN J. MARTIN, Stanford University.

The paper gives an account of an experimental examination which the writer had made at Bonn and Stanford Universities of the results of Mrs. Perky's experiments ("An Experimental Study of Imagination," *Amer. J. of Psychol.* 21, 422) on the differences between visual memory and imagination images.

As the differences between the two kinds of images which Mrs. Perky had found were not present in the writer's results, she looks

upon Mrs. Perky's results as having only an individual character, and considers it therefore a mistake to assign to them that general character which has been done in a recent textbook.

Literary Self-projection. JUNE E. DOWNEY, University of Wyoming.

In connection with an extensive study of the imagery aroused by reading poetic fragments, observations were made as to the frequency and kinds of self-projection—self-projection being defined as any form of explicit self-reference—in order to determine the significance for the psychology of self-consciousness of the various forms of self-projection and their function in esthetic appreciation.

The discussion concerned itself chiefly with the forms assumed by the visual and kinesthetic self-projection and with the relations subsisting between them.

It was shown that the different reagents saw themselves with varying frequency as actors in or spectators of a visualized scene. The visual self might appear as a vague figure or in considerable detail. Again, the orientation of the visual self might be vague or exceedingly precise. A double visual self-projection was not unusual.

Kinesthetic or organic self-reference was found to occur frequently and to assume the following forms: (1) Objectified and fused with the visual self; (2) oscillating with the visualized self and localized in the body of the subject; (3) objectified and fused with a visualized object or a visualized person other than the self; (4) abstracted from all visual content and objectified or not.

Relative to the esthetic value of self-projection, a distinction was made between an emphatic and non-emphatic self-projection and the question raised as to the significance of the latter mode of self-projection, particularly in the form of the visualized self. The possibility, however, of an *Einfühlung* mediated by a purely visual objectification, without organic resonance, was recognized.

The Nature and Limits of Introspection. R. DODGE, Wesleyan University.

Introspection is not only an instrument of psychological investigation, it is also itself a psychological process or group of processes, and as such must be capable of psychological analysis. Such an analysis should furnish data for the evaluation of the products of introspection, for an estimate of its reliability as an instrument, and for an estimate of the factors of mental life that it is best calculated to disclose.

Lacking a sense organ, introspection is analogous to sense per-

ception only in the processes of apperceptive integration. While sense objects are integrated as a world of things, the objects of introspection are integrated as a unitary experience.

Dependence on apperceptive systems and actual noetic patterns gives rise to gross sources of error, limits its application, and prevents the disclosure either of mental elements or the fundamental processes of mental life. The phenomena of introspection are not final facts of mental life, but like the phenomena of sound are indicators for scientific construction.

Emotivity and Emotion in their Relations with Adaptation. E. B. HUEY, Johns Hopkins University.

Emotivity is a psycho-organic disposition to interrupt adaptations felt to be called for, and for which the organism has at least partial resources, displacing these with derivative phenomena characterized by disorder and misfit. The ensemble of phenomena characterizing such interruption of adaptation is properly termed emotion.

Clinical observation reminds us that psychology tends to fixate on a few "classical" emotional expressions, the vasomotor and visceral (Lange-James Theory), the sentimental (heart, tears, etc.). Clinical observation shows almost equal involvement of all organs and functions, and shows opposite disturbances for emotions of the same name and almost identical disturbances for emotions of opposite names, the only common and essential feature being the break in adaptation, with disorder and misfit derivative functionings.

Emotional expression depends on (1) what functionings are called for by the situation; (2) what functionings happen to be in use at the time; (3) early acquired habits of reacting in a given manner to a given emotional situation; (4) what organs or functions are most enfeebled, these being affected preferably; (5) occurrence of misfit instinctive functionings of possible utility in race experience; (6) functionings suggested to the individual in the fatigue of emotion, by social custom or contagion or by auto-suggestion.

Intellectual and linguistic disturbances in emotion have been especially neglected, and are prominent and representative of the emotions of many persons. The brain itself may be as basal an organ of emotion as the heart (Janet), and for many persons disturbances of the pharynx, bladder, genitals, or skin "mirror the soul" more closely than do the heart or blood vessels.

The real cause of emotion is a failure in the mechanics of brain tegration, immediately occasioned by the occurrence of factors,

inner and outer, that are too difficult of synthesis under the given conditions and to whose action the organism may be abnormally sensitive. An instinct only becomes an emotion when it is malapropos or when it occasions complexity and strain too great for synthesis and for satisfaction of its intent.

Of theories of emotion, the present presentation owes almost everything to the clinics and lectures of Professor Pierre Janet.

Organic Sensation and the Symbolic Imagery of Thought. (By title.)

ELSIE MURRAY, Wilson College.

The term organic is here limited to the awareness of general organic reaction, internal or external, as distinguished from the awareness of specific bodily movements.

The object of this paper is to emphasize the rôle of this organic factor in the consciousness of meaning, and to urge an adoption of terms, and an introspective training which will enable the average observer to detect and name this component when present.

The attention of the writer was first attracted to this phase of the problem through certain introspections on the words *beauty* and *beautiful*, in which the meaning of these words appeared in consciousness not in illustrative but in reactive terms, in the guise, that is, of the actual or imaged recall of the total organic set characteristic of the esthetic mood. Systematic investigation of this linguistic peculiarity, its relative frequency and importance, seemed at first impracticable, owing to the difficulties inherent in the technique of organic introspection. Recent observations have, however, thrown a new light on the problem. The use of an extended imagery questionnaire in an introductory class of forty-five has brought emphatically to notice the fact that organic attitudes as wholes are accessible to the introspection of the relatively untrained observer. Through the use of stimulus words such as expectancy, impatience, fright, surprise, relief, etc., the possession of a fairly wide range of definite organic imagery¹ was roughly demonstrated. The spontaneous functioning of this imagery was then tested as follows. A list of abstract and general terms, such as mental, delicate, difficult, mistake, possible, etc., was placed in the hands of the student, with instructions to state in what terms the meaning of each word seemed to present itself. In the results organic and motor imagery claim at least an equal prominence with visual and auditory, though the preceding

¹ The question as to the central or peripheral nature of the recall is here irrelevant, since the accessibility of organic reactions to introspection, and the richness of subjective revival, is alone at issue.

tests and questions had indicated the special vividness of visual imagery.

The results of later and more accurate tests are not yet available. The writer feels, however, sufficient assurance to prophesy that a similar preliminary training, and the adoption and rough definition of a uniform set of terms for felt organic attitudes, such as excitement, stimulation, depression, irritation, etc., would enable many now reporting their ideation as purely verbal to detect a concrete conscious content. The value of a certain measure of such organic ideation hardly requires emphasis. The relative simplicity of the organic attitude, its vital relevancy to the total meaning, its status as the natural center of a system of irradiating associations, give it an intrinsic representative value far above that of the arbitrary verbal symbol, or the "pure thought" element of the imageless thinkers.

A Study of Meaning as Inferred from the Methods of Attacking Mathematical Problems. (By title.) JOSEPH PETERSON, University of Utah.

This study was made on sixteen high school students throughout the second half of their first year's work in algebra. The investigation was carried on by the writer, who used every means possible, without interfering with the students' whole-souled attack on the problems, of obtaining the mental content involved in the operations. A special method was that of comparing the work of the best with the poorest students and of ascertaining as far as possible in what specific ways this difference in mathematical ability manifests itself.

As a rule the poor students fumbled on their problems, treating the algebraic expressions not as symbols representing experiences or relations beyond themselves but rather as things-in-themselves. They worked too much in terms of percepts rather than concepts. Frequently, in operations for which the general formula to be followed was well known, they failed because of not seeing in the problem the general principles represented by the formula; that is, they failed to isolate the essentials of the solution and were consequently bound to treat each case as a "law unto itself," as one would treat a puzzle. This was especially noticeable in cases where certain "ear marks" would be altered, as the interchange of terms in an equation; or where an equation to be solved lacked a term, *i. e.*, had a zero coefficient. In general the weakness displayed by some of the students was one of failure to isolate essentials and to hold them in mind when once recognized. The stronger students were keener in

the perception of the general direction that a solution must take and in recognizing the larger aspects of problems, the principles involved in them. These students profited more by experience because they attended particularly to the aspects common to many problems.

The difference is one of the degree of meaning perceived in the problematic situations presented. Meaning is a sort of disposition toward activity in which certain fundamental qualities of experience are singled out, or abstracted, and thrown into the foreground to guide action. The meaning of anything is determined not only by past experience with that thing but also by its particular relation to its present purpose. Is meaning merely a composite of sensory images? If so, what holds these images together and gives them relation in any situation?—more images? If images *only* constitute meaning, and if two images may suffice to make meaning, one symbolizing or “meaning” the other, how can one tell which is which, without some larger emotive background or motor attitude giving trend to experience?

The Rôle of Attention in Advertising. EDWARD K. STRONG, JR.,
Columbia University.

The first function of an advertisement is to force itself upon our attention. Why certain advertisements fail in this respect and why certain others arouse our interest so that we read them clear through is the problem of my research.

In taking up this work three problems of method have been first attacked. The results of the first, which is now practically completed, indicate that the method of simultaneous presentation of many advertisements gives no valid results, while the successive presentation of this same material gives surprisingly constant results from different subjects. The second problem as to whether a constant rate of presentation or a rate varied by the subject at his pleasure gives results more comparable with the actual conditions of the casual reader is still to be determined. And the third, as to whether experimental results, when the subject knows he is being tested, check up with the actual impressions received by the casual reader, is still not settled, although enough data have been obtained to indicate pretty strongly that relatively the results are the same.

But we are interested not only in learning why certain advertisements are noticed but also in studying the differences between advertisements which are remembered for themselves and those which make memorable instead the commodity. There is a great difference here, but the factors comprising it have not yet been made clear.

There have been so far several by-products of this investigation of considerable interest to psychology. Two might be mentioned. The first is that there is no indication of the potency of either primacy or recency when more than ten advertisements are shown successively and then tested for attention-value and memorability by the recognition method. And secondly, it seems conclusive that advertisements are as "simple" *psychically* as nonsense syllables, at least as far as attention and recognition enter. This points to an important implication psychologically. Is it not true that because of the insistence on the use of so-called simple *physical* objects, psychological investigations, such as in the field of esthetics, have been falling off since the physically simple material has been studied? Now the use of advertisements has shown that those that obey the canons of art are the best attended to and remembered. Why can they not be used then in more wide-reaching esthetic studies? Is it not time, indeed, for an advance from the "simple" experimental material to that more related to experience?

A New Method of Studying Mediate Associations. M. F. WASHBURN, Vassar College.

The term mediate association is taken in the following sense: A process *A* is followed in consciousness by an apparently unassociated process *C*; later it appears that the connection was made by means of the process *B* formerly associated with both *A* and *C* but not in the present instance appearing in consciousness. The method used to study mediate associations thus defined was as follows: the observer was given a stimulus word and instructed to react with another word which should be wholly unassociated with the stimulus word. The method offered a good opportunity to study the effect of a definite task or *Aufgabe* set the observer. A number of typical mediate associations resulted in the course of the 662 experiments performed. The instructions, which inhibited ordinary associative processes, allowed the following processes to occur:

Sound associations: the instructions diminished attention to the meaning of the stimulus word and thus strengthened sound associations.

Perseverations from recent experiences of the observer.

Perseverating reaction and stimulus words, but not those used in the experiment immediately preceding.

Words associated with perseverating reaction or stimulus words.

Words of meaning directly associated with the stimulus word, the

fact of the association being overlooked through the tendency of the instructions to direct attention away from the meaning of the stimulus word.

Mediate associations.

The actual experiments were carried on under the author's direction by her pupil, Miss V. Atherton. The paper appears in full in the January number of *The American Journal of Psychology*.

The Effect of Adaptation on Temperature Discrimination. E. ABBOTT, Vassar College.

After simultaneously adapting the right and left hands to temperatures with a difference of five degrees, discrimination for temperatures slightly warmer was tested. Adaptation to moderate temperatures had more effect than to extreme temperatures.

The Relation of Reaction Time to the Duration of Auditory Stimulus.

GEORGE R. WELLS, Johns Hopkins University.

Five lengths of stimulus were used, viz., 7σ, 30σ, 51σ, 76σ, and 106σ. No characteristic difference was found in the reactions to these different stimuli. When a subject was given a long preliminary training in reacting to a stimulus of one of the above lengths and was later presented with series of stimuli of varying durations, he reacted to them all in the same way, including the one to which he had been "trained." And when a subject was "trained" to one duration of stimulus and then reacted to another stimulus of very different length, no difference was found in the reaction times of the two series.

A Pigment Color System. ALBERT H. MUNSELL, Boston.

This system aims to classify and visualize color relations in pigment form. It is built up experimentally, with the help of a photometer, Maxwell discs and the trained capacity of the painter, using the consensus of many individuals. Charts and models present the measured image, while decimal notation and a score provide for graphic records.

This classification depends on the recognition of three color dimensions—value, hue and chroma—arranged spatially as follows. A central vertical axis represents changes in value (painter term for luminosity) from black at the bottom to white at the top, the progression being logarithmic to follow the Weber-Fechner law. The value of every point on this axis determines the level of every possible

color of equal value. Vertical planes intersecting in this axis represent particular hues, the opposed portions being complementary in hue. Any three planes separated by 120° form a complementary trio, etc. Thus the angular position of any hue is determined. Chroma (intensity of hue or "saturation") is measured by the perpendicular distance from any point to the vertical axis, its progression being arithmetic.¹

Thus is constructed a solid in which every horizontal plane corresponds to one and only one value; every radial plane contains colors of but one hue; and the surface of each cylinder concentric with the axis contains colors of equal chroma. Each point in this solid stands for one and only one color, and when these three dimensions of a color have been measured, its position in the solid is obvious.

The system begins with central gray—the balancing point for pigment mixture as white light is for spectral hues. No regular solid portrays the unequal degrees of pigment value and chroma disclosed by measurement, but the *sphere* suggested by Rünge (1810) is a convenient model for establishing balanced relations. The spherical equator comprises ten equal hue steps arranged as five complementary pairs, all of equal chroma to accord with equal departure from the neutral center, and of middle value to accord with their level. Rotation causes retinal fusion of this hue-circuit in neutral gray. Zones lighter to white and darker to black are similarly established. At high speed the sphere reproduces the white-black axis. A certain low speed presents these balanced color zones to the eye at such rate that their vividness is almost prismatic.

Stronger chroma in various pigments projects beyond the sphere describing an irregular solid or *color tree*, whose trunk is the white-black axis, with branches extending to the maxima of red, yellow, green, blue and purple. The tree is a quantitative and qualitative statement of all pigment mixtures. These are displayed in a *color atlas*² whose charts—horizontal, vertical and oblique—are worked out in matt color to satisfy the three scales of measure.

The Retina and Righthandedness. H. C. STEVENS, University of Washington.

Measurements of the space sense of the retina for symmetrical extents upon the same retinal meridian were made by that form of the method of average error which Müller calls the determination of

¹ *Color Notation*, Munsell, Boston, 1905. PSYCHOLOGICAL BULLETIN, 1909, 6, 238

² *Atlas of the Munsell Color System*, Wadsworth Howland & Co., Inc., Boston.

equivalent stimuli by means of the method of limits. The standard extents were 40, 80 and 200 mm. There were four observers each of whom made 1,920 observations. The constant error for each standard was determined in 4 meridians of the field of vision, viz., the vertical, horizontal and right and left oblique meridians. The apparatus consisted of a black velvet disc 61 cm. in diameter. The center fixation point served as the middle point between two adjacent extents. The outer limits of the extents were marked by white spots. One of these spots was carried upon a movable radius which permitted the variable extent to be made larger, smaller or equal to the standard extent. Observations were made with the right and left eyes separately. The results may be stated as follows: (1) In the horizontal meridian, the right half of an extent in the field of vision is overestimated. (2) This overestimation holds true for both right and left eyes. (3) The extent which is overestimated forms its retinal image upon the left corresponding halves of the two retinas. (4) The left corresponding halves of the retinas are connected exclusively with the left hemisphere of the cerebrum. (5) By reason of the fact of a marked difference in the space sense of the two halves of the retina, those objects in the right half of the field of vision, by appearing larger, attract the visual attention which in turn leads to grasping movements of the right hand. The hand thus favored by earliest experience acquires a special skill which causes it to be used in all manual acts requiring the greatest precision.

The Determination of the Sensitivity of the Retina to Colored Light in Terms of Radiometric Units. (By title.) C. E. FERREE, Bryn Mawr College.

About a year ago the writer undertook to determine the relative and the absolute sensitivity of the retina to colored light in terms of units that can be compared. Since several years will be required to complete this work, he has thought it best to publish a preliminary note showing briefly the purpose and scope of the investigation. The following points will serve to indicate what is being attempted in this study.

1. All measurements of sensitivity will be made in terms of the number of radiometric units required to arouse color sensation. This will give an expression of the sensitivity of the retina in units that can be compared. At present we have no estimate of the comparative sensitivity of the retina to the different colors further than is expressed by the relative width of the collimator-slit that has to be used to

arouse color sensation when a light-source of a given candle-power is used. This kind of comparison is obviously unfair, because such different amounts of energy are represented from point to point in the spectrum that a given width of slit would admit many times the amount of energy to one part of the spectrum that it would to another. In short, no proper estimation of the sensitivity of the retina to color, relative or absolute, can be made with the methods now in use.

2. The limits of the color zones will be determined with colored lights representing an equal number of units of energy. In color theory a great deal has been made of the relative limits of color sensitivity. Hering's theory, for example, demands that the boundary of the zone for red must coincide with the boundary for green, and the boundary for blue with the boundary for yellow. The final answer to this question cannot be given until an investigation is made with colors equalized in energy.

We began a quantitative study of the factors that influence the sensitivity of the retina to color three years ago. With the control of factors we had at that time, we could not, for example, duplicate by several degrees at any two consecutive determinations the limits of the zone of sensitivity to any color. The result of our study has been that we are now able with a given light-source to duplicate within a degree the results obtained at a previous sitting. We can also duplicate almost as closely the threshold values or the amounts of light required to arouse color sensation in the more sensitive parts of the retina. Details of this work are given in a series of papers to be published in the course of the present year, beginning with the April issue of the *American Journal of Psychology*.

Visual Sensations Caused by Changes in the Strength of a Magnetic Field. C. E. MAGNUSSON, University of Washington.

The paper gives experimental data on the following points: (a) Verifying the observations made by S. P. Thompson and Knight Dunlap. (b) Ascertaining that the magnetic field induced while making and breaking a direct current gives a visual sensation. (c) Determining the threshold of the sensation in terms of ampere turns. (d) Determining the dependence of the sensation upon the frequency of the current. (e) No sensation other than the visual was noticed by any of the observers. No after effects appeared. For stronger fields, care should be exercised, as the sensations are of considerable intensity.

Local Signature and the Extensivity of Sensation. WILLIAM C. RUE-DIGER, The George Washington University.

The different theories that are advanced to account for the ability to localize points on the skin or in the visual field may apparently all be classified under three heads. These are (1) the kinesthetic theory, (2) the sensational-element theory, and (3) the sensational-complex theory.

According to the kinesthetic theory, localizations are made reflexly by the child, and the accompanying kinesthetic sensations give the needed data to consciousness for making localizations later. According to the sensational-element theory, every elemental visual and skin sensation has an inherent characteristic that varies with the particular end organ that is stimulated. According to the sensational-complex theory the sensations received from the elemental sense organs in the skin or retinas would be alike and the differences in local signs that we feel or see would be due to different combinations or complexes of these homogeneous elemental sensations.

The kinesthetic theory alone appears clearly inadequate (see Myers, *Experimental Psychology*, p. 239), and this leaves the choice to lie between the other two. The experiments that I have performed appear to point to the truth of the sensational-element theory. I have performed experiments with the Bloch instrument on the forearms of four subjects, using 1 gram of pressure in one series and 10 grams in another, and applying the pressures respectively to a vein and to the skin where no vein was in evidence.

Localization was just as accurate with one gram of pressure as with ten, and it was even more accurate on a vein than on the skin where no vein was evident. This is contrary to what one would reasonably expect according to the sensational-complex theory.

If it is true that there are innate differences in sensations corresponding to the points of the skin or retinas stimulated, the development of space perception may be readily accounted for. The assumption of sensational extensivity seems entirely unnecessary. Furthermore, this assumption, while insistently made by many psychologists, is not used by these psychologists in explaining or developing space perception.

Two New Sphygmographic Instruments. R. DODGE, Wesleyan University.

The first is a pneumatic photographic recorder of extremely low latency and high sensitivity. Used in connection with any good

microscope, it records vibrations of over 1,000 per second, shows overtones of vowels and heart tones, and gives pulse waves of any desired amplitude without changing its latency or other constants. Suitable for class lantern-demonstrations of pulse and plethysmographic changes, it is durable and practically fool-proof, at least for anyone who can use a microscope.

The second instrument cannot be shown in action. Used with a string galvanometer, it registers the pulse of a distant subject who is not hampered in his activities, provided he remains connected with the binding posts.

Some Recently Discovered Physiological Changes Attending Fear and Rage. W. B. CANNON, Harvard Medical School.

A close relation exists between adrenalin and the sympathetic system. The adrenal glands are caused to secrete when the sympathetic is stimulated, and adrenalin affects all structures innervated by the sympathetic as if they were receiving sympathetic impulses.

Major emotional disturbances (fear, rage) indicate the dominance of sympathetic impulses. In the cat, for example, fear or rage produces dilatation of the pupils, inhibition of the stomach and intestines, rapid heart, and erection of the hairs of the back and tail. Tests with excised intestinal strips (sensitive to adrenalin 1 to 20,000,000) prove that fear or rage causes also the adrenal glands to pour an increased secretion into the blood.

The persistence of the excited state of the body may therefore be due to chemical stimulation which continues the changes started by nervous impulses.

Injected adrenalin mobilizes sugar in the blood and results in glycosuria. Fear or rage has the same effect, if the adrenal glands are present. Emotional glycosuria can be evoked in a cat by permitting a dog to bark at it at close range.

Fear is related to the instinct to flee, rage with the instinct to fight (MacDougall). Possibly in the wild state emotions are useful in providing sugar as a source of energy, and adrenalin as a means of offsetting fatigue, in excessive muscular exertion.

Electrical stimulation of nerves innervating the adrenal glands, while a muscular fatigue curve is being written, increases (in some cases more than one hundred per cent.) the height of the curve.

A Contribution to the Physiology of Kinesthesia. (By title.) GEO. V. N. DEARBORN, Tufts College.

From an experimental study (begun in 1909) of the voluntary

(new and unrhythmic) movements of more than forty intelligent subjects (varying in age from fourteen to sixty-two, of both sexes, some blind and some with normal vision) the following conclusions issue, and they are supported by sundry outside evidence set forth in the paper itself:

1. Aside from the more or less passive indication of posture, resistance, equilibrium, vibrations, etc., the function of the conscious movement sensations is inhibition, the deliberate active restraint of tendencies to inaccuracy in voluntary action otherwise actuated.

2. Save in some "motiles," a series of voluntary movements perceived only kinesthetically is promptly visualized and then forms the conscious phase of the motor idea for the series' repetition. The motor idea of a truly deliberate movement is given, then, in visualizers as a partly conscious visual (*aut al.*) image in inseparable association with actuating kinesthetic coördinations wholly unconscious, which, lacking a better name, may be termed spinal kinesthesia. This motor idea is in practical opposition, in a sense, with the conscious kinesthesia, but the two may be fused by habitual effort.

3. The voluntary action of blindfolded "motiles" is like that of blind people, both having comprehensive conscious kinesthesia but usually at the expense of the accuracy of the general motor idea in visual and spinal kinesthetic terms.

4. The direction of a voluntary movement has no advance representation in the conscious kinesthesia and must therefore be determined in the combined visual and spinal-kinesthetic motor idea.

5. The extent of a movement, likewise, probably determined by the muscles and felt there, is presumably a function of the unconscious spinal kinesthesia. Hence Hollingworth's scepticism as to judgments of extent, and one or two of Woodworth's conclusions.

6. Motor skill, neurally speaking, consists especially in the power and habit of *fusing* in running control these two phases of kinesthesia—the actuating (unconscious) and the conscious inhibitory impressions on the voluntary cerebral resultant.

7. Voluntary movement as such, new and personal and difficult, is inherently an inhibitory process.

The products of this experimental study appear to make easier of understanding the duality of the pathway between the posterior lateral gray cord and the great cortex, one "kind" of kinesthesia (the inhibitory) going apparently with relative directness via the lemniscus, the other (the hereditary, spatial, impersonal, actuating influences) through the cerebellum, etc. These results seem also to

reconcile and help explain certain illusions and seeming inconsistencies in the relations of consciousness to various aspects of a voluntary movement.

The Value of Sublimating Processes for Education and Reëducation.

ERNEST JONES, University of Toronto.

The process denoted by the term "sublimation" is defined by Freud as "the capacity to exchange an original sexual aim for another no longer sexual aim, though a psychically related one." It has long been empirically recognized that undue sexual excitation can be relieved by diversion of the person's interests into other directions, such as those of sport, etc., and also that energy thus derived furnishes a not inconsiderable contribution to artistic and other social impulses. Two matters not generally recognized in this connection are these: What happens is not so much a *replacement* of one interest by another totally different one so much as the *displacement* of a given conative trend from one aim to another, more suitable one; the original trend or desire does not die, but undergoes a transformation in finding a different mode of expression. It is possible that the law of conservation and transformation of energy holds as well in the mental sphere as in the physical. Further, the diversion of normal sexual desire constitutes only a small part of what is included under the term "sublimation." Sublimation is more concerned with the socially useless and primitive components of the sexual instinct from which the adult form of sexuality is only a residuum left after an extensive process of repression of the rest. Accompanying this repression is the process of sublimation, which therefore is mainly a question of early childhood life. These discarded desires form the basis of many of our later acquired interests and activities, and it is maintained that a fuller knowledge of them would be of the greatest value to education by indicating the most fruitful paths along which sublimation could take place. It is at present to a great extent left to chance for a given educational topic to find some already existing potential interest in the child to which it can make an appeal, whereas if these potential interests were investigated and the nature realized of the energy which is at our disposal for educative purposes, then we should be in a position to apply them in the most profitable directions and thus make the best use of them for social purposes.

Several matters in connection with the reëducation of criminals, perverts, neurotic and insane patients are dealt with, and stress is laid on the application of the foregoing principles to the treatment of

advanced cases of dementia. Psychologically such patients are in a state of early childhood, and their activities are often confined to seeking long past sources of bodily pleasure. These activities should be correlated with the corresponding ones of infantile life, and the attempt to divert them into more suitable directions should be guided by a knowledge of the evolution they undergo in the normal child.

Apropos of the Doctrine of Reserve Energy. TOM A. WILLIAMS, Washington, D. C.

Using the conception of the subconscious as applying to a special series of nerve processes, energizing independently of those which are the bases of the thoughts of everyday life, a psychological theory has arisen that these subconscious processes constitute energies which may be regarded as a reserve susceptible of being utilized by means of special associationizing processes. On this basis a therapeutic method is employed.

This theory depends upon the postulate that the threshold of excitation is somewhat inversely proportionate to the richness in associations of the constellation to be excited. This postulate regards the inhibition of energy as synonymous with its storage, forgetting that inhibition itself is a greedy consumer of energy. So that the absence of manifestation of energy to a superficial examination at least, does not connote its storage on reserve on these grounds at least.

Nor is the fact that useful work is not done by any means an index that energy is not expended; for a very little observation shows that it is extended in fatuities and sterile activities.

So that for the principle of reserve energy would be more correctly substituted the principle of channeling energy in fruitful directions. The results of what is called training, that is, technical methods, clearly show this difference. The trained man may spend less energy than the untrained man, but his work is more effective in result because more wisely expended.

The Psychological Analysis of So-called Neurasthenic and Allied States. TRIGANT BURROW, Johns Hopkins University.

Etymologically, of course, neurasthenia means an exhaustion of the nerve structure. It is a fatigue-state constituted of chemical or molecular alterations of the substance of the neurones. Neurasthenia is then essentially an anatomical process. But is this definition of neurasthenia appropriate to the various aberrant states which are

at present universally subsumed under this generic head? Ought we longer to be satisfied with the prevailing static, neurological conception of this widely variable disease-complex, or ought we rather to press for a more restricted, individual, dynamic interpretation such as may be yielded through a psychological analysis of the particular case?

Cases of neurasthenia present symptoms which are noteworthy in respect to two important features: First, because of the lack of coherence and systematization, such as we are wont to demand in the recognized clinical disease-entities; and second, because of the absence of the objective morphological findings, such as might bear out the patient's subjective complaints.

In such a pass, we are clearly confronted with an apparent discrepancy, and in strict observance of established medical precepts, the neurasthenic ought accordingly to be excluded from the interest of the average physician.

To escape this alternative, neurology has invoked the conception of functional changes having their basis in disintegrations occurring within the elements of the nervous system, presumably so minute as to be impalpable to ordinary objective tests. The conception affords us a comforting subterfuge, but this is an insincere dodging of issues, unworthy of the scientific ideal.

Experience afforded by the use of the psychoanalytic method compels the recognition of important affective trends, such as seem ever insatiably pressing for satisfaction, and it would appear that in the event of obstruction to the natural course of such instinctive tendencies, there occur vicarious gratifications in unconsciously motivated reactions, such as are allied with the former through what may be called somatic associative connections. It is precisely such somatic associations that constitute in this view the so-called symptoms of the patient.

The phenomenon furnishing strongest support for this interpretation of many so-called neurasthenic states is the persistent reiteration of one and the same unconscious trend throughout a patient's dreams, as revealed upon analysis, and the very striking analogy between the psychological imagery of the patient as presented in his dreams and the *organic* imagery, as presented in his symptoms.

Considering the trend of these observations, are we not justified in bringing into question the prevailing neurological conception of so-called neurasthenic and allied states, and in view of the parallelism here indicated between the content of the patient's dreams and the

content of his objective symptoms, may we not regard the latter as also answering the purpose, as it were, of a physiological charade and as constituting like the dreams an associative or symbolic representation of an inherent biological trend, to which external circumstances have denied, perhaps, a normal fruition and which, therefore, seek an outlet in such unconscious, surrogate issues?

The Influence of Caffein on Mental and Motor Efficiency. H. L. HOLLINGWORTH, Columbia University.

Report of an elaborate experiment on 16 subjects for a period of 40 days, under controlled conditions of life, administration of doses, etc. The effect of single doses was traced for 72 hours after administration. The tests used were steadiness, rate of tapping, visual-motor coördination, typewriting (speed and accuracy), color-naming, naming opposites, calculation, size-weight illusions, cancellation, discrimination and choice reaction time, quality and amount of sleep. Motor tests show quick and transient stimulation. Association tests show stimulation which comes more slowly and persists longer. Tests of discrimination and coördination show similar stimulation, which may be preceded by retardation due to false reactions and consequent caution. No sleep disturbance for doses smaller than 4 or 6 gr. of pure caffein alkaloid. The magnitude of the caffein influence varies inversely with body weight, is reduced and delayed when the dose is taken along with food substance, and is relatively slight when the dose is taken in the morning. There is absolutely no evidence of any secondary depression or retardation following upon the stimulation. Full reports of the investigation appear in the January numbers of the *American Journal of Psychology*, the *PSYCHOLOGICAL REVIEW*, the *Therapeutic Gazette*, and in the *Archives of Psychology*, Columbia Contributions to Psychology, No. 21.

*A Kinetic Will Test.*¹ GUY G. FERNALD, Concord Reformatory.

In selecting and devising psychological tests to be applied in the differentiation of defectives, especially among delinquents, it is important to test the ability to endure for the sake of achievement. This function complex may be measured in terms of fatigue in units of time.

Fatigue is naturally and rapidly induced in a subject who stands with heels about 1 cm. off the floor. Incentive to endure is sup-

¹This test is to be known henceforth as "An Achievement Capacity Test."

plied in the stimulus and in visualizing the degree of elevation of the heels by means of a delicately energized indicator on a dial before the subject's eyes which faithfully magnifies the amplitude of the fluctuations of the heels.

This test has been applied to 116 Reformatory prisoners and to 12 Manual Training school students. The disparity of lowest and highest scores is remarkable—*i. e.*, $2\frac{1}{2}$ and $52\frac{3}{4}$ minutes in the former group and 12 minutes and $2\frac{1}{2}$ hours in the latter—and the difference of the average and median for these two groups is 35 minutes, about twice the average of the Reformatory group.

It is essential that the limit of mental persistence be reached before the limit of muscular resistance is encountered, and experience shows that this form of the test realizes that desideratum. No subject involuntarily rested his heels while still striving; but each decided to yield. This was the universal observation both objective and subjective.

The disturbing elements of varying training and body weight are almost nugatory, as in male subjects of nearly uniform age the coefficient of correlation of the development and strength of the musculature involved to the body weight would be direct and very high.

The Adaptation Board. HENRY H. GODDARD, Vineland Training School.

The ability to adapt one's self to changed conditions is something that comes with developing intelligence and young children possess it only in a slight degree or not at all. Feeble-minded persons who are arrested in their development so that they have the mentality of young children of various ages, show markedly this lack of power of adaptation. In order to measure if possible this lack, the Adaptation Board has been devised.

It consists of a board a centimeter thick, 22×28 cm. with four holes placed near the corners, three of these being 63 mm. in diameter while the fourth is 65 mm. A circular block is provided large enough to just fill the largest hole, therefore too large to be placed in either of the others.

The Test.—It will be noticed that the difference in the size of the holes is too slight to be detected by the eye.

The board is placed in front of the child in such a position that the hole into which the block will fit is in the upper left hand corner. The child is then made to discover which is the only hole into which

the block will fit. After trying this several times until he can show without hesitation the correct answer to the question, "which is the only hole into which the block fits," he is given the block and told to watch what happens. The board is then turned over from his left to his right and he is asked then to put the block into the only hole into which it will fit. The child of sufficient intelligence, of course, puts it in the upper right hand hole; if of lower intelligence, he tries it still in the upper left hand hole because that was what he had learned and he has not been able to adapt himself to the changed condition, even though he was watching the change.

For the second part, the board is now placed in its original position and the child shown again that now it is in the position where the block fits the upper left hand hole. He is then told to watch. The board is now inverted, the edge farthest from him being brought toward him, and he is now asked to put the block into the only hole into which it will fit.

Here are shown at once three types of children. The intelligent child places it, of course, in the lower left hand hole; while the child who is totally unable to adapt himself or to learn, tries it still in the upper left hand. There is, however, an intermediate group of children, who, while not able to adapt themselves to the exact condition, remember that on the former occasion, after being told to watch what happened, the block went into the upper right hand hole, and they therefore now try to put it there.

Report of Experiments at Bedford Reformatory, 1910. (By title.)

E. H. ROWLAND, Mt. Holyoke College.

Nine psychological tests of reaction-time, memory, attention, and suggestion, were performed on 35 women in the N. Y. State reformatory at Bedford. The object of these tests was to find out whether the resulting grades would be an index of the ability of the subjects, and whether those failing to pass a certain number of the experiments could be fairly judged as unable to earn their own living after their term was over. Failure in 6 out of 9 tests was called sub-normality. Eleven of the thirty-five failed to reach this standard. These already comprised the list of those graded by the superintendent as sub-normal and incapable of honest freedom, with the addition of two more who failed only in 5 tests.

The experiments were later tried upon Mt. Holyoke and Amherst students. No student failed in 6 tests.

The Present Status of the Binet-Simon Tests. J. E. WALLACE
WALLIN.

The reader discussed four methods by means of which to check up the accuracy of measuring scales of intelligence: (a) Extensive surveys of normal children in each age by a wide-range system of testing, to ascertain whether the age norms are correct, as determined by the percentage of passing and the size of the MV's; (b) annual tests of the same groups of normal children, to determine whether the amount of actual growth corresponds to the growth norms laid down in the scale; (c) the plotting of curves of frequency for homogeneous groups of individuals, to determine whether the curves assume the normal shape for chance distributions; and (d) the plotting of efficiency or capacity curves for each age for the various traits tested in the scale, or for traits tested independently of the scale, to determine whether the capacities increase in strength with age and whether they vary within the limits of the maximal permissible norm of variation.

An analysis by these methods of the available experimental data of various workers in different countries indicated that there are various inequalities and imperfections in the 1908 Binet-Simon scale, both in respect to the placement of a considerable number of individual tests and the correctness of several collective age norms. But it also appeared that, in spite of obvious inequalities, the scale possesses considerable value as an instrument for gauging mental station and classifying groups of mental defectives. Several objections to the 1911 scale were offered, and a plea was made for more extensive wide-range try-outs of the 1908 scale by uniform and standardized methods on normal school children, before any American revisions should be attempted.

The Status of the Binet Tests to Date. HENRY H. GODDARD, Vineland
Training School.

The *a priori* arguments against the tests were considered, and some cautions noted.

A summary of the results of their use brought to light these facts: The results of the tests applied to 400 feeble-minded children agree perfectly with long experience in institutional life. A second testing on the same group shows remarkable agreement with the first. 2,000 normal children tested by this method show the remarkable curve of distribution; and the results agree very closely with the experience of the teachers. 1,000 of these, retested a year later, again

show considerable correlation with the earlier test, but with marked and peculiar differences which must be explained. A test of 56 delinquent girls in Boston shows 52 of them mentally defective according to the scale. These are the girls that have given the most trouble to the probation officers. 100 Juvenile Court children in the Detention Home in Newark, N. J., show 66 per cent. feeble-minded according to scale, and only one of normal intelligence. 100 children admitted to the Rahway Reformatory in New Jersey show 26 per cent. feeble-minded. The test of an entire private school in Pennsylvania showed results agreeing strongly with the experience of the teachers with one or two striking exceptions.

Feeble-minded children tested from two to seven times show remarkable uniformity in the results, largely regardless of the experience and personnel of the examiner. Some tests of the insane have shown that the method is of remarkable value in these cases, the difference in the results being that whereas normal and feeble-minded children nearly always answer all the questions up to a certain point and then stop, the insane, on the contrary, miss the questions in earlier years and do those that are for older people, indicating that the disease has destroyed certain processes without producing a leveling down of the whole intelligence. The same thing has been discovered from the use of the tests on epileptics at Skillman, N. J., indicating that epilepsy is a degenerative process.

Conclusion.—The tests go a long way toward giving us what we want. They are accurate far beyond belief. While it is true that they need supplementing and improving, yet it is quite possible that this supplementing will have to be in the nature of a consideration of individual cases and special tests for special children. It is a problem that may well occupy the attention of psychologists, but no one should attempt to criticize the tests until he has used them on some hundreds of children.

The Application of Experimental Psychology to the Problem of Vocational Guidance. HELEN THOMPSON WOOLEY, Cincinnati.

The present paper reports an attempt which is being made to test the usefulness of a psychological laboratory as a part of a vocational bureau. The bureau is established in connection with the office which issues working certificates to children in Cincinnati. The general plan of research is to follow for five years the careers of a thousand or more children who have left school at the age of fourteen to go to work, and to compare them with a corresponding series of

children who stay in school. The records cover the child's school career; his physical condition; his home conditions; his industrial history, including a study of the places of occupation; and his mental state as determined by the psychological examinations.

The considerations which guided the selection of tests were the following: (1) a series suited to the capacity of 14-year-old children who have completed at least the fifth grade; (2) a series which would help to analyze the fundamental aptitudes of the child; (3) a series which could be administrated in about an hour's time; (4) tests which could be quickly evaluated; (5) a series in which the disturbing effects of communication between children who have been tested and those who have not, can be minimized, partly by selecting tests which are very little modified by previous knowledge of their nature, and partly by selecting those whose form can be changed without changing their value; (6) tests requiring only inexpensive apparatus.

The series now in use is the following. (A) For Sensation: (1) Visual acuity taken with the Snellen Chart, and (2) auditory acuity taken with the tick of a stop watch. These tests reveal nothing more than the presence of abnormalities which might have a hampering effect. (B) For motor ability: (1) The strength of the hand taken with an adjustable dynamometer, (2) the rapidity of movement in tapping, (3) the rate of fatigue in tapping, (4) the steadiness of the hand, taken with the apparatus described in Whipple, page 124, and (6) coördination as tested by card sorting. (C) For perception: The quickness and accuracy of perception, as revealed in the *A* test. (D) For the higher mental faculties: (1) Immediate memory for digits, (2) learning power, taken with a special form of substitution tests, (3) the use of language, and range of ideas, tested by association of opposites, and by completion of sentences, (4) ingenuity taken with a form board test. The speaker discussed the exact method of giving each test, and of evaluating results.

An Objective Measurement of Handwriting. D. STARCH, University of Wisconsin.

The proposed method of measuring handwriting consists in measuring, by means of a celluloid graphometer, the mean variation of the slant of letters and their mean deviation from the base-line. These two measures are reduced to the same units of linear distance and averaged. In this manner all the samples in Thorndike's scale were measured which showed that the uniformity of letters regularly decreases as the quality of the writing decreases. Measurements

of other specimens of writing made by this proposed method and by the method of direct comparison with standard specimens showed that the former method is considerably more accurate. The application of this graphometer scale to various problems of research was illustrated in the measurement of a considerable number of specimens of writing from pupils in the second grade to the last year in the high school. This yielded a curve of learning reaching its maximum point of excellence in the seventh grade.

Relative Time and Accuracy in Adding Upward and Downward.

(By title.) L. W. COLE, Boulder, Colorado.

Measured by averages, twenty-nine out of a group of thirty persons, selected at random, added the same problems more rapidly and less accurately when adding upward than when adding downward. Counting to the left was also slower and more accurate than counting to the right. This is apparently due to a habit acquired by reading from right to left. In both experiments the factor of habit seemed to produce a saving of time at the expense of accuracy. The subjects of the experiments were persons of average practice in adding. Probably a very great amount of drill in addition (perhaps more than a school program could allot to it) would be required before a different type of results would emerge and the adding process become both mechanical and accurate. This paper will be printed in the *Journal of Educational Psychology*, Vol. III., No. 2, February, 1912.

Montessori's Method of Teaching Writing and Reading. HOWARD

C. WARREN, Princeton University.

The Casa dei Bambini is an important modification of the Kindergarten originated by Maria Montessori in 1907. The pupils range from 3 to 7 years of age.

Besides sensory and intellectual training the program includes lessons in deportment and self-help, gymnastics, manual training, play, and nature study. The scheme of studies is founded on an unusually correct appreciation of the child's mental processes. Motor habits are developed from instinctive motor tendencies; habits of thought are built up by association. The theory of discipline is novel: the children are subject to no drill; and there are no extrinsic rewards or punishments. A cardinal principle in the method is the brevity of the instructions given.

Writing and reading are the culmination of a long series of sensory and muscular training. Touch and the kinæsthetic sense are em-

phasized. The child learns to distinguish blind-folded between silk, velvet, satin, wool, cotton, and linen, and between different grades of texture in each. The sense of form is taught in the same way.

The teaching of writing falls into three stages: practice in holding and wielding the pen; exercises in associating the tactual-motor form of a letter with its name and visual form; and combining of letters into syllables and words. On account of the careful preliminary training in the motor equivalents these children form letters more accurately at 5 and 6 than the ordinary child of 10 or 12 who has learned to write by imitating visual copies.

In the new system reading follows writing instead of preceding it. The children already know how to read detached words; but according to Montessori this is not really "reading." They are first trained to recite in unison sentences written on the blackboard. At length something is written which involves *action*. When the children understand and obey the directions, reading attains its true value. It is no longer merely mechanical expression, but a means of acquiring ideas. The change comes when the impulse to read aloud is checked.

The program and methods of these schools challenge our entire system of both primary and secondary education. They indicate that the present curriculum needs thorough revision. It is founded on a faulty psychology; it does not consider what a child is fitted to assimilate at any given stage of mental development. Montessori's system is based on a study of precisely these problems.

(This paper will appear in full in the March number of the *Journal of Educational Psychology*.)

The Relation between Amount to be Learned and Retention. V. A. C. HENMON, University of Wisconsin.

Ebbinghaus, in the widely quoted results on the relation of the length of series to the number of repetitions required for learning, found that the number of repetitions increases at first with very great rapidity and then less rapidly and that the increase in repetitions is relatively greater than the increase in the length of series. A systematic investigation of the problem in learning nonsense-syllables, poetry and prose has failed to confirm the law. On the contrary, there is a relative decrease in the number of repetitions as the length of series increases and an increase in retention after an interval of time. This result holds not only for practiced but also for unpracticed subjects and is most marked with sense material.

The Relation of Facility in Learning to Tenacity of Impression. E. A. McC. GAMBLE, Wellesley College.

Question 1.—Do the persons who learn with the greater facility retain for a given time the larger fraction of the material severally mastered? The results in point have been obtained with series of words, letters and figures, by the method of retained members, from about 350 college students. Tenacity was gauged by the number of series members which could be produced without a fresh presentation of the series, with a single presentation and after several presentations. The results show no correlation, either positive or negative, between facility and tenacity.

Question 2.—In the case of individual subjects, does the rate at which material is presented affect the fraction of the initial learning time which is saved in relearning?

Question 3.—When the learning time is lengthened by the difficulty of the material is the relearning time relatively short or relatively long? The results bearing upon these two questions have been obtained from trained subjects, with normal series of nonsense syllables, by the method of complete memorizing and with aural presentation. When series are learned and relearned at the same rate of presentation, the fraction of the learning time saved in relearning is greater if the presentation rate is neither very slow nor very fast. When the series are learned at different presentation rates but relearned at the same rate, the fraction of the learning time saved is greater for the series which were originally learned at the slow rate of presentation, unless the absolute learning time of the "slow series" is very small. Series which are hard to learn are more often hard than easy to relearn.

Question 4.—How may retention best be gauged? The method of reproduction without fresh presentation is unsatisfactory because it reveals only the strongest of the original impressions, the "supra-liminal associations." The method of relearning is unsatisfactory because in relearning it is impossible to distinguish facility in forming fresh associations from retention of subliminal associations. The method of reproduction after a single presentation is perhaps most satisfactory. The small amount of work done on this plot in the field of memory investigation may be due to its hedge of experimental difficulties.

The Relation of the Quickness of Learning to Retentiveness. DARWIN OLIVER LYON, Columbia University.

Do those who learn quickly remember the longest? Those who

have attempted to answer this question experimentally have obtained results that do not agree. Close inspection proves the problem to be a very elaborate one, for the results depend upon nature and length of material used as well as on age, sex, condition, etc., of the subject. Most important of all is the method used in ascertaining the subject's "retentiveness" after the lapse of the time interval chosen. Roughly speaking we may say that those who learn quickly remember longest where the material used is "logical" or "meaningful" in character, but forget quickest where the material is such as involves the memorizing of motor associations, which is generally the case with digits, words, and nonsense syllables. We can state quite positively that the amount of difference in retentiveness between the fast learner and the slow learner is much less than is generally believed.

Plateaus in Simple Learning. JAMES E. LOUGH, New York University.

The present study deals with the determination of the habit curve in the field of a simple visual association. The material for the test consisted of 3 sheets: (1) A test sheet with 10 lines of letters in mixed order; (2) a key sheet, in which 20 letters used in the test sheet are arranged in a vertical column and opposite each is printed some other letter; (3) a record sheet. The method has been described in detail in my previous reports and in Kirkpatrick's "Studies in Learning," *Archives of Psychology*, 1909. I have used this method since 1902 as a class test and as an individual test, and have collected over 500 records including adults and children. Some of these tests were made as home tests and some as laboratory experiments under carefully controlled conditions. No difference can be observed in the results of tests made under these two conditions.

These tests are made in order to study habit formation as affected by (1) practice, (2) fatigue, (3) distribution of repetition, (4) diurnal efficiency, (5) changing keys, (6) sex, (7) age, (8) ability, and (9) individual variation. I expect shortly to publish with Dr. P. R. Radosavljevich, under the title "Habit-Formation in the Light of Experimental Investigation," a detailed report of this study. At this time I wish to say only a few words with reference to the problem of plateaus as indicated by my experiments.

As it is known Bryan and Harter were the first who found in their study one or more special periods of delay in progress, so-called "arrest periods," "critical stages," or periods of "incubation," giving

a "plateau" or two in curve, where certain elementary habits make substantial gains, preparatory to their organization. In my tests in simple associative learning, where only one or a simple group of special associations are formed no "plateaus" occurred. The practice period in these tests lasted from 20 to 90 days.

The habit curves all agree in type; showing (1) a more or less concave form; (2) general increase of quickness of response; (3) certain irregularities. These irregularities, however, are not plateaus but are normal small irregularities due, as introspection proves, to regular and irregular fluctuations in attention and effort, to fatigue, to "breathing" factors, or to some inner or outer incident; the secondary causes of these irregularities are in some cases the time of day, weather, temperature changes, etc. The majority of subjects claim that those irregularities are due to fatigue, because even in a single test (10 trials in each group) in the 5th and 7th trial there is usually little or no gain, and sometimes a loss.

The nature of learning in these experiments is much simpler than in the experiments of Bryan and Harter, Swift, and Book, and my failure to discover plateaus would seem to indicate that this feature of the learning process is confined to the more complex activities.

Some Experimental Evidence on the Transfer of Training in Memory.

E. E. RALL, University of Tennessee.

This is a report of experiments with 44 students at the University of Texas in 1909 and 1911. A memory test on lines from "Evangeline" and nonsense syllables was given for three days before and after a training period which lasted four weeks and averaged 20 minutes a day. The training material was varied for different individuals, and included poetry and prose in English and foreign languages, irregular verbs and vocabularies. The time for the first three and the last three days of the training period was used to measure improvement or loss, the same amount having been memorized each day. Parallel control experiments, involving 28 observers, were carried on in both years, using only the tests.

The results showed wide variations: 4 out of 44 lost in the training, one lost in the "Evangeline" tests and 6 out of 34 in the nonsense syllable tests. In the control series 4 out of 28 lost in "Evangeline," 3 out of 16 in nonsense syllables. In the training 22 improved more, 20 less than in the "Evangeline" test; 2 improved the same in both, and 23 out of 34 improved more (or lost less) and 11 improved less in the training than in the nonsense syllable tests.

Taking the average of all gains and losses, the 25 observers in 1909 gained 32.5 per cent. in training, 26.9 per cent. in "Evangeline," 24.5 per cent. in nonsense syllables; while the 20 control observers gained 17.8 per cent. in "Evangeline" and 12 per cent. in nonsense syllables. Deducting the amount of gain in the control observers from that shown in the practiced group and calculating the percentages on the basis of the amount of material learned in a given time, it appears that there was, on an average, 21 per cent. transfer in "Evangeline" and 36 per cent. in the nonsense syllables. A smaller percentage of transfer is shown in the 1911 series.

CONFERENCE ON THE RELATIONS OF PSYCHOLOGY AND MEDICAL EDUCATION

1. *The Present Status of Psychology in Medical Education and Practice.* S. I. FRANZ, Government Hospital, Washington, D. C.

Psychology has recently grown in favor in connection with medical affairs. This has been due to the realization of the importance of psychiatry, and of the success of non-medical healers. In present-day medical education, *psychology* has a place in few departments of medicine, but in most schools *psychological matters* are discussed in the courses in physiology, psychiatry, neurology and medicine.

All physicians depend upon the account of mental processes for diagnostic information and for the estimation of the effects of remedial agents. In the consideration of mental diseases psychology has its greatest value to the physician, both in diagnosis and treatment. The general conceptions of the latter are inadequate, and usually too exclusive.

Psychology has value in research in psychiatry and neurology, and its principles have also been applied in pharmacological studies.

Technical psychology and its terms have been criticized by physicians, and it has sometimes been assumed that no special instruction is necessary, but if its general relations are to be understood some special attention to it is needed.

2. *The Value of Psychology in Psychiatry.* ADOLPH MEYER, Johns Hopkins Medical School.

It is necessary to consider the fields of both psychiatry and of psychology as open to expansion. There is a psychology which will cope not only with the problems of introspection, but also with the other problems dealing with the biological, physiological and even anatomical conditions of mental life. Who but the psychologist

would be qualified to deal with the broad field between the physiology of special organs and the behavior of personalities? Psychiatry has at all times tended to share the prevailing psychological attitudes. It inevitably has common ground with psychology, and to agree on the common ground or even on how we should want to characterize it is a vital issue for a discussion of the mutual value of two fields of work.

Psychiatry is *forced* to deal with psychological material and the more satisfactorily it does it, the better for both psychiatry and psychology. It determines mental facts partly as symptoms of diseases back of the conditions and partly as biological reactions of the type of mental integration, which, like suggestion, once induced, play a more or less well defined dynamic rôle.

The first task is to describe critically the plain events of abnormal reactions and conduct, as experiments of nature for the conditions under which they occur, the subjective and objective characteristics which allow us to differentiate the reactions from one another, the events and results in the conduct and life of the person, the dynamic factors and their modifiability, the time and influences needed for a readjustment of a state of balance. With this rule of formal technique and logical arrangement of the inquiry we are bound to get sound common ground for a psychiatry which aims merely at the identification of given conditions with accepted disease-processes and *also* for a dynamic pathology which gives psychobiological data a dynamic position.

With regard to the program developed by Dr. Prince, I feel that the college curriculum should not preëempt the field of psychopathology unless it has clinical material on which to work and on which to obtain the facts under discussion. Common-sense psychology offers enough problems for sound psychology at that stage. In the medical curriculum he would expect the program of Dr. Watson (including the study of instincts, work and fatigue and sleep) to be added to the physiology course in the second year (or the first year if the physiology of the nervous system can be made to precede); the course of pathology would then have to give space to the elements of psychopathology (effects of drugs, of glandular action, hypnotism and the collisions of attitudes and emotions, and their effects on memory). The third year would extend into the field of substitutions of the hysterical and psychasthenic type, and simpler psychotic reactions, and to the aphasia-apraxia group. The fourth year would then be prepared to cover psychopathology and psychiatry as it appears in the clinical work and in clinical research.

3. *Psychopathology and Neuropathology: The Problems of Teaching and Research Contrasted.* E. E. SOUTHARD, Pathologist to the Massachusetts Board of Insanity.

The ideas that I wish to bring to this symposium are few, and I hope not too unorthodox. How shall research psychology and research medicine come together, on what ground, and to what ends? I wish (1) to insist strongly on the unique value of the pathological method, not merely for the diagnostic and therapeutic purposes of medicine, but for biology as a whole and for the most vital of biological sciences, psychology. I wish (2) to point out how pernicious in research may be the dogmatic insistence on the doctrine of psychophysical parallelism in medical or premedical courses in psychology, pernicious because it inhibits the free interchange of structural and functional concepts and the passage to and fro of workers in the several sciences. I wish (3) to show that psychology and physiology have more in common than either has with such structural sciences as anatomy and histology, and that the main common element of both mental and cerebral processes is the time-element as against the space-element of the structural sciences. On this ground (4) I conceive that the mind twist and brain spot hypotheses for the explanation of certain forms of mental disease are entirely consistent with each other, since from a different angle each is dealing with the same facts. (5) Above all let us not divide up the tasks of research as we divide up the tasks of teaching, since research, looking to the future, defies the compartments of the past.

4. *Content of a Course in Psychology for Medical Students.* JOHN B. WATSON, Johns Hopkins University.

The proposed course should concern itself largely with the objective material of psychology. It should include a brief course in visual and auditory sensation, thorough tests and applications of the Binet-Simon system, and work in mental and muscular fatigue. The greater part of the time in the course should be devoted to experimental studies in the acquisition and retention of skillful acts, since this type of experimentation will show the methods and the different stages of acquiring accommodations, the distribution of effort in learning, short cuts in learning, etc. Such experiments pave the way for the normal understanding of lack of interest at certain stages of development, as shown in "resting places" and "plateaus"; the understanding of "bungling" and "conflicts"; the stamping in and retention of wrong methods of response and the effect of emotional states upon the acquisition and exercise of habit.

This work on habit formation should be followed by a study of the normal process of association, memory, and retention. These studies should be purely objective. Definite tasks should be set; words, phrases and various other material presented, then the time of learning under ordinary conditions and under conditions of excitement, obtained by rushing, interruption, etc., should be taken. The student will see that the rate of learning and the errors in learning can be measured as any other biological function can be measured. Memory in the narrower sense ("associations" with time, place, and emotional setting) can very easily be tested by the picture method or by the method of presenting concrete situations, now largely used in Germany in the psychological training of students of law.

This work on memory in the narrower sense may be greatly supplemented by the introduction of Jung's association method.

It is the view of the writer that the course should contain several lectures and experiments upon normal reaction time. It is unsafe and unwise to put a stop-watch in the hands of the medical student without at the same time telling him a little about the factors which influence reaction times, their normal variability especially in untrained subjects and the individual peculiarities of different subjects in this and other respects.

By these lectures and experiments upon the above subjects it is thought that the student will be prepared to enter the clinic, where he should find the means of broadening his knowledge of hypnotism, multiple personalities, suggestion, aphasia. Only in the clinic can be obtained the material for such study. Without the individual study of cases all lecture work is unavailing. It is the psychopathologist's function, and not the psychologist's, to teach such subjects. The study of the "subconscious" should be excluded; nothing is gained by this concept. The visible and tangible effects of suppressions, tangles, conflicting habits and the like, may be studied without positing a subconscious. Such a concept is as detrimental to the advancement of psychological analysis as is the discussion of those philosophical remnants—psychophysical parallelism and interaction.

The course might be given as an elective in the second or third year of the medical work. Two laboratory periods of two hours each and one lecture should be given. A thorough course in elementary psychology is presupposed as a part of the student's pre-medical training.